PRIORITIZATION OF REPUTATION LOSS FACTOR SUBJECT TO PIPELINE EXPLOSION FROM PUBLIC PERCEPTIONS

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With lots of love to my husband, Ibrahim bin Abdul Halim
My daughter, Maryam Humaira' binti Ibrahim
My mother, Kamisah binti Salam
My father, Idris bin Markom
My mother in-law Siti Nor binti Daud

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ABSTRACT

The pipeline explosions events can cause many negative impacts such as human losses, property damage/ losses, economic losses, environmental damage and reputation loss to the pipeline's operator. Reputation is a major risk issue for all organizations and needs to be considered alongside all other major risks such as operational, strategic and financial risks. However, this reputation risk impact is always not included in the risk assessment of pipeline damage because the risk values were not obtained in monetary terms. The consequences of pipeline failure are also influenced by reputational loss. Hence, it must be included and taken into account in the consequences assessment of pipeline damage as well. This study focuses on prioritizing the importance of the reputation loss factors according to the public perceptions. Eight reputation loss factors were identified from 10 major latest pipeline explosion post-accident case studies from previous study. Over 200 respondents were distributed with the online questionnaire survey form to rate the importance level of reputation loss factors using Likert scale rating method. The significance difference was obtained by the implementation of statistical analysis. Analytical Hierarchy Process (AHP) method for prioritization process with the aid of Super Decisions software was used to rank the priority vectors. Results show that the factor P3 "Destroyed private properties" as the highest contributor to an operator's reputation loss due to a pipeline accident. Hence, by all the prioritization, the pipeline owner can apply the mitigation measures immediately according the factor that formerly to be dealt with.

ABSTRAK

Letupan paip boleh menyebabkan banyak kesan negatif seperti kematian, kerosakan/ kerugian harta, kerugian ekonomi, kerosakan alam sekitar dan kehilangan reputasi kepada pengendali saluran paip. Reputasi adalah isu risiko utama untuk semua organisasi dan perlu dipertimbangkan bersama dengan semua risiko utama seperti risiko operasi, strategik dan kewangan. Walau bagaimanapun, impak risiko reputasi ini tidak termasuk dalam penilaian risiko kerosakan saluran paip kerana nilai risiko tidak diperolehi dalam bentuk kewangan. Kegagalan saluran paip juga dipengaruhi oleh kehilangan reputasi. Oleh itu, ia mesti dimasukkan dan diambil kira dalam penilaian akibat kerosakan saluran paip juga. Kajian ini tertumpu kepada faktor kehilangan reputasi mengikut persepsi orang awam. Lapan faktor kehilangan reputasi telah dikenalpasti dari 10 kes letupan paip terkini malalui kajian terdahulu. Lebih 200 responden telah diedarkan dengan borang kaji selidik dalam talian untuk menilai tahap kepentingan faktor kehilangan reputasi menggunakan kaedah penarafan skala Likert. Perbezaan penting antara faktor diperolehi dengan menggunakan kaedah analisis statistik. Kaedah Proses Hierarki Analisis (AHP) untuk proses keutamaan dengan bantuan perisian Super Decision telah digunakan untuk menilai vektor keutamaan. Keputusan menunjukkan bahawa faktor P3 "Kehilangan harta persendirian" sebagai penyumbang tertinggi kepada kehilangan reputasi operator saluran paip disebabkan kemalangan saluran paip. Oleh itu, berdasarkan semua faktor mengikut keutamaan yang telah diperoleh, pemilik saluran paip boleh menyediakan langkah-langkah pengurangan dan menangani risiko kehilangan reputasi syarikat pengendali dengan cepat mengikut kepada faktor yang telah disusun mengikut keutamaan.

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LIST OF ABBREVIATIONS

AHP	-	Analytic hierarchy process
AI	-	Average Index
ALARP	-	As Low As Reasonably Practicable
CEO	-	Chief Executive Officer
CI	-	Consistency Index
CNPC	-	China National Petroleum Corporation
DNV	-	Det Norske Veritas
EGIG	-	European Gas pipeline Incident data Group
FAHP	-	Fuzzy analytic hierarchy process
GAIL	-	Gas Authority of India Limited
KPC	-	Kenya Pipeline Company
LCY	-	LCY Chemical Corporation
LNG	-	Liquefied natural gas
MCDM	-	Multi criteria decision making
NIL	-	Not in list
NNPC	-	Nigerian National Petroleum Corporation
NTSB	-	National Transportation Safety Board
PETRONAS	-	Petroliam Nasional Berhad
PHMSA	-	Pipeline Hazardous Materials Safety Administration
PGB	-	PETRONAS Gas Berhad
PGU	-	Peninsular Gas Utilisation
PTS	-	PETRONAS Technical Standards
RI	-	Random Index
RII	-	Relative Importance Index
RL	-	Reputation loss
SD	-	Super Decisions

SS	-	Sample Size
SPSS	-	Statistical Packages for the Social Sciences
TSB	-	Transportation Safety Boards

LIST OF SYMBOLS

A	-	Cronbach's alpha reliability coefficient
a_i	-	constant expressing the weight given to i,
D	-	degree of accuracy expressed as a proportion (0.05)
f	-	frequency of an observation
K	-	sample with more than two groups
N	-	number of respondents; population size; number of rating scale index
n_i	-	number of respondents who rate the importance or influence of the factor as i = 1 as "very low"; 2 as "low"; 3 as "moderate"; 4 as "high"; and 5 as "very high".
N	-	the dimension of the matrix
P	-	population proportion
s	-	the required sample size
w_i	-	weight of factor i
X^2	-	the table value of chi-square
X	-	variable expressing the frequency response for i = 1, 2, 3, 4, and 5

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CHAPTER 1

INTRODUCTION

1.1 Preface

Oil and gas transmission by long distance pipeline has become one of the safest and most effective ways for the transportation of oil, gas and other chemicals (Tong *et al.,* 2016). Because these pipelines carry volatile, flammable, or toxic materials, they have the potential to give bad impact. Many accidents, such as explosions drew criticism from the National Transportation Safety Board and raised congressional concern about pipeline risks. Trends in pipeline accidents suggest that the opportunity for safety improvement shall be continued (Parfomak, 2016).

The pipeline accident events can cause public injury, property destruction, environmental damage and reputation loss to the pipeline's owner. Reputation is a major risk issue for all organizations and needs to be considered alongside all other major risks such as operational, strategic and financial risks (Brandy and Honey, 2007). However, this reputation risk impact is always not included in the risk assessment of pipeline damage because the risk values were not obtained in monetary terms. The consequences of pipeline failure are also influenced by reputational loss. Hence, it must be included and taken into account in the consequences assessment of pipeline damage as well (Zardasti *et al.*, 2015a).

1.2 Background Research

Natural gas or oil is a flammable and explosive material conveyed from pipelines transportation. It has posed special safety concerns from where various accidents (Russo *et al.,* 2014). Hundreds of pipeline failure happen each year because of pollution, loss in transportation capacity, loss of gas availability and expensive repair cost (Andersen and Misund, 1983). Nonetheless, failures on offshore pipelines would normally take longer to be repaired and therefore interrupt business seriously (Andersen and Misund, 1983). An accidents or incidents such as pipeline explosion can happen if there was a gas leak in the presence of an ignition source. It may also due to construction errors, internal and external corrosion, material defects, operational errors, outside force damage and earthquake (Cunha, 2012; Russo *et al.,* 2014).

There are several examples of latest massive pipeline failure events such as on the 28th June, 2014, where a series of gas explosions in the southern Taiwanese city of Kaohsiung had killed 25 people and injured 267 others. The exact cause of the gas leaks was not clear, but reports said that the blasts were caused by ruptured pipelines (BBC News, 2014). On 22nd November 2013, an explosion occurred when an oil pipeline in Chinese city of Qingdao, Shandong Province of China, leaked, caught fire and exploded. Oil leaked from a ruptured pipeline exploded in an eastern Chinese port city, killing at least 35 people, injuring 166 and contaminating the sea in one of the country's worst industrial accidents of the year (Daily Mail Online, 2013). These huge pipeline failure events involved many innocent civilians on the public area.

Safety failures in the field can cause deadly gas pipeline explosion. The pipeline explosions can cause many negative impacts such as human losses, property damage/ losses, economic losses, environmental damage and reputation loss to the pipeline's operator (ARIA, 2009). Reputation loss can take place if there are negative perceptions towards the stakeholders involved prior to the events. Consequence assessment on reputation loss had always not been taken into account because it is not visible and not in monetary value (Zardasti *et al.*, 2015). Reputation risk is very

important for any company (Deloitte, 2014). Good reputation takes years to establish but it only costs seconds to destroy. A company's credibility and reputation are viewed differently depending on which stakeholder holds the view (Marcellis and Teodoresco, 2012). It is define as the frequency of the occurrence of an undesired event in all activities that involves element of risk i.e. the possibility of failure on the level of safety of a system was designed and operated. Such failure may pose risks to people or the environment. The risk involved must be understood and decreased because reducing the risk is the most effective way and develop appropriate standards and design codes can be done by implementing precaution steps (Acton *et al.,* 2003).

1.3 Research Problem

A number of high-profile incidents such as explosions involving transmission pipelines in an urban and environmentally sensitive areas have recently gained public attention on pipeline safety (Russo *et al.,* 2014). The incidents of large diameter high pressure transmission pipelines can cause a significant damage to surrounding people and properties. It may result in injuries or fatalities as well as environmental damages (Sakuma *et al.,* 2009). The failures with casualties have not shown any decrease over the last decade (Papadakis, 1999). Apart from the adverse effect and loss to the people and environment, the reputation loss is also included in the great issues being addressed for example, the Deepwater Horizon explosion in 2010 had rose as a hot topic where the companies are under scrutiny and reputational risk (Arena *et al.,* 2015).

Typically, reputation loss impacts in pipeline assessment are disregarded because it is difficult to count, time dependent and it subjected to the criticalness of the event (Arunraj and Maiti, 2009). Reputation loss also depends on the stakeholder's expectations and historical behaviour of the entity (Bie, 2007). Stakeholder perceptions and expectations on pipeline damage event give high impact to the reputation loss of pipeline operators especially from the public. Public is the

earliest impacted group by an explosion event compared to other stakeholders such as investor, employees and customers. In the period of 1970-2013, European Gas pipeline Incident data Group (2005) stated that the public is the most common detector to pipeline incidents with approximately 36%, followed by 16% by patrols and 15% by contractors (EGIG, 2015). According to Zardasti (2016), the pipeline explosions events will decrease the public trust to the pipeline operator and unstoppable negative media reports from public will hence be accounted for reputation loss pipeline operator. The impact of loss of the pipeline operator's reputation due to public initiated by mishandling public reports, recurrence of similar accident, and severity of accident factors (Zardasti, 2016).

Nowadays, in a world of ubiquitous social media, managing public expectations and perceptions to evade reputation loss of pipeline operator is very important because perceptions can change. It can also be argued that remedial action without disclosure is not enough to repair legitimacy, because relevant publics need to be informed about actual changes before their perceptions can change and affect others (Summerhays and de Villiers, 2012). The prioritization of factor impact from public that contribute to reputation loss pipeline operator must be taken seriously. This impact will eventually forces pipeline operator to apply mitigation measures immediately according the factor that formerly to be dealt with (Shea, 2014; Zardasti *et al.*, 2015).

1.4 Research Aim and Objectives

The aim of this study is to prioritize the reputation loss factor subject to pipeline explosion based on public perspectives. In order to achieve the research aim, the objectives of this study are laid as follows:

i. To identify the reputation loss factor from public stakeholder perceptions in the recent pipeline explosion cases.

ii. To prioritize the reputation loss factor from public which are affected from pipeline explosion events using Analytical Hierarchy Process method.

iii. To validate the prioritization of reputation loss factor with previous study.

1.5 Research Scope

This study focuses on prioritizing reputation loss factors due to pipeline explosions from public perceptions. The public responses on the events were observed; views from other stakeholders such as investor, customer and employee were neglected. The data and information about latest ten years (2005-2014) the pipeline explosion cases in this study selected by referring to the previous research. The unidentified factors in the selected events from previous research were enriched by the recent collected information, which gives more additional data because reputation is time-dependent.

Questionnaire surveys carried out to obtain responses from public for this study. In previous research, the data survey from public was gathered only from students who pursue their higher-level studies in Malaysia. The collected data does not have variety of categories of public's perceptions. In this research, the survey data gathered from different respondents and include many categories which differentiated by state, educational level and profession.

This study focuses on the public who lives in the regions where onshore pipeline route of the Peninsular Gas Utilization (PGU) located in the East Coast of Malaysia. The prioritization procedures completed by using Analytic Hierarchy Processes (AHP) in order to reduce errors and increase accuracy.

1.6 Significance of study

This research is focusing only on one stakeholder and the public were chosen because they are the earliest group of the pipeline operator's stakeholder that affected directly by the event. Hence, it is important to get public's perceptions that can eventually lead to reputation loss of pipeline operator.

This study is one of the continuing efforts to improve results from the previous study due to the focused sample. The research samples selection from previous study was considered as not varies because the samples were only to students in Malaysia. This study has gathered more samples than the previous study, 200 respondents and 72 respondents, respectively. It focused on public perceptions and the categories of samples are of various and differentiated by state, profession and educational level. This is one of the ways to have a better population of selected sample of public that may directly affected by the impact of pipeline failure. Furthermore, reviewing the recent 10-year pipeline explosion case studies (2005-2014), improves the numbers of factors identified by previous research. Thus, consequence of the pipeline failure is appropriately assessed.

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