Innovation in Corruption Risk Mapping using a Value Chain Map and Its Application in the Upstream Oil and Gas Industry in Indonesia

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Keywords: Value Chain Map, Corruption Risk, Business Risk, Oil, And Gas Upstream Industry

Abstract: Risk management is perceived as an indivisible part of good management and governance. Identifying risk and communicating that information is important to all risk management frameworks but at present traditional frameworks use the perception-based and traditional heat map approach. A corruption risk map of upstream oil and gas industry integrated with a business risk map, designed on Value Chain Map (VCM) and Value Chain Analysis (VCA) principals, and combined with a non-geographical map, spatial analysis, and evidence-based material, are considered an innovation forming part of deliverables from the research entitled Research on Corruption Risk in Indonesian Upstream Oil & Gas Industry - Mitigation Policy Analysis - Evidence-Based Approach that is granted by ACE (Anti-Corruption Evidence Research Consortium) led by SOAS University of London and funded by the Department for International Development (DFID) from the UK Government. The corruption risk mapping that has been developed is expected to map corruption risks in line, and integrated with shareholder value, easily communicated and visually apprehensible. The proposed VCM could be collectively used not only as a risk map by stakeholders but also as a multi-dimensional database to store and analyze evidence-based data/information, enabling the collaboration and synergy in risk mitigation. To further ensure the potential use of this VCM-based risk map, both by the upstream oil and gas industry and by law enforcement, the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas), the Corruption Eradication Commission (KPK) and the Financial Transaction Reports and Analysis Center (PPATK), as related stakeholders, collaborated and supported the development. We conclude that the proposed VCM can serve as an application and utility of the value chain architecture for cost advantage purposes.

1 INTRODUCTION

The concept of the value chain (VC) was introduced by Porter (Porter, 1985) to show activities that a firm operating in a specific industry can introduce to deliver a valuable product or service, helping the company position itself in the pursuit of competitive advantage against its competitor. Value Chain Map/Mapping (VCM) is a method that defines the primary and supporting operations related to the service or product line of a company and is often used in management policy to define potential performance improvement. VCM is the initial process in value chain analysis to identify main and supportive business activities and all related components. The benefit of implementing VCM can be summarized as follows: a) provides a platform for communication and discussion with stakeholders, b) reveals missing information including needs, impacts, and gaps for each entity in the value chain, c) expands the perspective of an organization's external environment; d) helps organizations prioritize activities and provides stakeholders with a more tangible description of activities (Mooney, 2014).

Value chain analysis (VCA) is a method in which a company defines its main activities and supports activities that contribute value to its final product and then evaluate these activities to decrease expenses or boost differentiation. Analysis of the value chain has been implemented in different areas from the moment

Ibrahim, B., Robey, T. and Wahyudi, H.
Innovation in Corruption Risk Mapping using a Value Chain Map and Its Application in the Upstream Oil and Gas Industry in Indonesia.
DOI: 10.5220/0009442002950302
In *Proceedings of the 1st International Conference on Anti-Corruption and Integrity (ICOACI 2019)*, pages 295-302
ISBN: 978-989-758-461-9

it was introduced. It has some advantages to reduce operational costs, optimize efforts, eliminate waste, improve health and safety, and increase profitability (Reese, Waage, Gerwin, & Koch, 2016). There are two distinct approaches, depending on what sort of competitive benefit a business wishes to achieve: cost advantage and differentiation advantage (Jurevicius, 2013). Analysis of the value chain allows organizations to assess business processes in order to provide the greatest opportunity to decrease operating costs, optimize efforts, eliminate waste, enhance health and safety and boost profitability (Reese et al., 2016).

Value chains in the oil and gas industry have been developed to describe business processes in upstream, midstream, and downstream activities (Elsaghier, 2017; MOGA, 2018; OECD, 2016; Shqairat & Sundarakani, 2018). OECD describes the process of value chains in extractive industries from the decision to extract revenue spending and social investment projects (OECD, 2016). UNCTAD (UNCTAD, 2012) and IBEF (Ibef, 2014) classified value chains into upstream, midstream, and downstream. Sub activities under each process are divided in more detail by Olesen (Olesen, 2016) to Upstream (Tender & Concession, Exploration, Installation, Production, Field Abandoning); Midstream (Processing, Storage, Transportation) and Downstream (Sales, Distribution).

The oil and gas value chain may have a strong impact on businesses that operate in this sector because technology is high cost and sophisticated; exploration is uncertain; there are legal and social challenges; and transportation and storage needs. In Indonesia, the oil and gas sector is the economy's primary player and is strategically important in promoting future economic viable growth plans. This industry is one of many sectors that has received a great deal of attention when it comes to risk management because the risk exists in every single operation in upstream, midstream, and downstream activity. The oil and gas industry in Indonesia is a significant source of national revenue in tax receipts and through production sharing contracts (PSCs) under which a contractor is entitled to a share of total oil and gas produced to cover exploration and development costs, while the remaining oil and gas produced is spilled between the contractor and the government. This approach has been replicated in several oil and gas producing countries. However, PSCs have been at greater risk of corruption than other systems of extracting value from oil and gas production. The results and findings of this research may, therefore, have far-reaching benefits to the anti-corruption initiatives of other oil-producing nations.

Mitigating risk in the oil and gas industry commences with effective communication, the same way as other risk management programs begin. However, visualization in risk management is not easy since the risk is extremely difficult to visualize and describe. One method is by implementing Enterprise Risk Management (ERM).

ERM has gained organizational attention due to globalization in the business environment, technological advancement, innovation in business operations, and pressure from regulatory bodies to manage risk in a holistic manner (COSO, 2017). It is a popular structure employed by businesses to recognize future occurrences that may influence the enterprise, handle related hazards and possibilities and provide reasonable assurance that the goals will be met (COSO, 2004; Johnson & Johnson, 2018). However, not all studies about ERM and businesses have disclosed important beneficial relationships (Agustina & Baroroh, 2016; Pagach & Warr, 2011; Quon, Zéghal, & Maingot, 2012). The currently available risk mapping method using the traditional two axis chart can be seen in Figure 1 (CGMA, 2012).

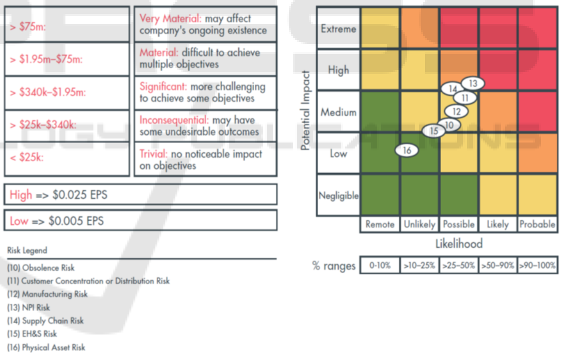

Figure 1. Risk heat map (CGMA, 2012)

Using this risk heat map in risk mitigation has caused some difficulties in visualizing and analyzing risks and interpreting the results. This paper will suggest these difficulties can be overcome by the development of a VCM for the upstream oil and gas industry in Indonesia. We believe that the proposed VCM is an innovation for both corruption risk and business risk and would have significant potential usage for the business environment and law enforcement. The study will focus on private sector corruption/ bribery in the industry of upstream oil and gas in Indonesia.

The research project seeks not only to deliver a VCM specifically for the upstream oil and gas industry of Indonesia but will also be of benefit to similar operations in other countries. A VCA consisting of Management Cockpit, DEA (Data Envelopment Analysis), Benford's Analysis, House of Risk, Corruption Risk Map (evidence-based) will be the initial proof of concept for the developed VCM.

2 METHODOLOGY

The VCM was developed for the purpose of mitigating corruption risk, but at the same time, can be used to reduce business risks in the upstream oil and gas sector in Indonesia. The VCM model is based on geospatial mapping to display layers containing different information and data. VCA can then be performed on VCM layers containing data and information in the form of numbers. Based on the output of the VCA assessment, color gradations are presented to show a risk map that can be used to map corruption risks, where this method is commonly used in the ERM technique.

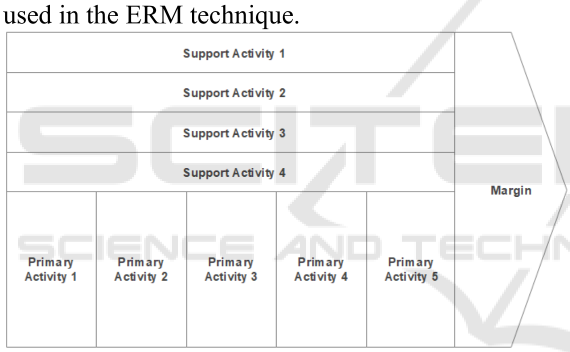

Figure 2. VC Model by Porter (Porter, 1985)

To understand the primary and supporting activities, related studies were reviewed, following which these studies, regulatory framework, and current practice in the context of the upstream oil and gas industry in Indonesia were evaluated. It is intended that the value chain conforms with business processes that have been implemented in upstream oil and gas in Indonesia, mainly by businesses in the private sector, such as contractors, vendors, and traders.

The development of VCM is carried out based on Porter's value chain method, as shown in Figure 2. The upper and lower part is defined as supportive and primary activities, respectively. The primary activity is considered the successive steps that flow through the operations process in upstream oil and gas in Indonesia depicted as the vertical box going from left to right while support activities in the form of horizontal boxes are activities that support the process in the primary activity.

In the process of identifying the business process, data extraction, and discussion were carried out with SKK Migas to understand and compile the activities of each box in the value chain. The processes were also determined from the regulatory framework in the context of Indonesia (Undang-Undang RI No. 22, 2011) and SKK Migas Decree Number: KEP-0078/SKKMA0000/2018/S0 about Proses Bisnis Skk Migas (SKK Migas, 2018). Current upstream oil and gas business activities in Indonesia are regulated by relevant legislation such as Law (Undang-Undang RI No. 22, 2011), Government Regulation (PP RI No. 59, 2007), Minister of Energy and Mineral Resources Regulation (Permen ESDM RI No. 52, 2018; Permen ESDM RI No. 59, 2007), and Governance Regulations in SKK Migas (PTK, Pedoman Tata Kerja) (SKK Migas, 2013, 2017, 2019).

Discussions and brainstorming were then conducted with stakeholders, particularly the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas), The Corruption Eradication Commission (KPK) and the Financial Transaction Reports and Analysis Center (PPATK) to ensure that the process flow in the primary and supporting activities represented the business processes in the upstream oil and gas in Indonesia. This step is crucial in order to have the agreement of VCM business processes.

For the purpose of analysis, Tableau software was used to display VCM in the geospatial mode. It was then used to sketch VCM based on coordinates as a spatial function. Each box has its own identity according to the name-value chain attached to it. Then, Tableau read the Excel file containing financial data and types of activities. The data was visualized in the form of a heat map. Values that deviate from the expected result could be indicators of fraud. Analysis of data will then be strengthen using Data Envelopment Analysis (DEA), Benford analysis, and House of Risk (HoR).

DEA is used to measure the relative efficiency of each value chain. It can be used to identify whether the value chain has efficiency (I, S, V, P, & A, 2013; Putra & Adinugraha, 2018). Any inefficiency could be caused by corruption (Ashoori, N.A., Mozaffari, 2013).

Detection of anomalies can be implemented in various ways. One of the techniques for analyzing anomalies is Benford's law, a well-known method of detection. When applied to value chainsets, the law of Benford can be used as a screening tool for fraud detection. The law defines the first digit frequency distribution in data sets and compares the distributions anticipated and observed. Since number 1 most frequently appears as the first digit in information progressions and subsequent numbers less frequently, powerful deviations from the anticipated frequencies or anomalies may show that the information is suspect or manipulated. If an authorization limit is $10,000; then frequent first two digits will be identified in the region of 99, 98, and 97 if an effort is made to maximize authorizing expenditures. Figure 3 shows Benford's law distribution embedded in Tableau software.

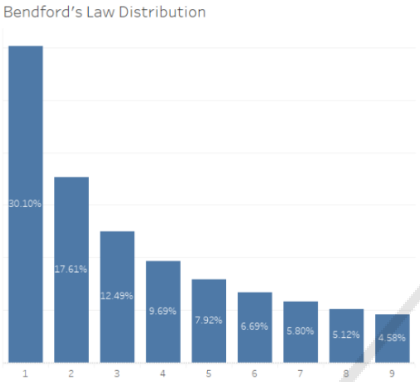

Figure 3. Benford's law distribution

House of Risk (HoR) has been historically used for identifying supply chain risk (Pujawan & Geraldin, 2009). In this research, HoR is used to identify corruption risks based on VCM. The corruption risks used in HoR were based on evidence obtained from the Right to Audit activities at SKK, investigative data from KPK, and analysis of suspicious financial transaction reports from PPATK.

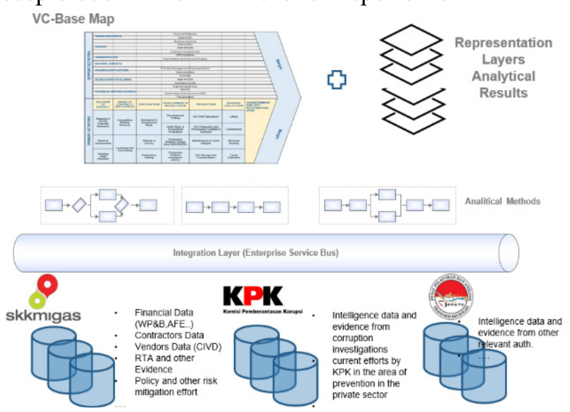

Figure 4. VCM Conceptual and data/information integration model

The developed VCM is then supported by VCA so that it can be used to mitigate both corruption risk and business risk. Data collaboration design for this purpose is illustrated in Figure 4. Integrated data and information from SKK Migas, KPK, and PPATK can be included in the VCM. The distribution of value or information will be displayed in layers in the form of a heat map. Therefore, this VCM will be used for the purpose of mitigating corruption risk and business risk.

3 RESULT AND DISCUSSION

The literature on business processes, conducted in accordance with appropriate legislation, was studied and conclusions shown in Table 1 for primary activities and Table 2 for supporting activities. The decision to extract and Award of Contracts and Licenses, the first two activities, were included in the value chain to show complete sequences in upstream oil and gas in Indonesia. These activities were not evaluated for current VCM and VCA but will be used in the future.

Then the value chain was developed, as shown in Figure 5. The primary activities, sequential, begin with Decision to Extract, Award of Contract and Licenses, Exploration, Development & Installation, Production, Revenue Collection, Abandonment, and Site Restoration. These activities are referred to as Level 1 and sub-activities under Level 1 labeled Level 2.

The activity in the Decision to Extract involves assessing the potential for oil and gas resources that have not been discovered and determining the feasibility of oil or gas production. Evaluations are carried out using one or a combination of the following methods: volumetric, well-performance, mathematical modeling, and analogy comparing reservoirs with similarities in geology and/or performance. Award of Contracts and Licenses are activities aimed at offering the right company to manage a working area (Wilayah Kerja, WK) containing oil & gas. Exploration is to evaluate the suitability of oil and gas projects and to conduct geological and geotechnical research. Development & Installation are activities to construct underground and surface equipment to securely and effectively produce oil and gas. Production includes activities to extract, process, and export oil & gas as per contract agreement. Revenue Collection involves taxation on profit from oil or gas lifting and subsequent commercial opportunities. Abandonment and Site Restoration are activities to permanently plug wells, remove surface equipment, and restore the block according to the initial contract conditions.

Table 1. Primary activities

Decision to Extract	Mapping & Survey Potential Resource
	Reserve Assessment
	Working Area Decision
Award of Contracts and Licenses	Competitive Bidding Process
	Licensing and Contracting
Exploration	Geological & Geophysical Study
	Seismic & Survey
	Exploratory Drilling
Development & Installation	Development Drilling
	GGR & Economical Evaluation
	Production Platform Design (Pre-FEED/FEED)
	Production Platform Installation (EPCI)
Production	OG Well Operations
	OG Production and Processing Facilities & Sundries
	Maintenance & Asset Integrity
	OG Storage and Transportation
Revenue Collection	Lifting
	Commercial
	Revenue Sharing
	Taxes Collection
Abandonment and Site Restoration	

Table 2. Supporting activities

	Personnel Expenses
Human Resources	Supervision
Finance	Business Insurance
	Depreciation
	Audit Services
	Finance & Tax Services
Administration	Office Expenses
	Public Relations & Community Projects
Material Services	
Technology Platform	IT & Data Management (Computerization)
	Communication
Regulatory Fulfillment	Formality
	Legal Services
	Compliance Audit
Technical Support Services	Engineering Services
	Security
	Health Safety & Environment (HSE)
	Transportation

In the support activity section, Level 1 is Human Resources, Finance, Administration, Material Services, Technology Platform, Regulatory Fulfillment, and Technical Support Services. Similar to the above convention, the sub-activities were labeled as Level 2, as depicted in an elongated horizontal box. Margins were created to show the efficiency indicator in the value chain

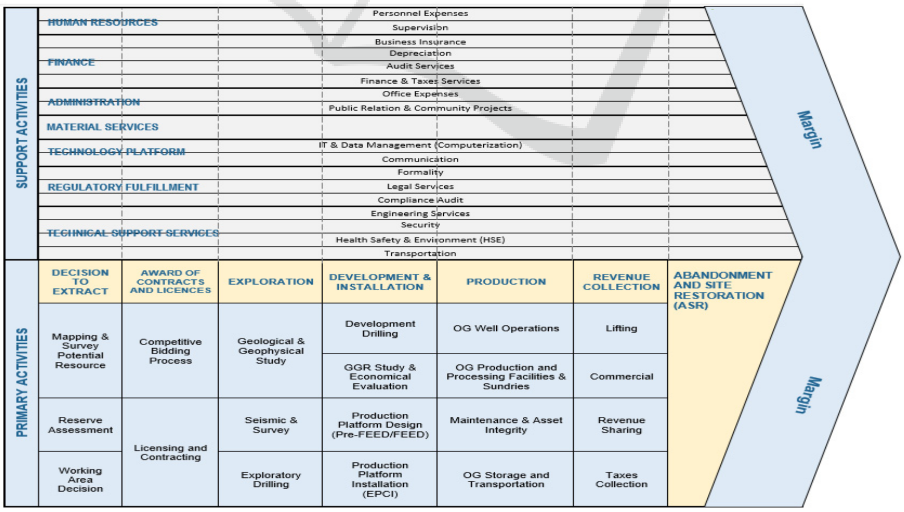

Figure 5. Value chain map in upstream oil and gas Indonesia

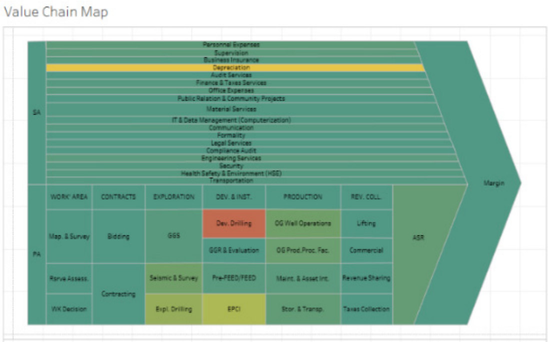

Figure 6. VCM expenditure analysis

Visual analysis can be performed by presenting a layer that has been generated by Tableau software. VCA was undertaken on the data represented by a particular layer. The layer can be in the form of financial data, activities of contractors or vendors as well as some audit findings.

Figure 6 shows the distribution of financial data that has been carried out for each activity in the value chain. This figure shows which activities have the smallest scale to the largest. The color in Figure 6 representing the amount of financial expenditure, the higher showing red, and the lower in green. The result can also be displayed in the form of a bar chart, as shown in Figure 7.

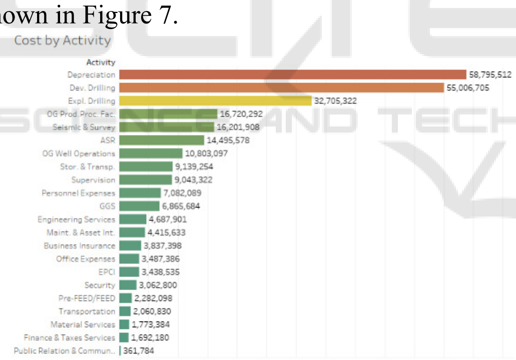

Figure 7. Financial report for activities in VCM

Figure 8. VCM showing Benford analysis

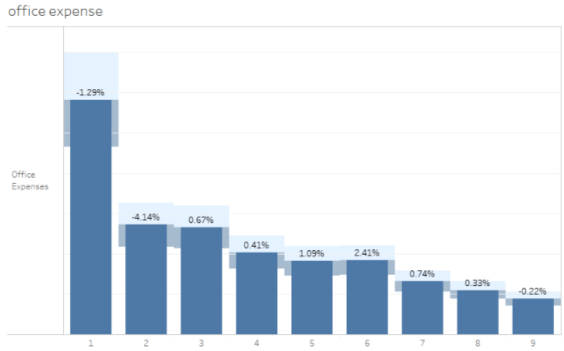

Figure 9. Example of Benford analysis for Office Expense

The financial map will later be supplemented by the Benford analysis map, as shown in Figure 8. Both layers provide information which has potential irregularities. Other layers, such as the number of contractors or vendors, PPATK data, and even the KPK information, work together to show indications of potential risks. Therefore, this VCM can be used as a Cockpit Management/ Strategic Management and Planning Tool.

4 CONCLUSIONS

The Value Chain Map for the upstream oil and gas industry in Indonesia was successfully developed and considered as an innovative risk mitigation method for both corruption and business risk and had the potential for use by the business environment as well as law enforcement prevention and investigation. We conclude that the proposed VCM can be served as an application and utility of the value chain architecture for cost advantage purposes. VCM can be adopted as a tool and utility of the value chain map for corruption risk and business risk. VCM can be used to improve the business processes in the upstream oil and gas industry in Indonesia.

ACKNOWLEDGEMENTS

This paper is an output of the SOAS Anti-Corruption Evidence (ACE) research consortium funded by UK aid from the UK Government. The views presented in this publication are those of the author(s) and do not necessarily reflect the UK government's official policies or the views of SOAS-ACE or other partner organizations. For more information on SOAS-ACE visit www.ace.soas.ac.uk.

We would also like to show our gratitude to SKK Migas for the support, time, and relevant data/information relating to the upstream oil and gas Indonesia and to KPK and PPATK for relevant information about corruption.

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