

Safety Supervision in Oil and Gas Industry

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Abstract

In the industry of oil and gas will responding to changes over time, whether in terms of technology, market needs, or pricing, the operational risk in the operation will also increase. The goal of this research is to examine the effectiveness of the existing safety Supervision methods used in the upstream portion of the oil and gas industry in order to highlight the significance of safety Supervision systems in the sector .Due to a high demand for workers, there has been a significant growth in employment in the operating of the industry over the past few years, making safety Supervision systems increasingly crucial to ensuring overall safety and lowering accidents in operating the industry .Major to minor incidents, including near misses, can occur. These can have an impact on the industry in terms of the economy, the workplace, and the workforce. Additionally, operating in this sector requires a significant amount of investment and a protracted time of operation. This study will analyses and examine the efficacy of the safety Supervision system that has been put in place in the upstream sector of the oil and gas industry, particularly at Indian Oil Adani Gas PVT Ltd. The research will emphasize knowledge of and the significance of managing safety in the oil and gas sector and will identify safety Supervision as the primary factor in preventing and minimizing accidents and incidents to occur in oil and gas industries. The information is gathered through questionnaire surveys and previous studies. The survey's data and findings are analyzed using the Relative Importance Index (RII), which ranks the outcomes according to their importance, and the Average Index (AI), which ranks the survey's feedback according to the respondents' level of agreement. This is done in order to assess how well safety supervision has been implemented in the industry's upstream sector and to emphasize the significance of safety Supervision.

Key Word: oil and gas industry, Relative Importance Index (RII), Average Index (AI), survey's feedback.

INTRODUCTION

Risks and danger are all around us, and they can manifest themselves in any circumstance, at any time, or anywhere—even on the job. There are dangers at work. According to the Ontario Ministry of Labour [1], a workplace or occupational hazard is anything that has the potential to endanger people in any way. Risks in the workplace need to be identified and assessed. Minimizing and removing the risk of the hazard is essential to protect workers and maintain workplace safety.

Occupational dangers in the oil and gas sector are definitely not an exception. There are greater risks associated with the oil and gas industry because it makes huge investments and has a long history of operation. It is more difficult to conduct business in the oil and gas sector and increases operational risks both upstream and downstream as a result of the industry's ongoing adjustments and adaptations to changes in technology, market demand, or prices Rains [2].Working in oil and gas industries has higher risk on threats and danger. ABS Consulting(n. d.), which is a global safety, risk and integrity management company pointed out in their website that in the oil and gas industry, there will always be struggles and doubt with the concern of health and safety throughout the operations in the industry. Therefore, this study is based on-

What is the importance of implementation of safety management in oil and gas industry especially in upstream sector?

What are the current practices of safety management implemented and how effective isthe system?

This study is the step of highlighting the importance of safety management in oil and gas industry and to evaluate and investigate the effectiveness of current safety management implemented in the oil and gas industry.

LITERATURE REVIEW

The world in oil and gas industry has been known as one of the industry that always involved in safety. According to the statistics from the U.S. Bureau of Labor in the reports by [5], the number of employment in the industry of oil and gas keep on increasing. With the increasing amount of employment in the industry, the chances of accidents to occur also increase. [6] in her paper states that as the operational risk faced in oil and gasindustry increases, the safety of environment and human continue to be the top priority in the industry. This emphasize that oil and gas companies should implement a process safety management(PSM) or Safety Management (SM) system that fully integrates the change in management methodologies across multiple facilities, workers and technological advancement to avoid catastrophic incidents and in addition to increase the overall safety of an operation [2]. defined Safety Management (SM) System as several processes that collaborate and work side by side for the purpose of improving safety and also in order to reduce the number accidents occur into ZERO [7].Researcher suggest that from the past investigations and researches, directly or indirectly, accidents happens are basically can be caused by 3 aspect, which are either people itself, materials or equipment or by the combination of these aspects. Hazards created can be relate closely to these aspects [7]. Therefore, [2] quotes that Safety Management systemare mainly focused on managing system to control and reduce hazards in the operations in 3 key areas, which are technology, facilities and personnel, the Management of Change Processalso should be addressing to these 3 elements in order to have a holistic management system. However, the management of change

must be evaluated carefully and reviewed, including by carrying out hazard analysis and consultation with safety engineering expert as any changes made have safety implication and as accidents often occur after changes implemented [4].

According to researcher [3], the suggestion of implementing and executing an Occupational Safety and Health Management System at every workplaces came into attention during the International Labour Conference at its 91st session on 2003, where the Conference Conclusions was to plan a world-wide approach on occupational health and safeties.

(1) Current Practices, Implemented system and its Effectiveness

There are some basic safety management tool and safety management system that are widely used in the oil and gas industry, such as Job Hazard Analysis (JHA) or Risk Assessment and A Permit to Work System (PTW). Job Hazard Analysis or Risk Assessment is a safety management tool that identified risk and hazards that may present in the specific job to be done and it is then evaluated and measured to eliminate or reduce the risk and implemented while Permit to Work System is a safety management system or called as safe system of work to ensure that safety on workplace and to ensure that all work are planned, controlled, communicated and carried out in safety manner [8]. In other words, JHA can be considered as the planning stages of a job, while PTW is on the implementing or carrying out the job. By performing JHA, the safety of employees is fully taken into consideration from the early planning stages of a job. The effectiveness of JHA are mainly depends on the employees and management as it should be done by taking both point of view on the job to identify the hazard and risk during operations. Besides, the JHA must always being reviewed and keep up to date in order for the JHA to be effective. Employees also should be clear and aware of all hazard and risks of the job from JHA performed. PTW consist of the details of work that need to be done, details of the safety precautions to be taken, identify all foreseeable risks and hazards, states the control measures to be implemented and ensure worksite in a safe condition when leaving or finishing the job. [9] pointed out that it is important as by having PTW, managers also can get the introduction of the works based on PTW during visits and can verify the existence or lacking of the PTW.

Besides, by having specific procedures, precautions and hazards analysis, risk of accidents and having hazards can be lessen. In order to effectively implement safety management system, it is a must to first identify and manage unsafe acts or conditions in the operations, as this can lead to higher potential hazards of near miss or much worse that lead directly to accidents. Although near miss is still not an accident yet, but near miss is the last step before an accident occur and there might be only an inch of difference between near misses and accidents [7]. In term of company side, [11-14] states that the existing Health, Safety, and Environment Management System (HSEMS) has been improved and reviewed in 2006 with more detailed in term of technical safety process standards which consists of eight (8) technical standards. These standards are; Process Safety Information, Process Hazard Analysis, Operating Procedure, Pre-Activity Safety Review, Management of Change, Mechanical Integrity, Proprietary and Licensed Technology Assessment (PLTA) and Design Integrity. This rules intended to help improving the performance in the operations in term of safety as it is needed to be complied by every personnel and contractors in COMPANY and failure to obey the rules will cause disciplinary action to be taken. A COMPANY (n.d.) state that ZeTo Rules is consists of ten (10) rules that need to be obey, which are:

- i. Permit to Work (PTW) necessary for the job is valid in order to work.
- ii. Before work started, energy separation or isolation need to be verified.
- iii. Before safety critical equipment is being disabled or override, authorisation need to be acquired.
- iv. Before confined space being entered, authorisation need to be acquired.
- v. When working at high places, we must be protected against a fall.
- vi. When using or holding dangerous chemicals, specific and valid personal protective equipment need to be used.
- vii. Before entering or digging a trench, authorisation need to be acquired.
- viii. Never be in a spot or location that is under suspended load.
- ix. Never bring any potential sources of fire into operation areas or smoke other than in designated area without authorisation.
- x. While driving, seat belt need to be used, speed limit need to be followed and mobilephone or walkie talkie cannot be used.

These are the summary from past research which related to the importance of safety management system and also safety management implementation in Oil and Gas industry and its effectiveness. These past researches are being used as clarification and references in order to ensure the current study objectives can be achieved. Table 1. below shows the finding/ key statement from each research:

NO	Articles	RESEARCHER (AUTHOR)	KEY STATEMENT/ FINDINGS
1	Increasing the Agility of Process Safety Management Systems	Rains, [2]	<ul style="list-style-type: none"> Increased risk and danger in oil and gas can be reduced and avoid occurrence of incidents & fatalities by implement safety management Industry constantly adapting to changes thus increasing risk of hazards. Accident such as Macondo well blowout have economic effect to several countries and resulting in loss of jobs and money (more than US\$ 37.2 billion). Emphasize implementation of Process Safety Management (PSM) and Management of Change (MOC) based on technology, facilities and personnel. Efforts from oil and gas sector in order to reduce risk have improved and catastrophic accidents have become rare events.
2	Safety Management in Oil & Gas Industry – The How's and the Why's	Rizwan & Al-Marri, [8]	<ul style="list-style-type: none"> Safety management are main key in operations and the implemented safety management should be effective to reduce accidents Explained the common safety management system used: Job Hazards Analysis (JHA), Risk Assessment, Permit to Work (PTW). Emphasize the important role of management and employees for effective management system.
3	Safety and Health Management system in Oil and Gas Industry	Chauhan, [3]	<ul style="list-style-type: none"> Emphasize need of effective safety management as workers in oil & gas industry exposed to danger and point out accidents such as explosion of Amuay Oil refinery on 2012 and Deepwater Horizon rig explosion on 2010. From the Occupation Safety and Health Management Systems (ILO-OSH 2001) guidelines, the structure of nation-wide or organizational should have Occupational Safety and Health Management Systems (OSHMS) that contain the components of

As shown in the table above, there are numbers of researches that have been made regarding the topic, however, there are some gaps or some unclarified topic that have not been discussed in each researches. Table 2. below shows the list of gaps identified from the above research:-

NO	Articles	RESEARCHER (AUTHOR)	GAPS
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1	Increasing the Agility of Process Safety Management Systems	Rains, [2]	<ul style="list-style-type: none"> Did not mention on effective safety management and how the effectiveness of safety management can be achieved.
2	Safety Management in Oil & Gas Industry – The How's and the Why's	Rizwan & Al-Marri, [8]	<ul style="list-style-type: none"> Discuss effectiveness based on employees and management only but did not discuss the proper steps to achieve effective safety management.
3	Safety and Health Management system in Oil and Gas Industry	Chauhan, [3]	<ul style="list-style-type: none"> Did not mention on the safety management implemented in oil and gas industry. Did not discuss on the importance of keeping the safety management up to date as industry keep adapting to change.
4	Risk Management in the Oil and Gas Industry	Leveson, 2011	<ul style="list-style-type: none"> Did not mention on how to achieve effective safety management and key component of safety management.
5	Emerging Issues in oil and gas industry safety management	National Energy Board (NEB), [18]	<ul style="list-style-type: none"> Did not mention on key aspect of an effective safety management system.
6	Effective safety management systems	Watson, [7]	<ul style="list-style-type: none"> Did not mention on the safety management implemented in oil and gas industry.
7	Corporate Safety's Responsibilities and Duties to Company Offshore Facilities	Coleman & Salleh, [17]	<ul style="list-style-type: none"> Did not mention on effective safety management and how to effectively implement safety management system.

Key to effective Safety Management

Researcher [7] suggests that effective systems of safety management needs continuous process of training, applying, examining, taking action, and management assessment that can be achieved with proper key elements, which are:

Management Participation – by identifying safety needs and hazards, planning and formulating safety management and providing procedures on how to control or eliminate hazards in the workplaces.

System (Proactive) – A proper and effective safety management system that take into consideration of all those affected by the system which also identifying and correcting any complication regarding safety before accidents happen.

Implementation – Implement the safety management system globally across all operations in the company once the systems have been established and prepared. Assistance during implementation and training on the systems should be done step by step from management to all personnel.

Measuring – Monitoring, evaluating, and gathering feedback based on the system implemented.

Review/ Action – Reviewing feedback to determine what recommendation of change should be made to the system and implementing and take action to adjust and improve the system.

Improvement Process – Steps to improve the systems from measuring and review and taking action are being done continuously.

METHODOLOGY

Methodology of the project comprise of 2 phase, which are Preliminary Phase or Literature review Phase and Data Collection Phase.

1. Preliminary Phase or Literature review phase is the stages where it is to identify all the objectives, problem statement and the scope of work of this project including to get the overall overview and background study of the topic. Data from journals, thesis, researches, books etc. are searched and used.
2. Data Collection Phase is the stages that collect, analyses and discuss data that obtained from the main data which is from the questionnaire and also data from the research found in the Preliminary Phase to achieve the objective of the project. Pilot Study is also done where the questionnaire will be administered and clarified by professionals in oil and gas and then will be refined. From the comments of the professionals, finalized questionnaire will be developed in order to have proper clarified questionnaire. This is to ensure the suitability and the effectiveness of the questionnaire.

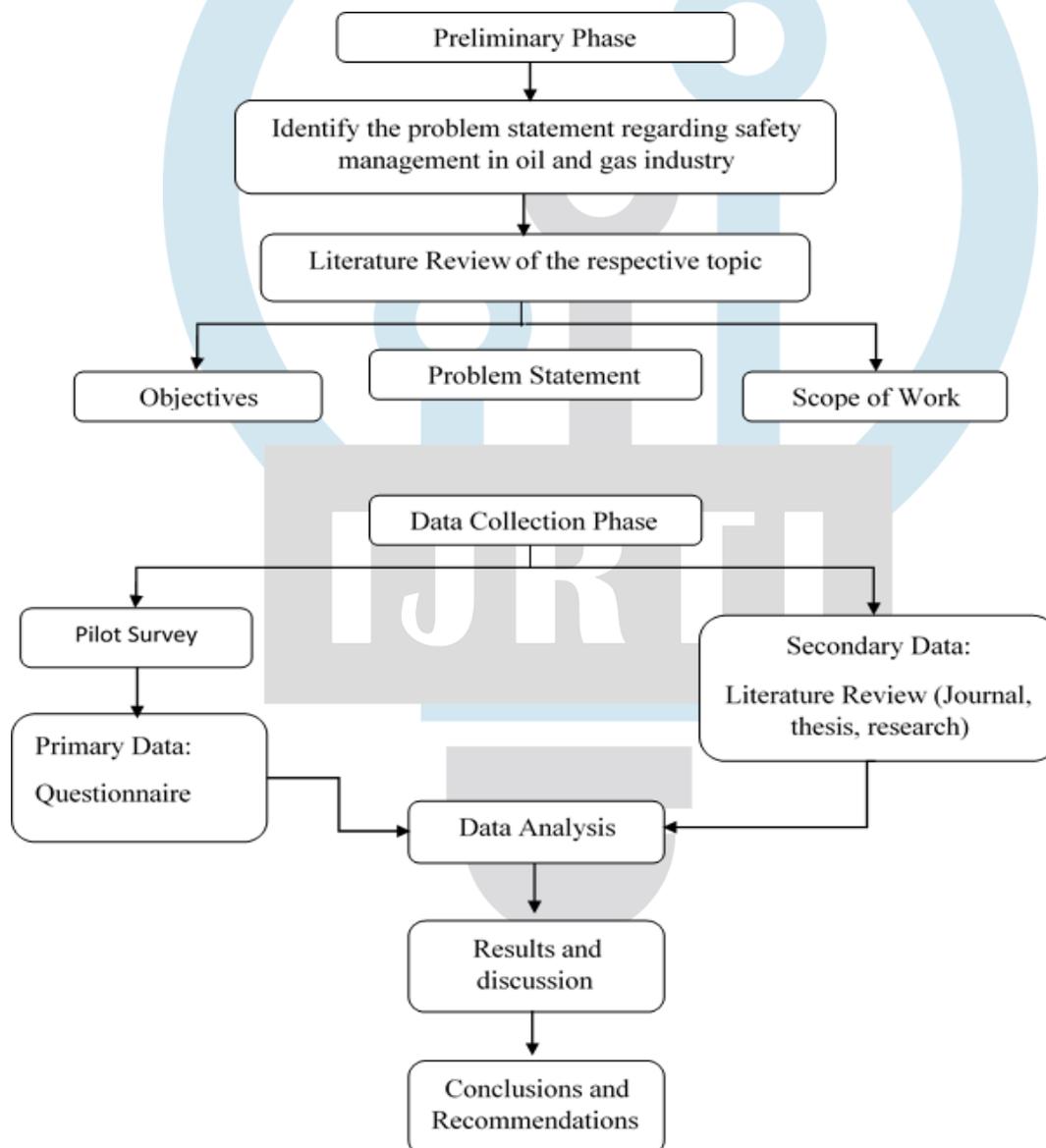


Figure 1: Methodology of Project

Data Analysis Method

The data analysis of the survey is done right after when the data collection from the questionnaire and literature review has been done. All the data and results obtained from the questionnaire distributed will be then analysed according to its suitability and proper method of analysis. The result will be then summarized. Data analysis is a part of the methodology approach in order to evaluate and combine all the data collected. The data analysis of the questionnaire is done by using the Average Index (AI) Formula, and Relative Importance Index (RII). From the data acquired from the questionnaire, the scores are developed and analysed by using following formula based on its importance marks.

Relative Importance Index (RII)

The data acquired from questionnaire results is analysed by Relative Importance Index (RII) method where the data were put into an Excel Spreadsheet in order to determine and rank the relative importance of the 'Importance of Safety Management System in Oil and Gas Industry'.

$$\text{Relative Importance Index (RII)} = \frac{\sum X}{ZN}$$

Where x is the weighting parameter from 1 to 5 for the factor given in the questionnaire, while Z is the highest weighting parameter (5 for this research) and N is the total amount of respondents.

Average Index (AI)

The data acquired for the Current Practices and also Current Implemented System and its Effectiveness from the questionnaire were analyzed by using Average Index (AI) formula as it is used to evaluate the degree of agreement by the respondents with the statement pointed out in the survey.

$$\text{Average Index (AI)} = \frac{\sum xN}{N}$$

Where x is the weighting parameter from 1 to 5 for the factor given in the questionnaire, while n is the number/ frequency of respondents and N is the total amount of respondents.

Majid [18] proposed that based on the value of average index, the agreement attributes of the results can be analysed whether:

Table 3: Average Index Rating Scale based on [18] (1997)

Weightage Scale	Range of Average Index	Agreement Attributes
1	$0 \leq AI < 1.50$	Strongly Disagree/ Not ever
2	$1.50 \leq AI < 2.50$	Disagree/ Rarely
3	$2.50 \leq AI < 3.50$	Moderate/ Sometimes
4	$3.50 \leq AI < 4.50$	Agree/ Frequent
5	$4.50 \leq AI \leq 5.00$	Strongly Agree/ Always/ Very Often

RESULT AND DISCUSSION

1. Results Based on the Relative Importance Index (RII), and Average Index (AI) Formula.

1.1 Importance of Safety Management in Upstream Sectors of Oil and Gas Industry

Table 4: Ranking based on the Relative Importance Index (RII) for the Importance of Safety Management

Rank	Importance	Weightage (People)					Relative Importance Index (RII)
		1	2	3	4	5	
1	Increase overall safety operation	0	0	1	5	20	0.95
2	Reduce the probability of accident occurrence	0	0	1	8	17	0.92
3	Ensure smooth execution of work	0	0	3	4	19	0.92
4	Increase confidence of workers during working	0	0	1	9	16	0.92

5	Enhance knowledge and skills of workers	0	0	0	11	15	0.92
6	Increase confidence of client	0	0	2	8	16	0.91
7	Increase/maintain the productivity of workers	0	0	5	8	13	0.86
8	Improve business profitability	0	0	4	11	11	0.85
9	Complete job within schedule	0	0	4	12	10	0.85
10	Reduce operational cost	0	0				0.79



Figure 2: Importance Safety Supervision

Based on Table 4, the respondents rank that the highest in the importance of safety management is to increase the overall safety operation with 0.95 relative importance index and followed by to reduce the probability of accident occurrence, ensure smooth execution of work, and also to increase the confidence level of workers during working with 0.92 relative importance index. Basically, all of this are correspond to the increased in the overall safety operation. This also shows that safety management in the industry is very important in order to ensure the safety of the workers and will then result in the reduction of accidents to occur while ensuring the smoothness in the work to be completed within time. Besides, from the Table 3, it shows that the awareness between COMPANY’ employees and also their contractors towards the importance and the need of safety in the operation is very high. Moreover, the respondents rank the least in the importance of safety management as to reduce the operational cost with 0.79 relative importance index. This is then followed by to improve business profitability and complete job within schedule with 0.85 relative importance index. Probably, this may be caused by as most of the respondents are basically engineers and technician, which are about 21 person while from management part are only 5 person, thus causing the cost, profits and completing the job within time are somehow less important to them. Thus, these importance are rank overall based on engineers and workers view, and not by the view from management part. These three (3) importance can be related together and combined as this will give the most impact on the management side. Therefore, based on the results, it can be concluded that different party have its significant importance regarding the subject and will then give different impact and view in the importance.

1.2 Current Practices of Safety Management in Oil and Gas Industry

Table 5: Ranking based on Average Index (AI) for Current Practices of Safety Management

Ranl	Current Practices	Weightage (People)					Average Index (AI)
		1	2	3	4	5	
1	Safety signboards at workplace is put at the site	0	0	1	7	18	4.65
2	Emergency response plan is used at the site	0	0	3	6	17	4.54
3	HSE policy is available and displayed to all worker	0	0	2	10	14	4.46
4	Safety awareness campaign is conducted by the company	0	0	2	11	13	4.42

5	Health safety officer is employed and is present to ensure the safety at the site	0	02	11	11	4.42
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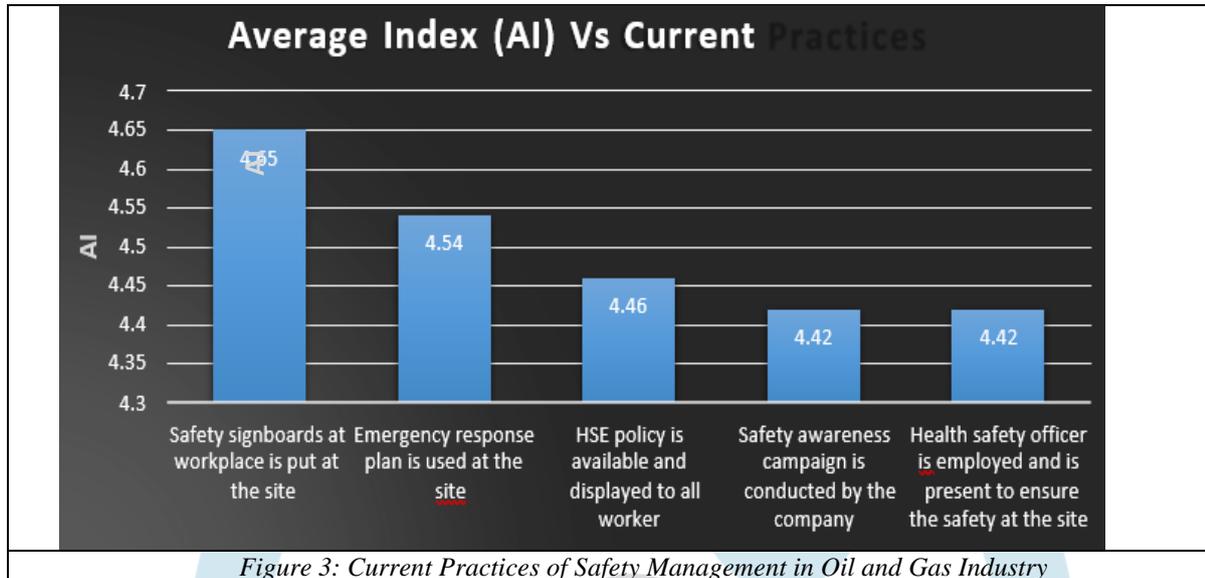


Figure 3: Current Practices of Safety Management in Oil and Gas Industry

The result in the Table 5 is ranked based on the average index as this results is based on their experiences and observations. The respondents rank the current practices that are most regularly experienced and observed is safety signboards is being used and displayed at the worksite and workplace with average index of 4.65. In other words, the Table 3 shows that the availability of safety signboard at workplace more prone to exist as the highest average index. About 18 people strongly agreed, 7 people agreed while 1 person rated this practices as moderate. This is a clear indication that the workplace and worksite environment had already been designed and set to remind workers about the safety and also the possible hazards or dangers. This signboards can also be viewed as precautions of reducing and avoiding accidents to occur. In addition, emergency response plan are also being used at workplace and ranks as the second highest average index. This indicate that safety management are being implemented effectively as one of the most important actions are being taken. This is because in the event of emergency, every second are critical. In the event either in the need for workers to evacuate or in the event of lockdown, quick warning or actions may save lives. This shows that there may be proper explanation or training on the event of emergency for all the workers. The least observed and experienced current practices with 4.42 average index are ‘safety awareness campaign is conducted’ and ‘health safety officer is employed and present to ensure the safety at worksite’. These may be rank as lowest because safety awareness campaign are done based on yearly basis on 6 monthly basis while there may be a few safety officers in the site as there will be also supervisors to supervise the safety of the operation. Although the respondent rank the HSE officer existence and safety awareness campaign as the lowest in current practices, the average index are still high and this proves that the management plays their role regarding safety.

Current Implementation of Safety Management System in Oil and Gas Industry and its effectiveness

Table 6: Average Index for Current Implementation of safety management based on its key effectiveness

No	Current Implemented System	Key Effectiveness (based on Average Index)		
		Consistently Applied	Highly Integrated	Assign Accountability
1	Safety Management System (SMS) is implemented at worksite.	3.92	3.81	4
2	On-site meeting or Safety tool box meeting is conducted before executing any job.	4.38	4.15	4.19
3	Personal Protective Equipment (PPE) is required to be wear at the site.	4.77	4.65	4.54
4	Risk Assessment and Job hazard analysis (JHA) is conducted and validated for every job to be executed.	4.46	4.42	4.38

5	Permit To Work (PTW) system is implemented.	4.62	4.54	4.5
6	Worker's competency is validated before executing any job. For example : Proper training, certification	4.5	4.42	4.5

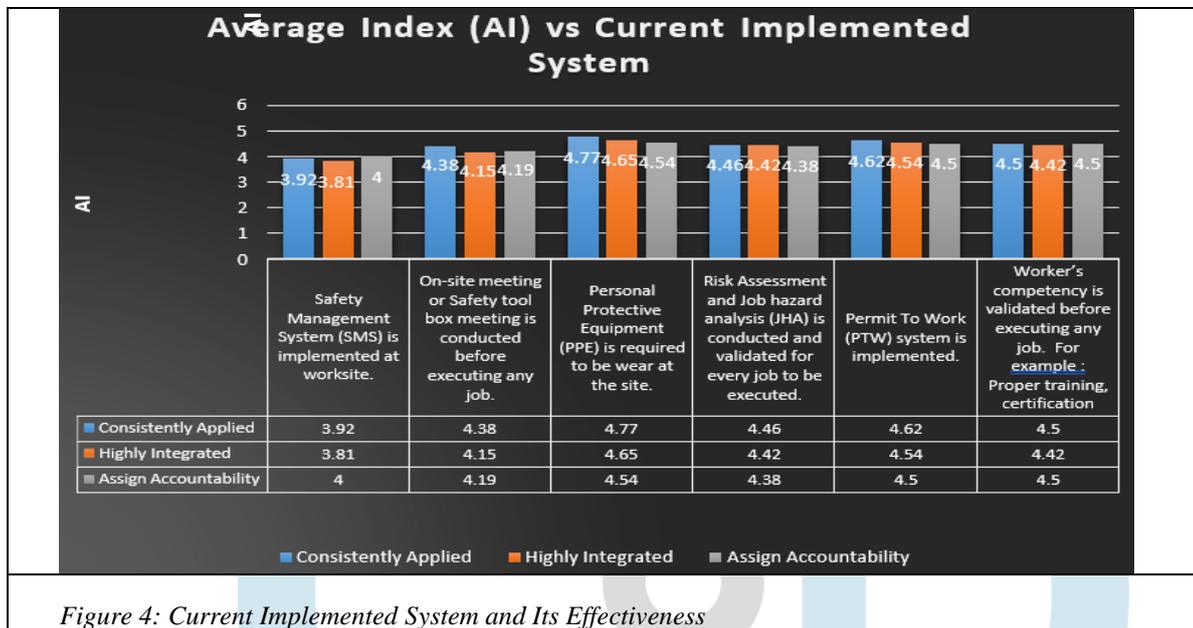


Figure 4: Current Implemented System and Its Effectiveness

The result in Table 6 are analyzed based on the average index too as it is based on observation and experience of the respondents. The current implemented system and its effectiveness is analyzed based on three (3) different aspect which are consistently applied, highly integrated and assign accountability. Based on Table 5, the results shows that based on the current implemented system and its effectiveness, the requirement of Personal Protective Equipment (PPE) is the most effective implemented system. This is because, this is the most basic thing to be observed at the worksite. Besides, workers need to use PPE before they even enter the site, thus ensuring the usage of PPE to be the most effective. While the least effective of current implemented system is the implementation of Safety Management System. Although the Safety Management System is a compulsory for every organization and operation, this may be rated as the least effective because of the less initiative taken by the management in order to ensure the existence and implementation of the Safety Management System at the worksite to be known by all the workers.

CONCLUSION AND RECOMMENDATION

Throughout the operations in the Oil and Gas Industry, there will always be a concerns regarding safety as working in the industry has high risk on danger and accidents. Besides, as the industry always evolving and continue to adapting to change, the risk on threat will always exist. From Table 5, it can be shown that all the authors from past researches agreed on the importance of safety management system in the Oil and Gas Industry in order to ensure the safety of the workers and to reduce the possibility of accidents to occur. Moreover, based on the questionnaire, it can be concluded that all the respondents agreed on the need and the importance of safety management in the industry. From the results, the importance of the safety management system are ranked based on their Relative Importance Index (RII). In addition, as per mentioned by some of the authors from past researches regarding the implementation of proper Safety Management System, and the common type of safety system implemented such as Job Hazard Analysis, Risk Assessment, Permit To Work (PTW), compliancy and competency of the workers, requirement of using Personal Protective Equipment (PPE), and also combined with the results on the respondents' agreement regarding the existence and implementation of these system, the effectiveness of the system can be evaluated. Therefore, as a conclusion, the objectives of this study are achieved.

From the analysis of the results based on the survey, it can be concluded that the awareness among the workers in COMPANY Carigali Sdn. Bhd Sabah Operation and its contractor regarding safety is high. Besides, based on the average index of current practices and current implemented system and its effectiveness, it can be identified that the company has play their role very well in term of safety, whether in designing the work site environment, the emergency plan, hazards and risk assessment, awareness of workers etc. This shows, overall, the safety management is good and stable. However, this does not reflect overall situation or condition in the other oil and gas companies the survey is within the company and their contractors. The situation may differ according to different companies. As a recommendation for further the study, in order to get more accurate results, the result from the questionnaire can be combined together with direct observation from site survey to get more reliable and better results. However, as the author does not have Basic Offshore Safety Induction and Emergency Training (BOSIET) to go to offshore to survey and experience by-hand on the safety management in the industry. Furthermore, as the number of respondent only consist of

26 respondents, and the survey is done based on small scale which is within COMPANY Carigali Sdn. Bhd Sabah Operation and their contractors, thus giving results that indicate in small scale of survey. The result can be improved and get more accurate data by doing large scale survey, increasing number of respondents, and by involving much more companies in the oil and gas industry into the survey. Other than that, in term of the company itself, the company head or the management team should realize the importance of safety management system correspond to the performance and productivity of the workers, the profits of the company, and also the safety of the workers as they play much bigger role regarding safety. They should implement the safety system implemented systematically and globally throughout the operations, and make sure that all workers know, remember and comply with all the system implemented especially to the new workers. Moreover, the company can introduce some safety incentives or bonus and penalties for the safe and unsafe behavior. This may help to improve the performance of the safety management of the workers. In addition, the management team should always keep track on their safety management system itself, to keep up to date whether in term of technology or facilities, and keep reviewing and improving their system to ensure the safety of the workers. Besides, the awareness about the safety management among the workers and compliance and competency by workers need to be improved. Therefore, in a nutshell, based on the occurrence of the major accidents in the past, the safety management system has been implemented globally and greatly improved by every company in order to reduce the number of accidents occur concurrently increase overall safety in operation. However, the safety management system should be monitored and reviewed frequently for its effectiveness specifically based on key areas of highly integrated, consistently applied, and assign accountability.

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