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A uniform supply chain management framework for oil and gas sector: A preliminary review

Adel Alhosani *, Shafie Mohamed Zabri

Faculty of Technology Management, Universiti Tun Hussein Onn Malaysia, Johor, Malaysia

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ABSTRACT

The multidisciplinary nature of the oil and gas sector makes Supply Chain Management (SCM) practices in this sector more complex. Moreover, lack of generic model/framework results in lack of sharing knowledge, training, proper model or framework, and add additional complexities to SCM in oil and gas sector. Furthermore, the SCM knowledge of oil and gas sector is scattered in internet, books, thesis, journals papers, conference's papers, online database, and organizations. It lacks the obvious structure to unify, facilitate, reuse, and manage that scattered knowledge. Thus, it receives little attention from researchers. Current researchers have not focused on fundamental and essential guidelines to establish a baseline for SCM in oil and gas sector. This paper identifies and proposes common SCM practices concepts in oil and gas sector to unify the view of SCM practices in the form of a conceptual framework that can be seen as a baseline for this domain. The framework will be validated and refined to assist as a representational layer to unify, facilitate, and expedite the access to SCM practices in oil and gas sector. The specific aims are to facilitate knowledge sharing, combining and matching different SCM activities according to the different situations.

1. Introduction

The supply chain management has received an unlimited deal of attention by academics and practitioners in the current years (Saad et al., 2013). SCM will lead to offering the essential level of consumer service to a precise section and refining consumer service through enhanced product availability and reduced order cycle time (Banomyong and Supatn, 2011). SCM is defined as the management of the stream of things comprising the movement and storage of warehousing, raw materials and complete goods from point of source to consumption (Chima, 2011). The SCM involves configuration, organization and non-stop development of a serial set of operations. There are four main steps in SCM namely design, execution, control, and monitoring of supply chain activities in a way to meet the defined goals of a company. The role of SCM is to integrate these activities in a way to achieve a sustainable competitive advantage. Due to increasing competition amongst firms, the focus of companies has moved away from optimizing operations in a specific location to the whole supply chain activities (Carter and Rogers, 2008; Chima, 2011). Therefore, SCM is an appropriate basis for investigating possible issues and improving the performance of organizations.

The SCM activities are applicable to any type of business such as those producing a product or providing a service to a customer. However, the activities of one business entity might be different than the other. In the oil and gas sector, SCM is very similar across the organizations operating in oil and gas sector. The SCM in oil and gas is concerned with the efficient integration of the gaining of raw material (crude oil), manufacturing (refining), transportation, and warehousing (Shapiro, 2006; Siddiqui et al., 2012).

Several SCM models and frameworks have been established for a better understanding of SCM practices in Oil and Gas domain. However, the SCM knowledge is dispersed across different databases over the internet (Flöthmann and Hoberg, 2017). Therefore, this paper attempts to structure and organize the SCM knowledge domain for oil and gas sector through the process of identifying, extracting, and unifying the common processes of the domain in a theoretical framework.

Structuring and organizing SCM knowledge of oil and gas sector in a generic platform provides several advantages such as sharing, reusing, facilitating,

* Corresponding Author.
Email Address: amh4867@takreer.com (A. Alhosani)
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unifying and managing SCM knowledge of oil and gas sector among stockholders and practitioners.

This paper focuses on the SCM practices in the oil and gas sector. The main purpose of every Oil and Gas Company is to find and create oil, gas, or Oil and Gas derived products (Sadaghiani et al., 2015). The operations in this industry have become more challenging for the Oil and Gas companies in respects to the environments, locations, and the trade paths during last decade. In this route, optimal logistics and supply chain solutions can assist companies to find the best way from the pool to the refinery and as a result materials handling, import and export facilities, technology, and information (Chima, 2011).

According to Ahmad et al. (2017), SCM practices of Oil and Gas firms are highly fragmented. Because of that, there is the absence of studies that consider the followings:

a. Preparation of diverse supply chain tasks and policies towards viable practices.
b. Diverse sections and concepts of Oil and Gas supply chain.
c. The mutual development of the financial, environmental and public performance of supply chains.

The existence of these lacks, therefore, shows that Oil and Gas industry has no systemic SCM research (Ahmad et al., 2017). This is important due to two reasons, namely: a) the future is largely dependent on the Oil and Gas; b) these products are highly influential in utilizations by the society.

This article makes a particular contribution in the area of SCM. These contributions are:

a. Innovative SCM framework: In this article, an innovative SCM framework is introduced that will help to synchronize the activities across different companies in oil and gas sector.
b. Common Process: The SCM practices have a large number of processes in use. In this article, a set of common process are identified.
c. Grouping of Common Process: The common processes were group together. These processes have different name under different schemes. They were grouped together according to their meaning, concept, and activities.
d. Naming the Common Processes: Every group of common processes was given a unified name to easily share the knowledge and information among different organization in oil and gas sector.

The next section provides a detailed literature review of the topic which is followed by the research methodology that develops the new SCM framework. Finally, the conclusion and future work was highlighted.

2. Literature review

The Oil and Gas industry is reasonably large to be managed by a single firm, therefore, the activity of this business type is distributed among a number of groups that work together to fulfill the consumer's needs. The SCM in Oil and Gas in measured by the number of groups involved in the development of the Oil and Gas Resources. The Oil and Gas industry contains national and global transportation, ordering, import, export, and information (Sadaghiani et al., 2015). Accordingly, it has a long supply chain network operating on a global scale. Chima (2011) mentioned that the competition is among the supply chain, not among the firms. Insignificant SCM decreases effectiveness lags developments, and reduce product outcomes (Jabbarzadeh et al., 2016; Siddiqui et al., 2012).

Midttun et al. (2007) conducted a study in the context of Norway to identify the SCM related issues facing during the integration of corporate strategies between the petroleum companies and suppliers. Their study reveals that main focuses of the suppliers are on the technological improvements. However, the area of focus for the petroleum companies is health, safety, and environment. This study identifies that the reason is the lack of communication where the main focuses were never discussed among the main strategies. This concluded that if the supplier serves the company with no sustainability initiates, the company may face legal, financial or reputational risk. Thurner and Proskuryakova (2014) highlighted that to improve the SCM, the companies should also focus on the innovative strategic solutions. Such solutions will emphasis on the utilization of the employees' knowledge for developing the techniques, and making the partnership with international traders using an open access program. The close ties between the company and suppliers will help to improve the environmental effects that can result in cost efficiency and effectiveness in SCM (Tesfay, 2014). The literature is evident that large percentage of the Oil and Gas producing countries are trying to improve their economy by compelling the foreign investor to trade with their local companies. Ngoasong (2014) elaborated the role of foreign investors by investing in the domestic oil and gas sectors. While, Ablo (2015) emphasized on enhancement of the capacity building, and promoting the increasing participation of local businesses in their Oil and Gas Industry through the Enterprise Development Centre (EDC) by Ghanaian authority. Both studies concluded the concerns of the local authorities in international Oil and Gas (IOC) companies. Ablo (2015) pointed out the lack of effectiveness of an EDC to facilitate and participate the local firms in Oil and Gas projects. Such operations are comparatively small for large businesses. Yet, this platform like EDC is a place for exchanging knowledge for local business, governments and foreign companies.

3. Supply chain management framework

For this research, the qualitative procedure will be used as a research methodology. The reasons for

choosing a researcher-completed qualitative procedure as the main study tool was mainly due to it being a practical and effective way of producing SCM framework for oil and gas sector. It is also considered to be the most appropriate and effective method, taking into accounts the personal and socio-cultural behaviors of the respondents in the SCM domain in the oil and gas sector.

To provide a concrete analysis, a real organization will be considered for evaluation. The Abu Dhabi National Oil Company (ADNOC) is the state-owned oil company of the United Arab Emirates (UAE) that was established in 1973. It is recognized as the fourth largest oil company in the world and has access to UAE's oil and gas reserves. The major operations of the company include exploration, production, processing, refining, marketing, and transportations. ADNOC has 17 other companies. These companies have been distributed into three types based on their tasks, namely: exploration and production companies, processing and refining companies, and marketing and transportations companies (Choudhary, 2014). However, each company has specific SCM practices. Thus, there is a lack of generic SCM practices. This study attempts to identify, investigative, recognize and extract the common concepts of SCM practices in oil and gas sector, and then merged and harmonized the extracted concepts based on their meaning and functions. Also, the semantic relationships amongst common concepts will be highlighted. The output of this study is a generic framework which will be called SCM framework (SCMF). The purpose of SCMF is to structure, organize, manage, facilitate, and share the SCM practices of ADNOC and its branches.

It is highlighted in the literature that this study requires a building of IT artifact (framework). SCM domain of oil and gas sector has a complex nature and for that reason, it requires multidisciplinary skills and abilities. As a result, this study will utilize the DSR method for information system research as a methodology to guide this study. Since this study is aimed to yield a new SCM framework (SCMF), DSRM is a suitable research methodology for this study (Johannesson and Perjons, 2014). The special characteristics of the DS methodology is that is solution oriented as opposed to its equivalent which is mainly based on the problem under consideration (Hevner and Chatterjee, 2010). Generally, the DSRM is based on six main steps; namely: a) Motivation and problem identification, b) objective for a (Peffers et al., 2007) solution, c) design and development, d) demonstration, e) evaluation, and f) communication (Peffers et al., 2007). Fig. 1 shows these steps.

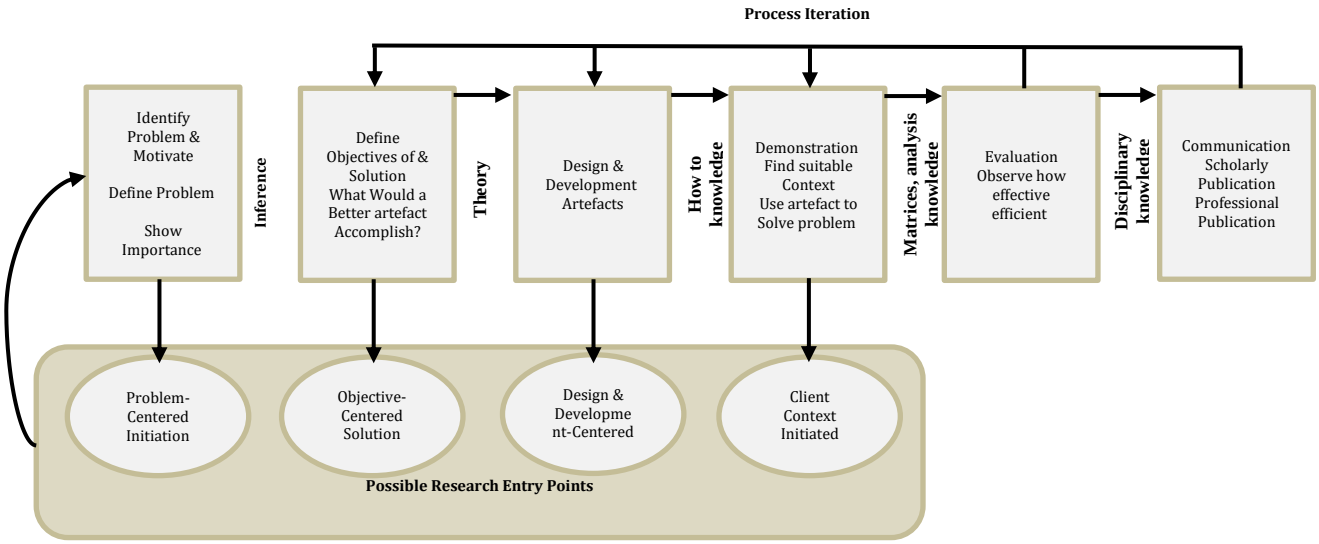

Fig. 1: Design science research methodology

In Fig. 1, there are four possible research entry points shown. The purpose of the first point is to recognize the issue and highlight the research motivation. After identification, it explains the problem to explore its importance. This point is responsible for an extensive literature review, problem identification, information gathering from experts, and a preliminary analysis to confirm the significance of the problem (Offermann et al., 2009). The second entry point now focuses on the design of the metamodel providing a strong association with the existing models from the literature. Here, a solution for the problem, in the form of artifact, is designed. The third entry point deals with the actual development of the artifact. This entry point focuses on the building of the required functions of the solution. The fourth entry point concentrates on the selection of the most suitable solution. In this point, the newly developed solution is used to solve the actual problem. The solution and its performance is demonstrated using experiments or different recognized techniques (Peffers et al., 2007).

The last phase deals with the sharing of the new framework with the research community through different electronic resources and databases.

In the current research, while utilizing the DSRM approach, it divides the research task into four main phases (Fig. 2). Phase 1 is responsible to develop and define the problem, and highlight the importance of the problem. Phase 2 is responsible for the

identification, investigation and validation of the common SCM concepts in oil and gas sector concepts. Phase 3 further illustrates the proposition of Oil and Gas SCM concepts and development SCM framework. Finally, Phase 4 validates and evaluates the SCM framework along with real-world scenario. Each of the four phases of this research includes a number of tasks, associated with one or more research activities. The next paragraphs explain each of the phases, their tasks, and associated activities.

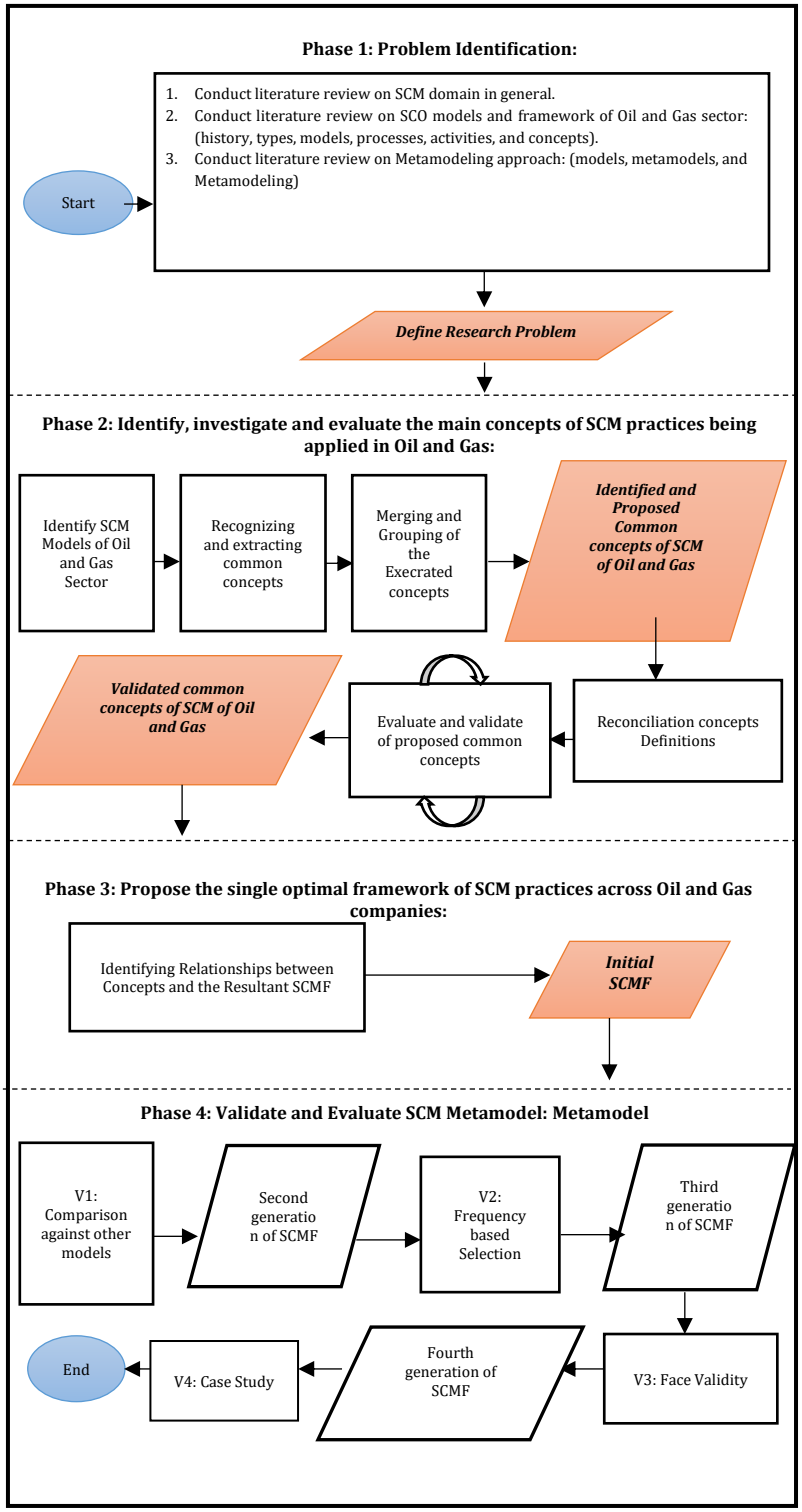

Fig. 2: Research methodology for SCM framework in O and G

3.1. Phase 1: Problem identification

This methodology starts with the identification of the clear unsolved issue and signifies the worth of its solution. This conceptually represents the issue in a manner that solutions capture the complexity of the problem. It led the research community to focus on the complexity of the issues and provides targeted solutions (Peffers et al., 2007). It deals with an investigation of Oil and Gas SCM models, frameworks, approaches, methods, tools, processes activities, operations, concepts and terminologies. The SCM practices in oil and gas sector is identified as valuable, heterogeneous and scattered. The

knowledge is scattered among journals, conferences, experts, books, book chapters, magazines, dissertations, reports, other sources of the web. Such dispersed nature knowledge makes it difficult to find a clear direction for generalizing the concept. Therefore, a thorough assessment of the literature is required for the understanding the problem and its nature.

3.2. Phase 2: Identify, investigate and evaluate the main concepts

Identifying, investigating and evaluating common Oil and Gas concepts and their definitions are dealt in this phase. A detailed study of the existing models will be conducted to understand the basic concepts and common SCM practices in the oil and gas sector. This will give a basic understanding and knowledge of the SCM processes, activities, and concepts in Oil and Gas. There are four steps involved in this phase.

Step 1 is to identify SCM models in oil and gas sector; the construction and validation models will be identified and selected. Model selection for this research will be based on coverage factors that were identified in previous research (Al-dhaqm et al., 2017; Ali et al., 2017; Kelly and Pohjonen, 2009; Othman et al., 2014). A wide coverage of viewpoints, concepts, and terminologies that are broadly applicable will be required to fulfill the aim of identifying and proposing common concepts SCM practices in oil and gas sector.

Step 2 is to recognize and extract the common concepts based on criteria that discussed by Ali et al. (2017). The common concepts of SCM practices in oil and gas sector will be recognized and extracted.

Step 3 is to merge and group of the execrated common concept. The extracted SCM concepts in oil and gas sector are merged and grouped together based on similar activities and concepts (Al-dhaqm et al., 2017). All concepts having similar activities and meaning are organized, merged and grouped into separate groups.

Step 4 is to propose common concepts of SCM practices in oil and gas sector. This step aims to identify and propose common concepts for every group. The mapping process will be adopted to identify common concepts. The concept, which has a higher frequency in the group, will candidate and be referred to as a common concept.

Step 5 aims to reconcile the common concepts definitions. Thus, the similar definitions will be reconciled and harmonized into one abstract definition.

Step 6 will validate the common concepts of SCM practices in oil and gas sector. The identified and proposed common concepts will be validated and improved to make it complete and coherent.

3.3. Phase 3: Propose the single optimal framework

The development of the main framework of this research (the SCMF) will start in this phase. A set of common and frequently used concepts is first determined. Relationships among these concepts are then identified. The framework creation process is an iterative process with a continuous refinement of new concepts. The output of this step is the initial version of Oil and Gas SCMF to be validated.

3.4. Phase 4: Validate and evaluate SCM framework

The final phase consists of the validation and evaluation of the proposed framework. In order to come with consistent concepts, it should be definable, representable, comparable, and contain coherency and consistency (Hevner and Chatterjee, 2010). Therefore, the SCMF needs an evaluation process. Four validation techniques will be applied:

1. Comparison against other models: It refers to the verification process of the initial framework, built on the existing models. It will also assess the new framework for any omitted concept in comparison with the other model available in the literature (Kleijnen and Sargent, 2000).
2. Frequency-based Selection technique: This method will thoroughly analyze the SCMF (Manning et al., 2008; Xu and Chen, 2010).
3. Face Validity technique: This technique will be used to validate the structure and behaviors of the SCMF (Sargent, 2015).
4. Case Study: This technique will be used to assess the applicability of the SCMF.

4. Conclusion and future work

In this article, we propose a new SCM framework for oil and gas sector. The complex business structure of the Oil and Gas industry and their scattered knowledge across different internet knowledge bases make the SCM practices more complex. They lack the generic framework which makes the information sharing and process synchronization more complex. The proposed framework will enable all the Oil and Gas industry to work in a unified framework. It will help the SCM practice across different organizations which will ease the SCM practices and overall cost.

This article represents the proposed framework. Further research on the literature review and data collection is in the process. The framework evaluation and development will be finalized after the thorough analysis of the literature and existing models.

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