T.C.
ISTANBUL GEDİK UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

PROCESS SAFETY MANAGEMENT FOR UPSTREAM PETROLEUM OPERATIONS IN KIRKUK

MASTER'S THESIS

Hallow Qadir Ahmed ALJABBARI

Engineering Management Master in English Program

JUNE 2021

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Thesis Advisor: Prof. Dr. Gözde ULUTAGAY

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Enstitümüz, Engineering Management Department İngilizce Tezli Yüksek Lisans Programı (191281004) numaralı öğrencisi Hallow Qadir Ahmed Aljabbari'in "Process Safety Management for Petroleum Upstream Operations in Kirkuk" adlı tez çalışması Enstitümüz Yönetim Kurulunun 08.07.2021 tarihinde oluşturulan jüri tarafından *Oy Birliği* ile Yüksek Lisans tezi olarak *Kabul* edilmiştir.

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DECLARATION

I, Hallow Qadir Ahmed ALJABBARI, do hereby declare that this thesis titled as "Process Safety Management for Upstream Petroleum Operations in Kirkuk" is original work done by me for the award of the masters degree in the faculty of Engineering Management. I also declare that this thesis or any part of it has not been submitted and presented for any other degree or research paper in any other university or institution. (08/07/2021)

Hallow Qadir Ahmed ALJABBARI

DEDICATION

This research is the fruit of my efforts; first of all I want to dedicate it to the soul who left us early my dear father (Qadir Ahmed). I also dedicate this work to my beloved mother (Bahija Mohammed). I want to dedicate my master thesis to my lovely wife (Aveen), you deserve this dedication because you are the one who learn me how the love, faith, fulfillment and giving should be. I will never forget your support, encouragement and insistence to complete my master's degree.

I am dedicating this work to my beautiful angels (Hanya, Arveen) "Honey, Butterfly" I hope one day read this survey and make your way to success and become better than me. I'm sure you will be creative in the society with your knowledge and moral that me and your mother keen to teach you.

I also dedicate this work to my dear brothers (Arno, Aso, Boko and Kardo) God bless you all. Last but not least I dedicate this work to the dear ones father-in-law and mother-in-law (Mohammed and Asmahan).

PREFACE

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ABBREVIATIONS

SMS : Safety Management System
CAAA : Clean Air Act Amendments
PSM : Process Safety Management
OSHA : Occupational Safety and Health Administration
EPA : Environmental Protection Agency
CCPS : Center for Chemical Process Safety
MOC : Management of Change
ISO : International Organization for Standardization
EPA : Environmental Protection Agency
CCPS : Center for Chemical Process Safety
HSE-MS : Health Safety and Environmental –Management System
BOEM : Bureau of Ocean Energy Management
BSEE : Bureau of Safety and Environmental Enforcement
IADC : International Association of Drilling Contractors
SOP : Standard Operating Procedure
CCPS : Center for Chemical Process Safety
RBPS : Risk Based Process Safety

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PROCESS SAFETY MANAGEMENT FOR UPSTREAM PETROLEUM OPERATIONS IN KIRKUK

ABSTRACT

Safety Management System is vital for oil and gas projects, Organizations center Around Process Safety Management to shield employees and offices from mishaps, like blasts and terminates. Most components of PSM are firmly identified with employees, who decide the hierarchical culture, and authoritative culture straightforwardly influences process safety management.

Organizations put a push to have a solid safety culture, which are practices and reactions with respect to crisis and unusual circumstances.

This study involves survey to investigate the level of awareness of safety standards in petrol and gas sectors. The outcomes of this study involve stating of set of recommendations that vital for safety skills improvement in the designated study sample.

Keywords: *Safety, ISO-50001, Management, Neural Networks, Remote Locality, Process Safety Management, Employees.*

KIRKÜK'TE PETROL ÜRETİMİNDEN ÖNCEKİ AŞAMALARI GERÇEKLEŞTİREN PETROL İŞLETMELERİ İÇİN PROSES GÜVENLİĞİ YÖNETİMİ

ÖZET

Proses Güvenliği Yönetimi, çalışanları ve işyerlerini, patlamalar ve imhalar gibi sorunlara karşı korumayı amaçlar. Proses Güvenliği Sisteminin bileşenlerinin büyük bir çoğunluğu, proses güvenliği yönetimini doğrudan etkileyen hiyerarşik kültür ve idari kültür ile kati bir şekilde tanımlanır. Kuruluşlar, krizlere ve beklenmedik gelişmelere yönelik uygulamalar ve tepkilerden oluşan sağlam bir güvenlik kültürüne sahip olmak için ellerinden gelen çabayı gösterirler. Bu çalışma, petrol ve gaz sektörlerinde güvenlik standartlarının farkındalık düzeyini araştırmaya yönelik bir anket içermektedir. Bu çalışmanın sonuçları, belirlenmiş çalışma örnekleminde güvenlik becerilerinin geliştirilmesi için hayati önem taşıyan bir dizi tavsiyenin belirtilmesini içerir.

Anahtar Kelimeler: *Güvenlik, ISO-5001, Yönetim, Sinir Ağları, Uzak Yerellik, Proses Güvenliği Yönetimi, Çalışanlar*

1. INTRODUCTION

1.1 Safety Managmenet System (SMS)

Characterizing a Safety Management System "SMS is a management instrument to improve safety decisions". Round table members couldn't concede to an accurate meaning of what a SMS is, yet there was agreement that it is a corporate device to improve dynamic by fusing safety into a business work.

All the more explicitly, it is a systematic way to deal with oversee safety that incorporates the fundamental authoritative construction, management account capacities, safety approaches and processes required for effective recognizable proof of dangers and management of safety chances. risks are characterized as "a genuine or potential condition that could prompt an impromptu occasion or arrangement of occasions (for example setback) bringing about death, injury, word related ailment, harm to or loss of hardware or property, or harm to the climate", though hazard is characterized as "a mix of the seriousness of the disaster and the likelihood that the incident will happen" (DOD, 2012).

A SMS ought to be seen as an essential system that can uphold the advancement of explicit strategies and techniques by specialist organizations to oversee safety hazard, with the help and oversight of the controller. With the appropriate utilization of SMS, the two controllers and specialist organizations can advance from a significantly consistence (rule) based way to deal with an exhibition based safety management system.

This involves re outlining the duties of the specialist co-op, from that of consistence zeroing in on adhering to the guidelines, to one of execution where an association shows that it has set up and reported management responsibility and the suitable danger management methods to guarantee safety. SMS addresses the combination of a few controls, system safety, human variables, and business management.

It is intended to work inside an authoritative structure. As talked about by Maurino (2017), a SMS should flawlessly coordinate safety management processes and

institutional game plans by transforming safety into a basic business work – at a similar degree of significance as money, showcasing, and the mission activities of the association.

It endeavors to distinguish safety lacks and dangers in a process of hazard management that comprehends the results of peril openness and techniques for alleviating hazard. SMS addresses a change in the way to deal with safety management.

The change in accentuation puts less dependence on a prescriptive, or consistence based administrative methodology, and zeros in additional on an exhibition based system.

1.2 History

Startling arrivals of poisonous, responsive, or combustible fluids and gases in processes including exceptionally dangerous synthetics have been accounted for a long time. Occurrences keep on happening in different enterprises that utilization profoundly risky synthetic compounds which might be poisonous, receptive, combustible, or dangerous, or may show a blend of these properties.

Despite the business that uses these exceptionally dangerous synthetic substances, there is a possiblity for a coincidental delivery any time they are not suitably planed. This, thus, makes the chance of calamity. Ongoing serious catastrophes incorporate the 1984 Bhopal, India, occurrence bringing about in excess of 2,000 passing; the October 1989 Phillips Oil Organization, Pasadena, TX, episode bringing about 23 passing and 132 wounds; the July 1990 BASF, Cincinnati, Gracious, episode bringing about 2 passing, and the May 1991 IMC, Authentic ton, LA, episode bringing about 8 passing and 128 wounds.

Albeit these serious calamities including exceptionally perilous synthetic compounds caused public to notice the potential for significant fiascoes, the openly available report is loaded with data concerning numerous other less eminent arrivals of profoundly unsafe synthetic compounds. Risky synthetic deliveries keep on representing a critical danger to workers and give impulse, globally and broadly, for specialists to create or think about creating enactment and guidelines to dispose of or limit the potential for such occasions.

In July 17, 1990, OSHA distributed in the Government Register (55 FR 29150) a proposed standard,— "Process Safety Management of Profoundly Risky Synthetic substances"— containing prerequisites for the management of dangers related with processes utilizing exceptionally perilous synthetic compounds to help guarantee protected and restorative working environments. OSHA's proposed standard underscored the management of risks related with exceptionally risky synthetics and set up a far reaching management program that coordinated innovations, strategies, and management rehearses.

The notification of proposed rulemaking welcomed remarks on any part of the proposed standard for process safety management of profoundly dangerous synthetic compounds and declared the booking of a consultation to start on November 27, 1990, in Washington, DC. On November 1, 1990, OSHA distributed a Government Register notice (55 FR 46074) planning a subsequent hearing to start on February 26, 1991, in Houston, TX, specifying extra issues, and broadening the composed remark time frame until January 22, 1991.

The hearings on the proposed standard were held in Washington, DC, from November 27, 1990, through December 4, 1990, and in Houston, TX, from February 26, 1991, through Walk 7, 1991. The Regulatory Law Judge directing at the hearings permitted members to submit post-hearing remarks until May 6, 1991, and record post-hearing briefs until June 5, 1991. OSHA got in excess of 175 remarks because of the notification of proposed rule making.

Notwithstanding these remarks, the hearings brought about right around 4,000 pages of declaration and very nearly 60 post-hearing remarks and briefs. For peruses' benefit, this distribution incorporates, as an index, the full content of the last OSHA standard gave in the Government Register on February 24, 1992, including the rundown of covered synthetic compounds and limit sums. There are presently 25 State plan States; 23 covering private and public (State and neighbourhood government) areas and two covering public area as it were.

Plan States should receive similar norms to the Government inside a half year of a Bureaucratic standard's proclamation. Roughly four months after the distribution of OSHA's proposed standard for process safety management of exceptionally dangerous synthetics, the Perfect Air Act Revisions (CAAA) were established into law (November 15, 1990). The CAAA necessitates that the standard incorporate a

rundown of profoundly risky synthetics which incorporates poisonous, combustible, exceptionally responsive, and unstable substances.

1.3 Problem Explanation

In 11 December 2005, impacts and flares occurred at the Bunce field oil amassing and move a stop, Hemel Hempstead, U.K. Bunce field (2007) highlighted in the event report that the essential driver of the spread of mischief came about in light of the beginning of a raging cloud-conveyed from spilled gasoline by over-burdening a limit tank during the evening. Through assessment, it was shown that the possible explanation was likely the feeble level measure which conceivably annuls the extent that a potential safety switch and modified PC action to stop the filling process which prompts this shocking event.

Besides that, the tragic event of the Flixborough setback has brought the importance of the management of progress (MOC) clearly when it incorporates the concise change to diverting between anticyclone oxidation reactors As shown by PC based knowledge , with a ultimate objective to care for creation, a transient diversion line was presented around a fifth of a movement of six reactors at an office in Flixborough , Britain , in the Spring of 1974. The diversion failed while the plant was being restarted after unimportant fixes on June 1, 1974, conveying around 60,000 pounds of hot process material, made commonly out of anticyclone. The ensuing smoke cloud exploded, yielding an energy release indistinguishable from around 15 tons of explosive.

The impact completely demolished the plant and hurt nearby homes and associations, executing 28 workers, and hurting 89 representatives and neighbours. Taking into account the report of the accidents, the passing change was worked by individuals who were off-kilter in arranging enormous lines furnished with thunders. Thusly, this setback can be kept up at an essential separation from if there is a practical MOC structure that can recognize the arrangement imperfection before the change was done.

1.4 Aim of Study

Introduction The concept of process safety Management and is defined as the science that is concerned with preserving human safety and health, by providing safe work environments that are free from the causes of accidents, injuries or in other words, it is a set of procedures, rules and regulations in a legislative framework aimed at To protect people from the risk of injury and to protect property from the risk of damage and loss. Process safety management is included in all areas of life.

The general objectives of process safety Management seeks to achieve:

a. Protecting the human element from injuries caused by the risks of the work environment by preventing their exposure to accidents and injuries and occupational diseases.

b. Preserving the components of the material element represented in the facilities and the devices and equipment they contain from damage and loss as a result of accidents.

c. Provide and implement all process safety requirements that ensure the provision of a safe environment that prevents risks for the human and material elements.

d. process safety Management, as a scientific approach, aims to establish safety and tranquility in the hearts of workers while they perform their work and reduce the bouts of anxiety and panic that afflict them while they coexist, due to the necessities of life, with tools, materials and machines that contain dangers that threaten their lives and under unsafe conditions that expose their lives from time to time grave dangers.

1.5 Hypothesis

Hypothesis 1: Locality where the petroleum projects are established has vital impact on workers/professionals safety.

Hypothesis 2: international (globalized) safety standards such as (ISO 50001) are outperformed in the cost reduction formula.

Hypothesis 3: Globalized safety codes are essential irrespective of presence of nationalized safety codes.

Hypothesis 4: Impact of data sciences and smart technologies such as safety management systems is vital for human life in petroleum industry.

Hypothesis 5: It is essential for breakeven from any petroleum projects to ignore the environmental constrains.

1.6 Thesis Organization

Thesis is consisted of four chapters:

Chapter one: Introduction which states the problem statement and research hypothesis formulation.

Chapter two: Literature survey that demonstrate the generalization of the safety management systems.

Chapter three: Methodology which states the approaches used for analyzing the results for the survey.

Chapter four: Results and discussion that discusses the obtained results in details.

Chapter five: Conclusion and recommendations are illustrated in the last chapter.

Finally the references and appendix come straight.

2. LİTERATURE REVIEW

As new innovations are created, industry processes become more muddled. The processes are needed to include bunches of variables, which were not utilized previously, to deliver wonderful items. Subsequently, individuals get the advantages from top caliber with the low cost of items, and organizations likewise thrive their business and contribute more money to foster their innovations to improve items with low expenses. Notwithstanding, these changes, going from easy to confounded, are joined by dangers of process disappointment also.

The dangers influence their business as well as can be associated with the safety of the specialists and the overall population. In the drug and oil ventures, handle unsafe synthetic materials the most, a solitary little disappointment in Process Safety Management (PSM) can achieve outrageous harms and setbacks. Because of this high danger followed by disappointment in the process, process management gets essential to get safety and should be exact and sensitive.

Therefore, synthetic organizations have been focused on PSM to decrease mishaps in the work environments, and Word related Safety and Wellbeing Organization (OSHA), Ecological Security Office (EPA), Community for Compound Process Safety (CCPS) gave PSM rules to diminish chances and forestall mishaps before it occurs. Despite the fact that those rules were given to organizations, various mishaps happened by disappointments of process management over the most recent couple of years, which might have been forestalled and limited the harms by PSM.

For instance, the West Compost Organization blast in 2013 brought about 15 fatalities, in excess of 260 wounds, and inescapable local area harm. Episodes from the disappointment of PSM helped individuals to remember its significance and caused individuals to reevaluate the reasons for the disappointment of PSM. To comprehend why the mishaps continue to happen, it is imperative to understand what the references cover.

The references distributed by associations regularly notice plausible danger factors, working systems, crisis arranging, occurrence examinations, representative preparing, and support.

Despite the fact that all the innovation and gear are overseen as references by organizations, it is hard to completely guarantee that representatives are following the guideline. In light of the states of PSM, the consequences of the process would be diverse because of human powers. It is on the grounds that people have alternate points of view and information in gear, processes, climate, and safety. Furthermore, the viewpoint and information on representatives are likewise unique in relation to organization to organization.

The recurrence of PSM preparing for representatives and the assessment of PSM are acted in the organization could be fundamental variables to influence in general PSM. As such, having proper safety culture in associations is a fundamental key to diminish mishaps and forestall disasters. As recently referenced, a couple of associations have given rules that help to plan and forestall eccentric mishaps making colossal setbacks and harms organizations.

Despite the fact that the rules are from various associations, the settings of references have likenesses for effective PSM. Since the references are planned and utilized for the substance business, it is hard to apply every one of the rules that are remembered for college research centers. In any case, there are a few variables identified with representatives and authoritative culture which could be utilized and improve the protected climate.

The college research facilities are less risky and more modest sizes contrasted with genuine substance organizations, however its processes and synthetics utilized for tests are as yet unsafe to resources, staff, and understudies.

Critical viewpoints can be learned in improving human components in the oil and gas industry from ventures, like aeronautics, atomic force, and protection. In any case, the oil and gas industry shows explicit difficulties that can make it hard to apply configuration processes and guidelines that have prompted positive outcomes in different ventures (Ramirez et al., 2013).

The improvement of different processes and principles has clung to address the issues arising in the worldwide oil and gas industry. Logical examination widely

centers around the brain research of how mindlessness and intellectual predispositions may prompt deficient danger evaluation and ill-advised dynamic processes. In this way, the need to make down to earth and basic arrangements is dire than any time in recent memory (Bergh et al., 2014).

The introduction of Prosperity, Safety, and Environment Management Systems (HSE-MS) is a huge piece of this process. Key parts of HSE-MS join a vow to appropriate drive chips away at, characterizing clear targets and objections, and undertaking demanding risk evaluation and control system (Flotsam and jetsam, 2010).

Exactly when relationship in the oil and gas industry stick to these pieces of their overall management, positive results can be viewed as regular eventually. Correspondence among all divisions of affiliations should be ensured to meet the presumptions for all accomplices in the business. Management should give obligation and individual commitment to prosperity, safety, and the environment in general (Zimolong and Elke, 2006).

A genuine suspicion that could be shown relates to setting an individual outline of clinging to major HSE rules. The decisions that could be made should consider portions of significant worth, cost, affirmation, and creation.

In the process of introducing HSE principles in the oil and gas industry, it should be pointed out that assignment of resources should be done reasonably attempting to do without a doubt the main components of HSE. The improvement of neighborhood HSE courses of action should be as per corporate objections and norms relating to the oil and gas industry (Ramirez et al., 2013).

Setting objections for reliable improvement should be the place of assembly of introducing such techniques. All levels of management should be related with practically identical processes to achieve ideal capability and productivity. Also, certain objectives should be made to lighten risks inside affiliations working in the oil and gas industry. The period of risk evaluation and management should be dependably introduced in oil and gas associations to stick to major HSE management decide that may add to lessening the peril of scenes in this industry (Zimolong and Elke, 2006).

This movement is identified with the establishment of a fitting methodology that charts serious and continuous threats including their evident effects. Additionally, it is fundamental for lead versatile danger assessments at the arrangement, headway, and working stages. The usage of threat management mechanical assemblies may basically empower the process of achieving the set key targets. It has been perceived that a fruitful managerial programmer requires three key estimations: astonishing and well-resourced rules, defining obligation limits to drive fitting practices in the business and ensuring solid industry maintain (Berg et al., 2014).

The globalization of HSE issues for the oil and gas industry should be researched to show a process of setting selective necessities of execution in the field. In 2011, the European Commission conveyed a movement of definitive proposals to guarantee toward the ocean safety (Ramirez et al., 2013).

The accentuation on ensuring the normal natural surroundings has been properly kept up. HSE approaches are needed to cover oil spill and emergency response availability, quality affirmation, and management structures. The most limit objective of similar exercises is to ensure a strong and safe environment for representatives in oil and gas associations similarly with respect to tenants of different countries (Flotsam and jetsam, 2010).

The direct of explicit activities from the oil and gas industry should be done with the possibility of demanding capable norms for safety. Believe it or not, the safety of workers should be thought about very much like the environment and financial characteristics. At the point when everything is said in done, oil and gas associations are centered on making real structures for checking of their specific workplaces and plants. The occasion of various scenes in the business, for instance, the Macon do event, the US Part of Within accepted extraordinary measures in 2011 to direct threats around here (Haight, 2013).

Two new associations were made to separate a movement of activities and activities the Delta of Mexico, very much like the Organization of Safety and Natural Necessity (BSEE) and the Branch of Toward the ocean Energy Management (BOEM). Also, the Workplace was responsible for giving new and additional convincing rules to address the specific positions and working of these two workplaces (Bergh et al., 2014).

Thing judgments close by outpouring controls and ecological change computer programmers have added to the improvement of real and significantly practical HSE structures. It might be suggested that these points can on a very basic level influence the creation and usefulness of different things introduced by oil and gas associations. Likewise, there are certain common laws that require affiliations that work in this industry to restore all zones where explicit events or unapproved appearance of changed dangerous materials have happened. It might be normal that HSE laws and rules can vehemently influence the activities of oil and gas associations (Zimolong and Elke, 2006).

In any case, it very well may be attempting to show what may be the conceivable future effects of explicit institutions embraced with respect to the overall oil and gas industry. There may be dangers identified with HSE costs and liabilities, which may be obvious in the activities of overall oil and gas associations.

Thusly, such affiliations see the meaning of completing solid HSE norms and management mechanical assemblies to energize the accomplishment of explicit outcomes (Flotsam and jetsam, 2010).

One of the definitive constructions that give significant information on applying HSE principles in the oil and gas industry is the IADC HSE Case Rules. These principles "give a design to developing a consolidate prosperity, safety and ecological management system for use in reducing the risks related with offshore and inland exhausting activities" (Overall Relationship of Entering Task laborers, 2014).

The significance of the guidelines reflects in the choice of selective assumptions that can help in extending overall prosperity, safety, and biological care comparing to the oil and gas industry. The general affirmation of the guidelines in countries, for instance, Australia, Canada, South Africa, and Cuba surmises their far and wide congruity to address emerging troubles in the different business (Trash, 2010).

The need to help managerial experts all throughout the world may add to the movement of guidelines and decides that are immovably custom-fitted to contrast with the necessities of oil and gas associations. Emphasis is put on reassuring that the most authentic industry practices have been executed similar to prosperity, safety, and common concerns.

2.1 Process Safety Information (Process Safety Competence)

The fitness of the administrator is a significant job since human mistake is one of the components of PSM disappointment. In the event that the administrator's reactions to a crisis are not suitable, the circumstance could turn into a genuine mishap, which causes colossal harm. To maintain a strategic distance from the present circumstance, administrators ought to have adequate information about the processes, safety, and hardware.

The processes ought to be acted as per the SOP and the employees should realize how to respond when unforeseen occasions happen, have the option to control gear, and perceive changes ahead of time.

To guarantee process safety, the organization ought to consistently give preparing freedoms to rehearsing and testing their expert skill and process understanding. The organization should guarantee that the preparation is given to suitable individuals, fitting data is given to them, and the fitness procured from the preparation is reliably applied to the process to get the safety.

Bosses should finish a gathering of composed process safety data prior to leading any process risk examination needed by the norm. The game plan of created measure wellbeing information, completed under a comparative schedule required for measure hazard assessments, will help the business and the representatives drew in with working the interaction to perceive and comprehend the dangers introduced by those cycles including extraordinarily hazardous manufactured substances.

Cycle wellbeing information ought to recollect information for the dangers of the significantly risky engineered materials used or made by the interaction, information on the advancement of the interaction, and information on the stuff simultaneously.

Data on the perils of the exceptionally dangerous synthetic substances in the process will comprise of in any event the accompanying:

- Harmfulness,
- Reasonable openness limits,
- Actual information,
- Reactivity information,

- Destructively information, and
- Warm and synthetic strength information, and unsafe impacts of an accidental blending of various materials.

Data on the innovation of the process should incorporate in any event the accompanying:

- A square stream chart or worked on process stream outline,
- Process science,
- Greatest planned stock,
- Safe top and bottom limits like temperatures, pressing factors, streams or creations,
- An assessment of the consequences of deviations including those affecting the security and prosperity of workers.

Where the first specialized data does not exist anymore, such data might be created related to the process risk investigation in adequate detail to help the examination.

Data on the gear in the operation should incorporate the accompanying:

- Accessories of development,
- Funnelling and instrument outlines,
- Electrical arrangement,
- Alleviation framework plan and plan premise,
- Ventilation framework plan,
- Configuration codes and standards utilized,
- Accessories and power adjusts for operations worked after(26-5- 1992),
- Safety frameworks (interlocks, discovery, or concealment frameworks).

The business will archive that hardware follows perceived and for the most part acknowledged great designing practices.

For existing hardware planned and built as per codes, standards, or practices that are not, at this point in everyday use, the business will decide and report that the gear is planned, kept up, assessed, tried, and worked in a protected way. The social event of

the above-depicted cycle wellbeing information gives the reason to recognizing and understanding the dangers of interaction and is fundamental in developing the interaction risk assessment and may be significant for concurring with various game plans of PSM like administration of progress and scene assessments.

2.2 Operating Procedure

The Working system includes composed guidance for the process, the portrayal of the process, danger, fear, control, and shooting inconvenience. The working strategy ought to depict the setting in detail so administrators could precisely follow the means. Furthermore, the strategy ought to incorporate crisis circumstances, for example, crisis methodology when the siphon is unavailable. Without an itemized depiction, the administrator could work the process with an unseemly method. Along these lines, each progression ought to be clarified in detail. When a methodology is made, each administrator should adhere to the guidance with no special case, so the hardware and process can be executed in a planned way. At the point when the technique is needed to be adjusted, process designers, administrators, and related employees should partake to build up the strategy together so it tends to be altered and assessed with alternate points of view, and chiefs and supervisors should survey it before it is utilized. The business should create and execute composed working systems, predictable with the process safety data, that give clear guidelines to securely directing exercises engaged with each covered process. OSHA accepts that assignments and systems identified with the covered process should be fitting, clear, steady, and in particular, all around conveyed to employees. The techniques should address in any event the accompanying components:

Steps for each working stage:

- Introductory start up;
- Ordinary operations;
- Brief operations;
- Crisis closure, including the conditions under which crisis closure is required, and the task of closing down an obligation to qualified administrators to guarantee that crisis closure is executed in a protected and ideal way;

- Crisis operations;
- Ordinary closure; and
- Start-up following a turnaround, or after a crisis closure.

Operating limits:

- Outcomes of deviation, and
- Steps needed to address or maintain a strategic distance from deviation. Safety and wellbeing contemplations:
- Properties of, and perils introduced by, the synthetic compounds utilized in the process;
- Insurances important to forestall openness, including designing controls, regulatory controls, and individual defensive hardware;
- Control measures to be taken if actual contact or airborne openness happens;
- Quality control for crude materials and control of risky compound stock levels; and
- Any uncommon or special risks.
- Safety frameworks (e.g., interlocks, identification, or concealment frameworks) and their capacities.

To guarantee that a prepared and exceptional reference is accessible, and to shape an establishment for required representative preparing, working strategies should be promptly available to employees who work in or keep a process.

The working methods should be investigated as regularly as important to guarantee that they reflect current working works on, remembering changes for process synthetics, innovation, and gear, and offices. To prepare for obsolete or wrong working strategies, the business should ensure every year that these working systems are current and precise. The business should create and execute safe work practices to accommodate the control of risks during work exercises like lockout/tag out; limited space passage; opening process hardware or funnelling; and command over the entrance into an office by upkeep, a worker for hire, lab, or other help faculty. These protected work rehearses should apply both to employees and to project worker employees.

2.3 Employee Participation

Employers should build up a composed strategy to carry out the representative cooperation needed by PSM. Under PSM, employers should talk with employees and their agents on the direct and advancement of process peril investigations and on the improvement of different components of process management and they should give to employees and their delegate's admittance to process risk examinations and to any remaining data needed to be created by the standard.

2.4 Training (Training and Performance Assurance)

Preparing employees is a functional technique to improve process safety. Preparing causes employees to recognize the significance of process safety, safety guidelines, task prerequisites, and obligations for safety. Also, execution confirmation is a technique to assess whether employees understand required obligations and information from preparing and can apply them in real circumstances.

Through the assessment, associations can decide whether extra preparation is needed to get their process safe. Since the crisis arranging and reactions are not quite the same as each position, the necessary preparation should be unique. The preparation and execution confirmation may occur in a study hall or work environment. OSHA accepts that the execution of a compelling preparing program is perhaps the main advance that a business can take to upgrade representative safety.

In like manner, PSM necessitates that every representative as of now engaged with working a process or a recently relegated process should be prepared in an outline of the process and in its working strategies.

The preparation should remember an accentuation for the particular safety and wellbeing dangers of the process, crisis operations including closure, and other safe work rehearses that apply to the representative's work undertakings. Those employees previously engaged with working a process on the PSM viable date shouldn't really be given introductory preparation.

All things being equal, the business may ensure recorded as a hard copy that the employees have the necessary information, abilities, and capacities to securely complete the obligations and duties indicated in the working systems. Boost

preparing should be given no less than like clockwork, or all the more regularly if essential, to every representative associated with working a process to guarantee that the worker understands and sticks to the current working methods of the process. The business, in discussion with the employees engaged with working the process, should decide the fitting recurrence of boost preparing.

2.5 Training Documentation

The business should decide if every worker working a process has gotten and perceived the preparation needed by PSM. A record should be continued containing the character of the representative, the date of preparing, and how the business checked that the worker comprehended the preparation. It is hard for an association to deal with the general process. By participating and dispersing works with different organizations, an organization can deal with the process all the more effectively.

Therefore, how the association chooses and oversees workers for hire is significant. The more workers for hire engaged with a task, the more confounded the undertaking would be and likely let completely go, without magnificent management obviously.

Working with workers for hire, which have an absence of specific abilities and fewer encounters, may expand likely dangers in the process. Worker for hire management is to guarantee the administrations from workers for hire don't expand the expected danger of the process' safety in the association.

Numerous classes of provisional work might be available at a place of work; such labourers may really work in the office or do just a specific part of a task since they have particular information or expertise. Others turn out possibly for brief periods when there is a requirement for expanded staff rapidly, for example, in turnaround operations.

PSM incorporates exceptional arrangements for project workers and their employees to accentuate the significance of everybody taking into consideration that they don't do anything to imperil those working close by who may work for another business. PSM, consequently, applies to project workers performing upkeep or fix, turnaround, significant redesign, or claim to fame work on or neighbouring a covered process.

It doesn't have any significant bearing, notwithstanding, to workers for hire offering coincidental types of assistance that don't impact process safety, for example, janitorial, food and drink, clothing, conveyance, or other stockpile administrations.

2.6 Employer Responsibilities

While choosing a project worker, the business should get and assess data with respect to the agreement manager's safety execution and projects. The business additionally should illuminate contract employers of the known likely fire, blast, or poisonous delivery perils identified with the worker for hire's work and the process; disclose to contract employers the relevant arrangements of the crisis activity plan; create and carry out safe work practices to control the presence, passageway, and exit of agreement employers and agreement employees in covered process regions; assess intermittently the presentation of agreement employers in satisfying their commitments, and keep an agreement representative injury and sickness long identified with the project worker's work in the process territories. The agreement boss must:

- Guarantee that agreement employees are prepared in the work rehearses important to play out their work securely;
- Guarantee that agreement employee is told in the known expected fire, blast, or poisonous delivery perils identified with their work and the process, and in the appropriate arrangements of the crisis activity plan;
- Report that each agreement worker has gotten and perceived the preparation needed by the standard by setting up a record that contains the personality of the agreement representative, the date of preparing, and the methods used to check that the representative comprehended the preparation;
- Guarantee that each agreement worker observes the safety rules of the office including the necessary safe work rehearses needed in the working techniques segment of the standard; and
- Inform the business with respect to any remarkable perils introduced by the agreement boss' work.

2.7 Safety Review before Commissioning

It is significant that a safety survey happens before any exceptionally risky compound is brought into a process. PSM, thusly, requires the business to play out a before commissioning safety audit for new offices and for altered offices when the alteration is sufficiently critical to require an adjustment in the process safety data. Preceding the presentation of a profoundly dangerous synthetic to a process, the before commissioning safety survey should affirm that the accompanying:

- Development and hardware are as per plan particulars;
- Safety, working, support, and crisis methods are set up and are sufficient;
- A process risk investigation has been performed for new offices and proposals have been settled or executed before commissioning, and altered offices meet the management of progress necessities; and
- Preparing of every representative associated with working a process has been finished.

To eliminate chances, the association should ensure that gear planned appropriately, introduced at the opportune spot as per determinations. Wrong establishments and plan and materials of gear unquestionably contain high dangers. Particularly, in the synthetic business, destructive substances harm pipelines and decrease the sturdiness of lines and hardware, which could prompt spillage and blast. Subsequently, gear requires ordinary examinations and substitutions in the event that it is material. Resource trustworthiness incorporates reviews, tests, and systems of support, and by doing those, it ensures the safety hardware works during a crisis and the general framework is solid.

These resource respectability and unwavering quality exercises ought to be performed consistently by administrators, mechanical designers, process engineers, and the like. Mechanical specialists supervise the upkeep of hardware, and process engineers regulate the assessment of strange scents, sound, and conditions. OSHA trusts it is imperative to keep up the mechanical honesty of basic process hardware to guarantee it is planned and introduced accurately and works appropriately. PSM mechanical trustworthiness necessities apply to the accompanying gear:

- Pressing factor vessels and capacity tanks;

- Funnelling frameworks (counting channelling parts like valves);
- Help and vent frameworks and gadgets;
- Crisis closure frameworks;
- Controls (counting observing gadgets and sensors, cautions, and interlocks); and
- Siphons.

The business should build up and execute composed techniques to keep up the continuous respectability of process hardware. Employees associated with keeping up the continuous trustworthiness of process gear should be prepared in an outline of that process and its risks and prepared in the strategies relevant to the employees' work undertakings.

Review and testing should be performed on process gear, utilizing techniques that follow perceived and by and large acknowledged great designing practices. The recurrence of reviews and trial of process hardware should adjust to makers' suggestions and acceptable designing practices, or all the more as often as possible whenever resolved to be important by earlier working experience.

Every investigation and test on process hardware should be recorded, distinguishing the date of the assessment or test, the name of the individual who played out the examination or test, the chronic number, or another identifier of the gear on which the review or test was played out, a depiction of the examination or test performed, and the aftereffects of the examination or test.

Hardware inadequacies outside as far as possible characterized by the process safety data should be amended before additional utilization. At times, it may not be fundamental that inadequacies be rectified before additional utilization, as long as insufficiencies are revised in a protected and convenient way when other essential advances are taken to guarantee safe activity.

In building new plants and gear, the business should guarantee that hardware, as it is created, is appropriate for the process application for which it will be utilized. Fitting checks and investigations should be performed to guarantee that gear is introduced appropriately and is reliable with plan details and the maker's guidelines.

The business likewise should guarantee that support materials, spare parts, and gear are reasonable for the process application for which they will be utilized.

2.8 Hot Work Permit

A license should be given for hot work activities directed on or almost a covered interaction. The license should report that the fire anticipation and assurance necessities in OSHA guidelines {1910.252(a)} have been executed before starting the hot work tasks; it should show the date approved for hot work, and recognize the item on which hot work is to be performed. The license should be kept on record until the finishing of the hot work.

The purpose of the management of change (MOC) is to assess the risks from changes and reduce the risk. The MOC prevents changes in equipment, procedure, and process that could increase the potential risks. Reviews and evaluations of proposed changes of equipment, organization structure, activities, and design facilities before implementation are considered by the MOC. Unless appropriate reviews prior to implementation, it will increase the risks of the process.

The requested changes from individuals at the workplace are delivered to project teams and organizations, and those teams and organizations review the requests whether the request is harmful to the process.

They could deny the changes because the changes increase a significant amount of risks or allow changing them because the changes do not affect or even decrease risks. However, the review process should not be performed by one person because the person may miss essential factors and reviews from diverse people may detect other unseen risks. After approval of changes, the change must be delivered to relevant employees and performed as it is.

These composed methods should guarantee that the accompanying contemplations are addressed before any change:

- The specialized reason for the proposed change,
- Effect of the change on representative security and wellbeing,
- Changes to A license should be given for hot work activities led on or almost a covered interaction. The grant should report that the fire counteraction and

assurance prerequisites in OSHA regulations {1910.252(a)} have been carried out before starting the hot work activities; it should demonstrate the date approved for hot work, and recognize the item on which hot work is to be performed. The license should be kept on the document until the finishing of the hot work. Workers who work a cycle and support and agreement representatives whose work assignments will be influenced by an adjustment of the interaction should be educated regarding and prepared in, the change preceding the start-up of the cycle or the start-up of the influenced part of the interaction. In the event that a change covered by these systems brings about an adjustment of the necessary interaction wellbeing data, such data likewise should be refreshed as needs are.

On the off chance that a change covered by these techniques changes the necessary working methods or practices, they additionally should be refreshed.

An urgent piece of the process safety management program is an intensive examination of episodes to distinguish the chain of occasions and causes with the goal that restorative measures can be created and carried out. Appropriately, PSM requires the examination of every occurrence that came about in, or could sensibly have brought about, a cataclysmic arrival of a profoundly dangerous substance in the work environment.

A particular occurrence examination should be started as immediately as could be expected, yet no later than 48 hours following the episode. The examination should be by a group comprising of at any rate one individual educated in the process in question, including an agreement worker if the occurrence included crafted by a worker for hire and different people with fitting information and experience to research and investigate the episode altogether.

An examination report should be readied including at any rate:

- Date of episode,
- Date examination started,
- Depiction of the episode,
- Elements that added to the episode, and
- Proposals coming about because of the examination.

A framework should be set up to instantly address and resolve the occurrence report discoveries and suggestions. Goals and remedial activities should be recorded and the report assessed by completely influenced staff whose work errands are pertinent to the occurrence discoveries (checking contract workers when fitting). The business should keep these occurrence examination reports for a very long time.

2.9 Emergency Planning and Response

In the event that, regardless of the best arranging, an episode happens, it is fundamental that crisis pre-arranging and preparing let workers mindful of, and ready to execute appropriate activities. Hence, a crisis activity plan for the whole plant should be created and carried out as per the arrangements of other OSHA rules 29 CFR 1910.38a. Likewise, the crisis activity plan should incorporate methods for handling little arrivals of unsafe synthetics. Employers covered under PSM likewise might be dependent upon the OSHA perilous waste and crisis reaction guideline 29 CFR 1910.120 a, (p), and (q).

All processes ought to observe the standards which incorporate government guidelines and laws, public and worldwide codes, and inner and outer standards. The data ought to be available to likely clients. CCPS RBPS states, "The standards framework will assist the organization with working and keep a protected office, reliably execute process safety rehearses, and limit lawful obligation." likewise, the standards framework is utilized in the review program to assess PSM execution. OSHA's process safety data which incorporates the standards arrangement of CCPS RBPS proposes that the business and worker ought to see the process data. The process data should remember data for the dangerous synthetics utilized or created from the process, the innovation of the process, or hardware in the process as demonstrated in Table A1. Recognizing the process data ahead of time assists with bringing issues to light of process safety and building up the process peril examination.

3. METHODOLOGY

3.1 Study Procedure

Total questionnaires of twenty-five questions that split into five categories are distributed amongst fifty petroleum professionals including engineers and technical staff as well as labours. We filtered the candidates as per their education qualification so that some criteria are maintained for sake of candidates' inclusion decision and candidate exclusion decision.

3.2 Inclusion Criteria

1. Candidate must fall into the permitted age group as per the options given on the biometric section in the said survey.
2. Candidate must fall into the permitted education levels as per the options given on the biometric section in the said survey.
3. Candidate must fall into the permitted field experience levels as per the options given on the biometric section in the said survey.
4. Candidates by whole must be a mixture from male and females petroleum workers and research scholars.

3.3 Exclusion Criteria

It was maintained by filtering out all those candidates who are not fulfilling the inclusion criteria mentioned in the previous section. However, a time limit was given for all candidates (whomsoever interested) for participation to reply by his opinions on the said survey within a time of 14 days. Questions are broadcasted by Google Forms and link is shared with colleagues who interns are sharing it in their community groups. There was a norm that only petroleum professionals are permitted to participate so each candidate must send his resume and information through email to the writer of this thesis.

3.4 Research Sample

Study is conducted in fever of petrol projects that are under Ministry of Oil, Iraq and this research is aiming to measure the level of safety awareness and develop efficient management roles for petroleum project.

3.5 Gender Distribution

As results obtained for all the candidates, pre-processing is performed in order to convert the responses into numerical format. However, gender distribution was determined by calculating the number for male candidates those are replied to the said survey within the defined period and fallen under the inclusion criteria. There were total thirty-nine candidates who are finally settled with the said survey. Out of which twelve are females and twenty-seven are males. Figure 3.1 below is showing the same.

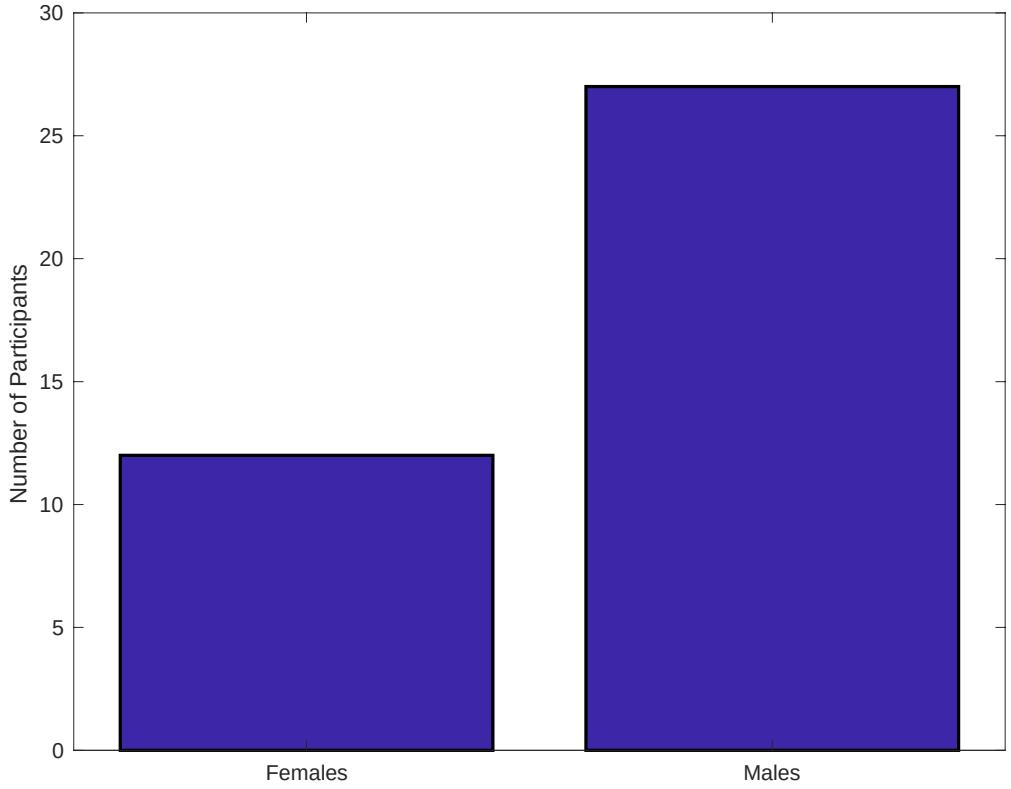

Figure 3.1: Gender Distributions vs. Number of Candidates

3.6 Educational Qualifications

Candidates were under intensive investigation to evaluate their fitness into the survey through studying their education criteria according to the inclusion conditions. Three categories are made which are Diploma, Bachelor and Master. However, it was referred to the higher education's such as master, doctoral and post-doctoral by the term Master and higher in the survey. Figure show the results obtained from this stage where the distribution of the total survey participants over the educational categories. Results shown that most of the candidates are with bachelor degree including engineers and technical professionals. The second largest population is seen having diploma degree which mostly the workers and professional labours and finally around fifteen per cent of the total workers are seen with higher education including the research scholar and consultant engineers and designer.

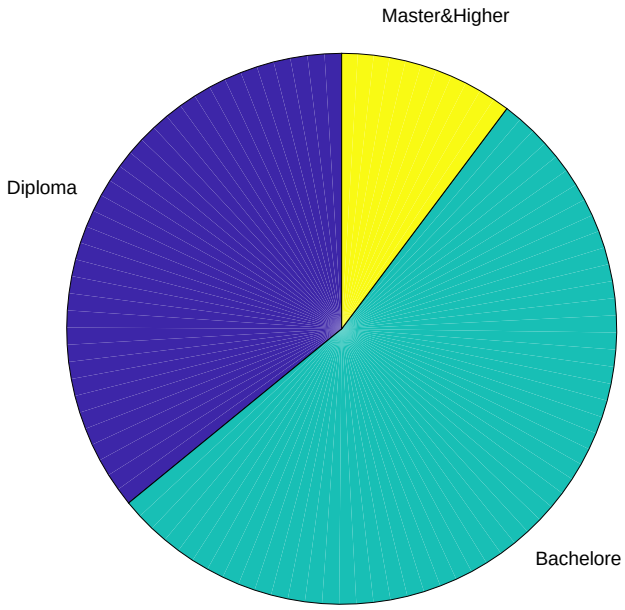

Figure 3.2: Educational Qualification Distributions vs. Number of Candidates.

The other stage of verification that fall under the said inclusion criteria is whether the candidate is received extra training or education in regards to the skills improvement. However, this stage is a supportive stage and not essential for excluding the particular candidate. Figure 3.3 below is demonstrating the results of this stage.

Results shown that most of the candidates are not received any training or skill development coerces. Around twenty per cent of them are received those particular courses.

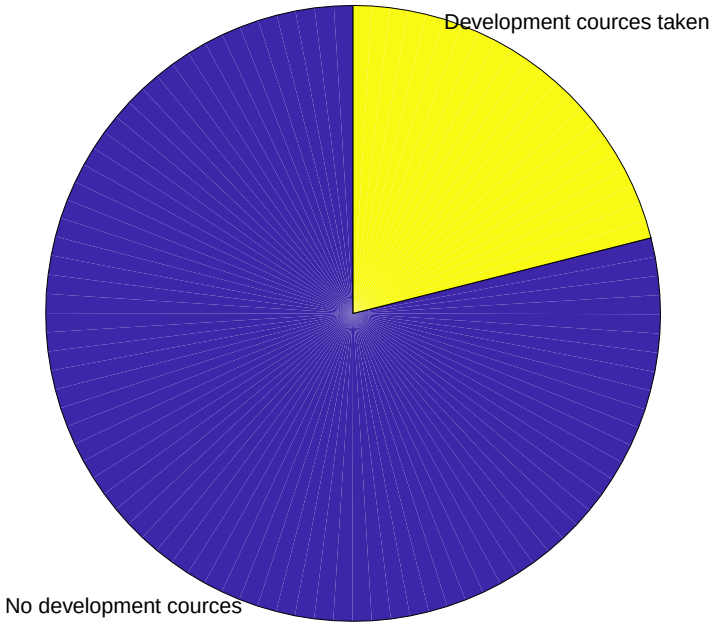

Figure 3.3: Skill Development Courses vs. Number of Candidates

Form the other hand, here we imitated the survey for finding whether all the candidates are oil and gas professional staff. We found that around twelve per cent of them are not physically worked with oil and gas field. Those people are included into the survey because they are mostly a research scholar and project designers with oil and gas interest. Figure3.4 below is demonstrating the same.

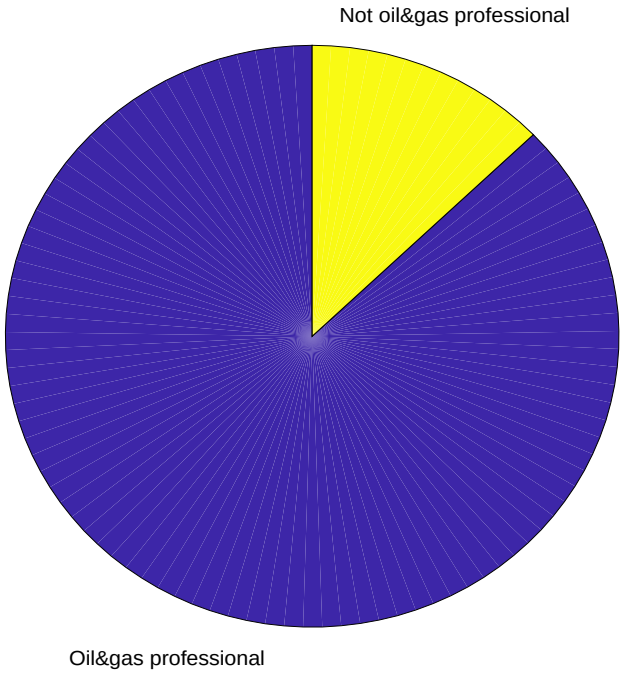

Figure 3.4: Oil and Gas Relevant Experience vs. Number of Candidates

3.7 Experience Level

Experience is being obtained within four groups namely: one to five years, six to ten years, eleven to twenty years and twenty-one to thirty years. It was considered that thirty years old is the border line for the service and minimum experience is one year. Results shown that most of the included candidates are of eleven to twenty years . Figure3.5 below is demonstrating the same.

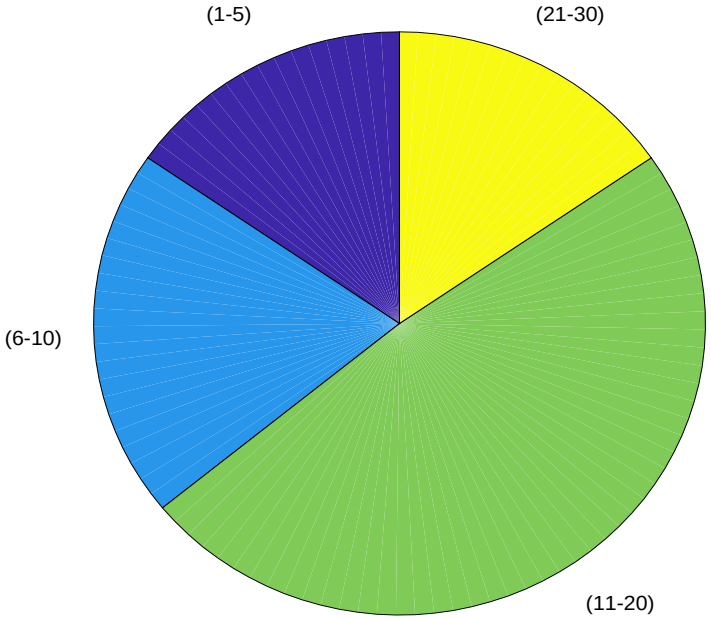

Figure 3.5: Years of Experience vs. Number of Candidates

3.8 Delphi Method

Delphi method is a sort of measurable methodology that depends on studies to gather the data from the fares and endeavors to arrive at an agreement about specific realities [B. Bak-Jensen and P. Sorensen, (2007)]. By getting the data from the field sends out, information is to be created likewise and utilized in the examination.

Stages to perform Delphi method:

1) Study Establishment (N. Nguyen and J. Mitra 2018) depending on past surveys, the writer's suggestions and expert's advices.
2) Nominate the experts (K. Jiang and C. Singh 2011) we should name the experts that we think they have academic qualifications.

3) Share the questions with the nominated experts in several ways like Google form link, Fax, Emails, Posts, Personal interviews and social media (A. S. Dobakhshari and M. Fotuhi-Firuzabad 2009) to give their opinion.

4) Make changes on the questions as the candidates listed and send them the questionnaire again by the same way.

5) Make decision if the experts can answer the questionnaire or not, depending on the biometrical questions(V. S. Lopes and C. L. Borges 2015).

6) Getting the questionnaire answers and coding them as figure 3.1 (The IEEE reliability test system 1996).

7) Scoring the codes, find the impact factor using impact factor equation (Guoxin LI, Kai LUO, Deqin SHI. 2020) changes the word "agree, disagree, strongly agree, strongly disagree and natural" which we get to mathematical structure.

8) Suggest the score value number that we depend on to accept or reject a hypothesis (Guoxin LI, Kai LUO, Deqin SHI.2020).

Table 3.1: Delphi Method's Responses Coding

No.	Answer/ Feedback	Value (weight)
1	If response is “neutral”	0
2	If response is “strongly agree”	2
3	If response is “strongly disagree”	-2
4	If response is “agree”	1
5	If response is “disagree”	-1

4. RESULTS AND DISCUSSIONS

4.1 Response Analysis

Every hypothesis is constructed with help of five questions in the survey, the same is explained in the above sections. However, this section is illustrating the impact factor for each question using the scores obtained by Delphi method. The neutral responses are firstly for each question. Table 4.1 is demonstrating the results of every response i.e. neutral, agree, disagree and strongly agree. The discussion of the responses foe each question is given below:

Table 4.1: Count of Responses as Per the Categories

Question Number	Neutral	Strongly Agree	Strongly disagree	Agree	Disagree
1	27	0	0	5	7
2	8	0	9	9	13
3	0	22	0	17	0
4	3	17	0	18	1
5	4	7	11	9	8
6	10	0	10	2	17
7	21	0	0	15	3
8	8	4	0	27	0
9	16	0	0	20	3
10	12	0	0	21	6
11	1	5	6	16	11
12	16	7	0	16	0
13	9	0	0	25	5
14	11	0	0	27	1
15	16	0	0	23	0
16	5	13	0	21	0
17	14	9	0	16	0
18	14	0	0	20	5

Table 4.1: (Continued) Count of Responses as Per the Categories

Question Number	Neutral	Strongly Agree	Strongly disagree	Agree	Disagree
19	7	0	12	11	9
20	8	10	0	20	1
21	0	0	13	3	23
22	10	0	1	15	13
23	4	12	0	23	0
24	19	0	0	9	11
25	4	16	0	19	0

1. The remote projects locations are mainly impacting the workers safety as no hospitals or health care units are in those vicinity.

Interpretation: this question received 27 neutral responses, zero strongly agree, zero strongly disagree, 5 agree and 7 disagree. It is clear that neutral responses are overcoming that due to the nature of the question that links the safety with infrastructure of health sector that far from the oil and gas project locality.

2. Remote project locations are amongst those factors that degrade the costs planning as company need to invest a lot on the transportation from and to project.

Interpretation: this question received 8 neutral responses, zero strongly agree, 9 strongly disagree, 9 agree and 13 disagree. It is clear that disagree responses are overcoming that due to the nature of the question that links the cost and budget with only transportation cost which can be tackled by establishment within project lodges for the staff.

3. Employment of remotely localities and lands (unemployed) for petroleum alike projects may enhance the country income capital.

Interpretation: this question received zero neutral responses, 22 strongly agree, zero strongly disagree, 17 agree and zero disagree. It is clear that strongly agree and agree are the dominants responses and this question was came with majority consensus.

4. Contractors role are important in safety as infrastructures alike hospitals, health care unites can be established within the project locality.

Interpretation: this question received 3 neutral responses, 17 strongly agree, zero strongly disagree, 18 agree and 1 disagree. It is clear that strongly agree and agree are the dominants responses and this question was came with majority consensus.

5. While establishing a project of oil and gas at far locations, workers cannot be prevented from gas poisoning.

Interpretation: this question received 4 neutral responses, 7 strongly agree, 11 strongly disagree, 9 agree and 8 disagree. It is clear that strongly disagree is the dominant which means workers can be preventing the gas poisoning.

6. Works safety knowledge is measured by their experience in the profession; the experienced workers can be deployed for training other workers (fresher) for cost constrains support.

Interpretation: this question received 10 neutral responses, zero strongly agree, 10 strongly disagree, 2 agree and 17 disagree. It is clear that strongly disagree and disagree are the dominant.

7. Globalized standards are more efficient than the national codes and standers in terms of safety.

Interpretation: this question received 21 neutral responses, zero strongly agree, zero strongly disagree, 15 agree and 3 disagree. It is clear that neutral is the dominant, but question got good agree responses as well.

8. Safety engineer/ supervisor might take the initiatives for upgrading the safety skills of the workers including the technical skilled workers and engineers at the petroleum sites.

Interpretation: this question received 8 neutral responses, 4 strongly agree, zero strongly disagree, 27 agree and 0 disagree. It is clear that agree is the dominant and no disagreement where this question can be considered with good positivity level.

9. Globalized standards alike ISO 50001 are considered important for safety since it deploys a modern data technology and monitoring systems in order to enhance the safety.

Interpretation: this question received 16 neutral responses, zero strongly agree, zero strongly disagree, 20 agree and 3 disagree. It is clear that agree is the dominant and no disagreement where this question can be considered with good positivity level.

10. Globalized standards are looking after environment refinery norms for creating of environmentally friendly projects.

Interpretation: this question received 12 neutral responses, zero strongly agree, zero strongly disagree, 21 agree and 6 disagree. It is clear that agree is the dominant and no disagreement where this question can be considered with good positivity level with moderated neutral level which might be due the less knowledge about the planning and environmental values.

11. It is difficult for incorporate the modern technology that ensures safety and enhance the profitability of the projects in the petroleum fields.

Interpretation: this question received 1 neutral response, 5 strongly agree, 6 strongly disagree, 16 agree and 11 disagree. It is clear that agree is the dominant but also got a noteworthy disagree responses.

12. National standards concepts are about ensuring of country legal norms in any project established over the land of that particular country.

Interpretation: this question received 16 neutral responses, 7 strongly agree, zero strongly disagree, 16 agree and 0 disagree. It is clear that agree is the dominant and same level is realized on the neutral responses.

13. International standard organization has made so many codes that can be used according to project size and purpose and it utilized the computerization in order to enhance the said performance where such concept does not exist on national codes.

Interpretation: this question received 9 neutral responses, zero strongly agree, zero strongly disagree, 25 agree and 5 disagree. It is clear that agree is the dominant and same level is realized on the neutral responses.

14. Both national and international standards are technical concerns and need to be judge independently according to the project planning and ground scenarios and none can be preferred on the account of other.

Interpretation: this question received 11 neutral responses, zero strongly agree, zero strongly disagree, 27 agree and 1 disagree. It is clear that agree is the dominant and same level is realized on the neutral responses.

15. Both national and globalized standards are concerning about safety technologies

and environmental refinery.

Interpretation: this question received 16 neutral responses, zero strongly agree, zero strongly disagree, 23 agree and zero disagree. It is clear that agree is the dominant and same level is realized on the neutral responses.

16. Petroleum field workers can be equipped with special suits that are sensors incorporated where those sensors are part of communication network that used for storing the logs data for professional staff management.

Interpretation: this question received 5 neutral responses, 13 strongly agree, zero strongly disagree, 21 agree and zero disagree. It is clear that agree and strongly agree are the dominant and same level is realized on the neutral responses.

17. Machine learning stuff alike neural networks are vital for development of smart management system in perform projects.

Interpretation: this question received 14 neutral responses, 9 strongly agree, zero strongly disagree, 16 agree and zero disagree. It is clear that agree is the dominant and same level is realized on the neutral responses.

18. Intelligent technology can o more than management tasks, it can be used for petrol reservoirs prediction as well.

Interpretation: this question received 14 neutral responses, zero strongly agree, zero strongly disagree, 20 agree and 5 disagree. It is clear that agree is the dominant and good level is realized on the neutral responses.

19. Computer based technology can replace many human based roles in gas and petroleum projects.

Interpretation: this question received 7 neutral responses, zero strongly agree, 12 strongly disagree, 11 agree and 9 disagree. It is clear that strongly disagree is the dominant and same level is realized on the agree responses.

20. Intelligent systems in petroleum projects are suffered for the limited data resources hat act against reliability constrains.

Interpretation: this question received 8 neutral responses, 10 strongly agree, zero strongly disagree, 20 agree and 1 disagree. It is clear that agree is the dominant and good level is realized on the strongly agree responses.

21. Since high profitability rate can be expected from petroleum projects, it is feasible to skip some environmental roles alike smoke filtering and exhausting system constrains.

Interpretation: this question received zero neutral responses, zero strongly agree, 13 strongly disagree, 3 agree and 23 disagree. It is clear that disagree is the dominant and same level is realized on the strongly disagree responses.

22. Petroleum projects and heavy industry cannot be a part of green and environments friendly projects.

Interpretation: this question received 10 neutral responses, zero strongly agree, 1 strongly disagree, 15 agree and 13 disagree. It is clear that agree is the dominant and same level is realized on the disagree responses.

23. Environmental regulations are one of the most budget consuming factors in petroleum fields.

Interpretation: this question received 4 neutral responses, 12 strongly agree, zero strongly disagree, 23 agree and zero disagree. It is clear that agree and strongly agree are the dominants.

24. Environment related constrains are vital for workers safety as well as global warmness in the petroleum fields.

Interpretation: this question received 19 neutral responses, zero strongly agree, zero strongly disagree, 9 agree and 11 disagree. It is clear that disagree is the dominants and good agree responses are existed as well.

25. Petroleum projects need to pass from environmental constrains test during the planning stage in order to get the licenses for work commencement.

Interpretation: this question received 4 neutral responses, 16 strongly agree, zero strongly disagree, 19 agree and zero disagree. It is clear that agree and strongly agree are the dominants.

4.2 Neutral Responses

As per the obtained results neutral is found in almost all the questions as in Figure below, the total value of the neutral responses is 247 scores out of 975 (the total scores e.g. 25 x 39) for the questions. Questions 1, 7 and 24 are top most neutrally answered questions while the Questions 3, 21 and 11 are bottom line.

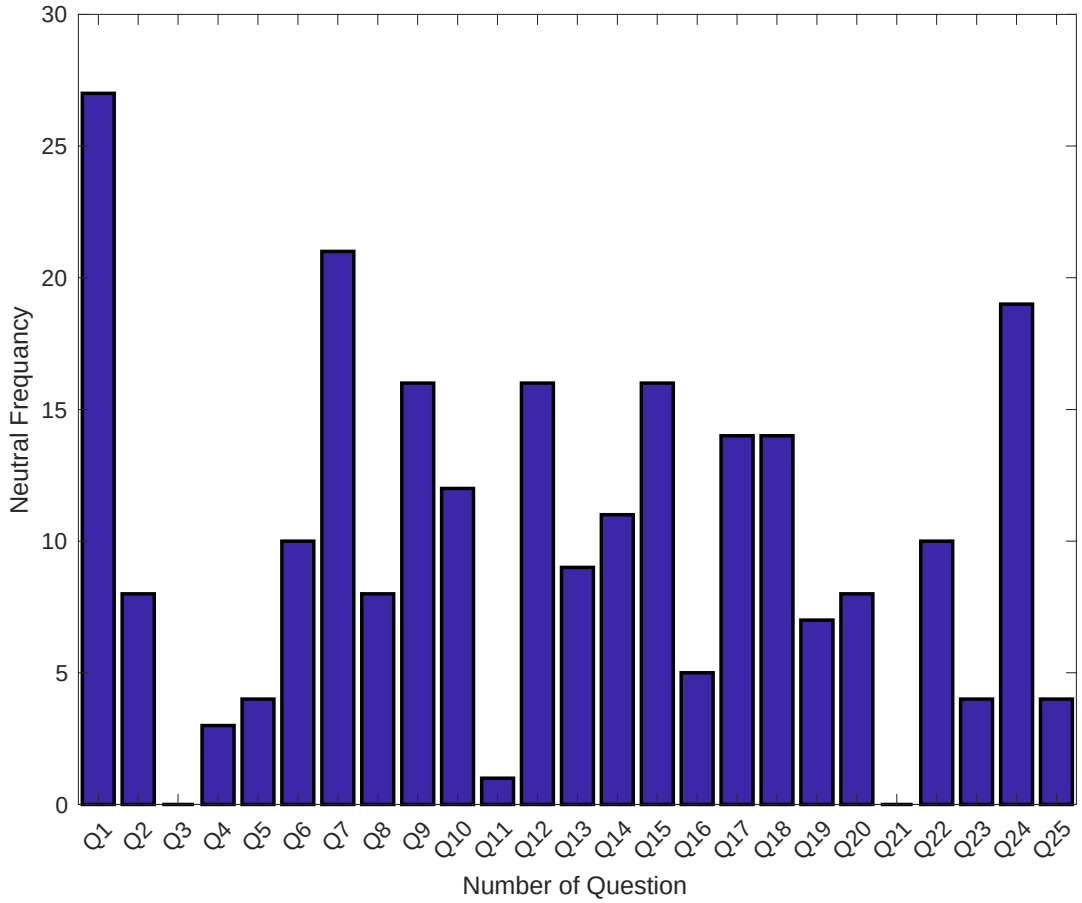

Figure 4.1: Neutral Responses Count in Each Question

4.3 Strongly Agree Responses

As per the obtained results Strongly Agree is found in the questions as in Figure below, the total value of the Strongly Agree responses is 122 scores out of 975 (the total scores e.g. 25 x 39) for the questions. Questions 3, 4 and 25 are top most Strongly Agree answered questions while the Questions 1, 2 and 6 are bottom line.

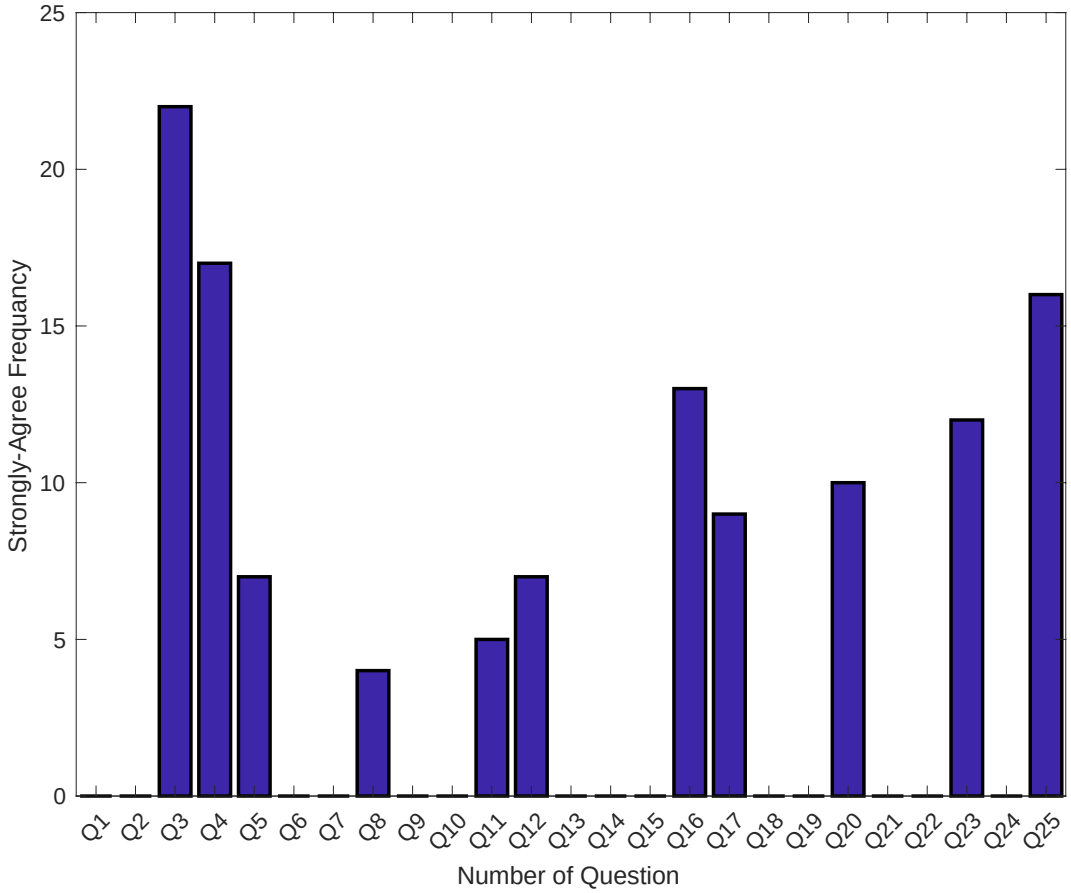

Figure 4.2: Strongly Agree Responses Counts in Each Question

4.4 Strongly Disagree Responses

As per the obtained results Strongly Disagree is found in almost all the questions as in Figure below, the total value of the Strongly Disagree responses is 62 scores out of 975 (the total scores e.g. 25 x 39) for the questions. Questions 21, 19 and 5 are top most Strongly Disagree answered questions while the Questions 1, 3 and 4 are bottom line.

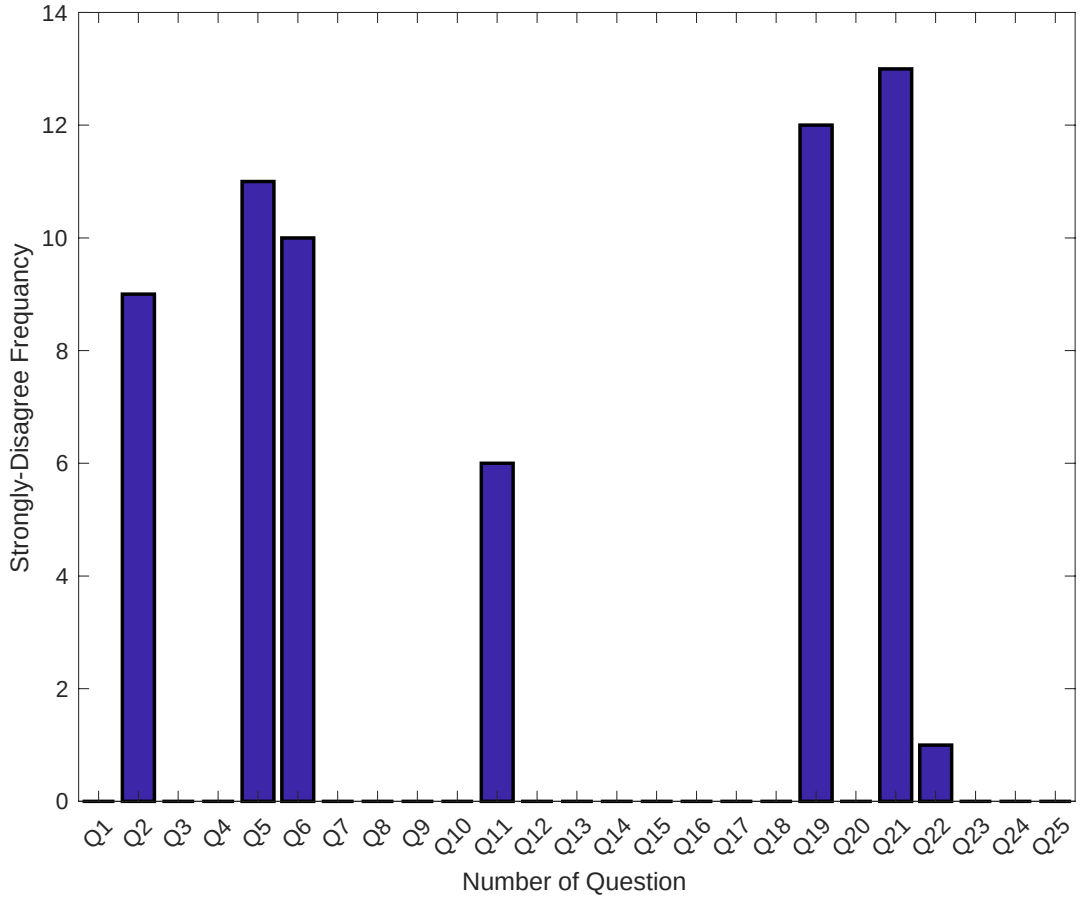

Figure 4.3: Strongly Disagree Responses Counts in Each Question

4.5 Agree Responses

As per the obtained results Agree is found in almost all the questions as in Figure below, the total value of the Agree responses is 407 scores out of 975 (the total scores e.g. 25 x 39) for the questions. Questions 8, 13 and 14 are top most Agree answered questions while the Questions 6, 21 and 1 are bottom line.

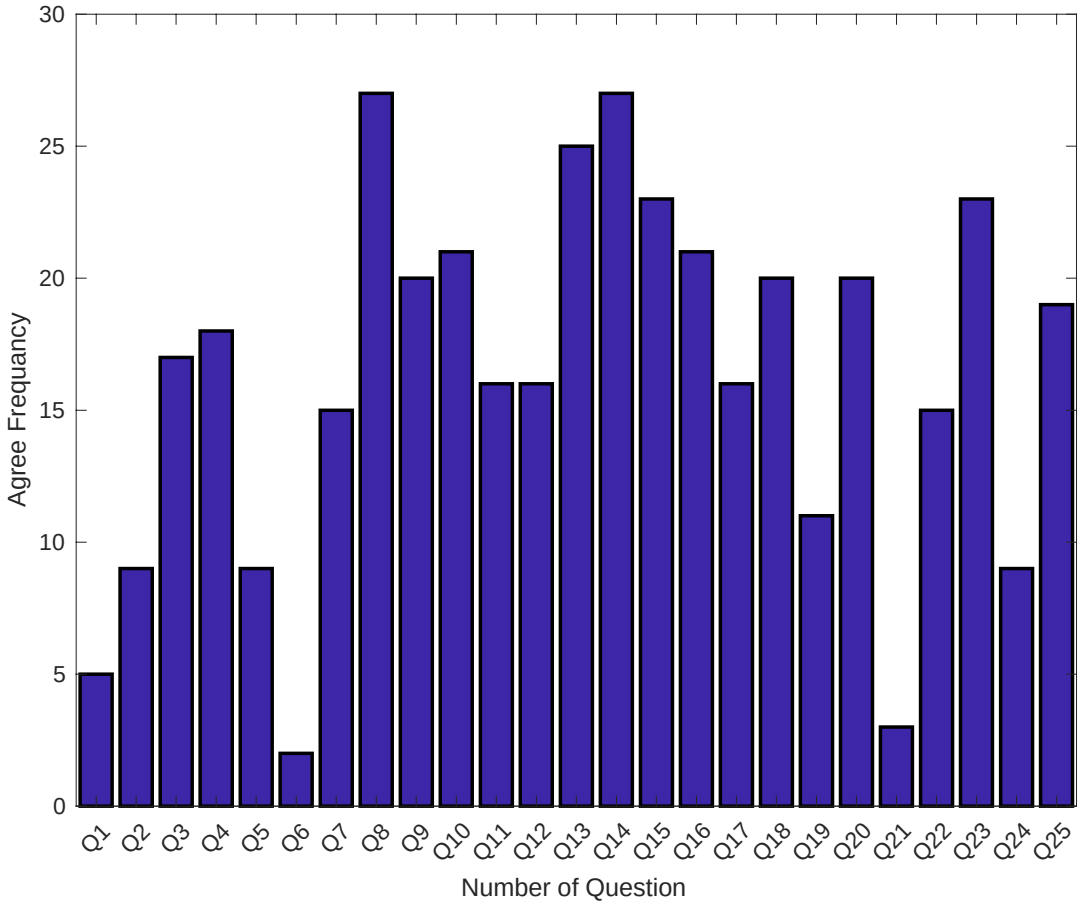

Figure 4.4: Agree Responses Counts in Each Question

4.6 Disagree Responses

As per the obtained results Disagree is found in almost all the questions as in Figure below, the total value of the Disagree responses is 137 scores out of 975 (the total scores e.g. 25 x 39) for the questions. Questions 21, 6 and 2 are top most Disagree answered questions while the Questions 3, 12 and 15 are bottom line.

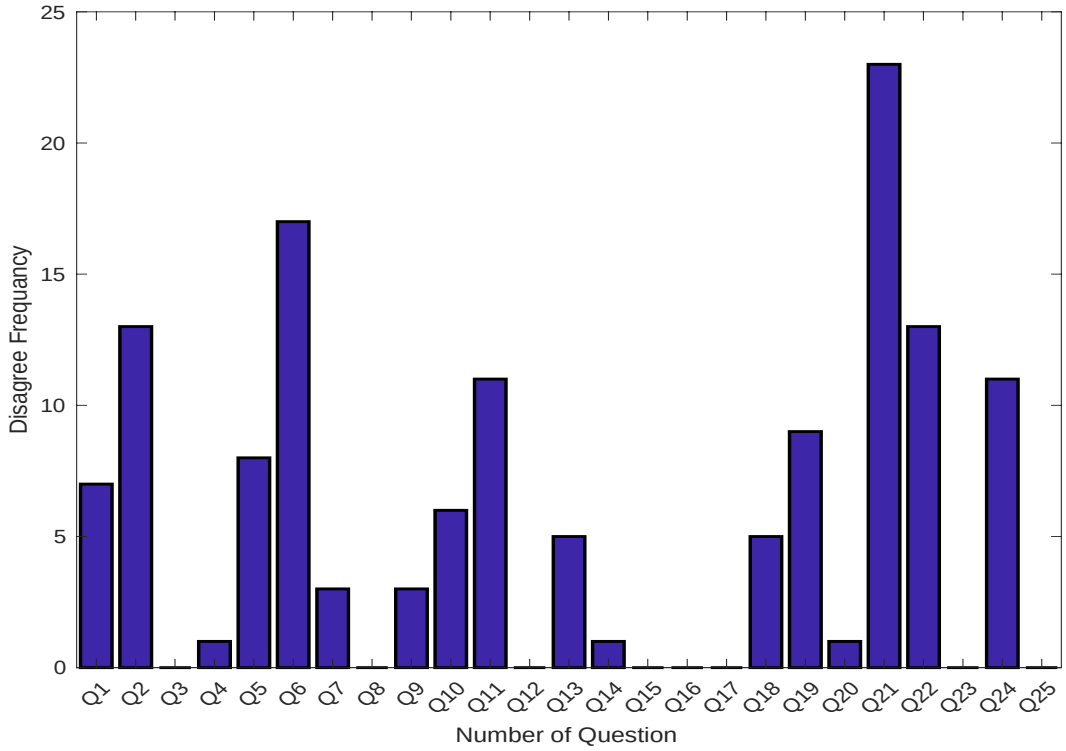

Figure 4.5: Disagree Responses Counts in Each Question.

Responses can be summarized by calculating their impact with reference to the total impact as in Table 4.2.

Table 4.2: Total Count of Each Response (Comparison)

Responses	Number of responses
Neutral	274
Strongly-Agree	122
Strongly-disagree	62
Agree	407
Disagree	137

4.7 Hypothesis Test

With help of Delphi method hypothesis that stated above are being examined with references to the responses above. Table 4.3 is illustrating the score of each question and then pointing out the hypothesis label of the same question.

Table 4.3: Hypotheses Test Results

Question Number	Linked Hypothesis	Score
1	Hypothesis 1	-2.5641026
2	Hypothesis 1	-28.205128
3	Hypothesis 1	78.2051282
4	Hypothesis 1	65.3846154
5	Hypothesis 1	-8.974359
6	Hypothesis 2	-44.871795
7	Hypothesis 2	15.3846154
8	Hypothesis 2	44.8717949
9	Hypothesis 2	21.7948718
10	Hypothesis 2	19.2307692
11	Hypothesis 3	3.84615385
12	Hypothesis 3	38.4615385
13	Hypothesis 3	25.6410256
14	Hypothesis 3	33.3333333
15	Hypothesis 3	29.4871795
16	Hypothesis 4	60.2564103
17	Hypothesis 4	43.5897436
18	Hypothesis 4	19.2307692
19	Hypothesis 4	-28.205128
20	Hypothesis 4	50
21	Hypothesis 5	-58.974359
22	Hypothesis 5	0
23	Hypothesis 5	60.2564103
24	Hypothesis 5	-2.5641026
25	Hypothesis 5	65.3846154

Figure below is demonstrating the scores of each question as per Table 4.3. Question 3 is the top most scored while question 21 is least scored question.

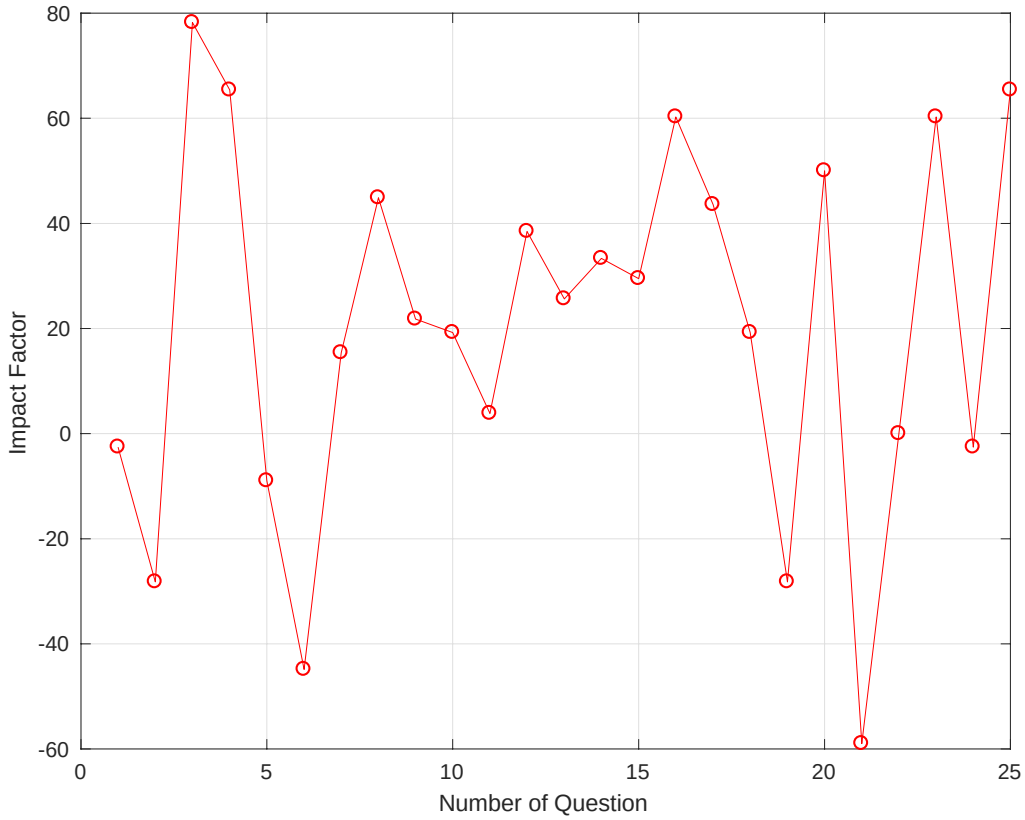

Figure 4.6: Score Level (Percentage) for Each Question

The score of the hypothesises and final result of each is illustrated in Table 4.4 The score of 110 is decided to be the boundary line for the test process and according decisions are made in Table 4.4.

Table 4.4: Hypothesis Test and Decision

Label	Statement	Decision	Score
Hypothesis 1	Locality where the petroleum projects are established has vital impact on workers/professionals safety	Rejected	103.83
Hypothesis 2	International (globalized) safety standards such as (ISO 50001) are outperformed in the cost reduction formula	Rejected	56.41
Hypothesis 3	Globalized safety codes are essential irrespective of presence of nationalized safety codes	Approved	130.76
Hypothesis 4	Impact of data sciences and smart technologies such as safety management systems is vital for human life in petroleum industry	Approved	144.87
Hypothesis 5	It is essential for breakeven from any petroleum projects to ignore the environmental constrains	Rejected	64.102

5. CONCLUSİON AND RECOMMENDATION

5.1 Conclusion

This study was made to evaluate the safety norms and to assess the knowledge of safety and project management in the fields of oil and gas. Twenty five questions are distributed among many of candidates and candidates are filtered according to previously set inclusion and exclusion criteria. The overall thirty-nine candidate are reported approved for this survey participation.

Questions are made in such way that each five questions are serving one hypothesis so that total five hypothesises are set. The results are obtained after data pre-processing using Mat lab Software. Results are analysed using Delphi method and it revealed that only two hypothesis are approved i.e. “Impact of data sciences and smart technologies such as safety management systems is vital for human life in petroleum industry” and “Globalized safety codes are essential irrespective of presence of nationalized safety codes”.

5.2 Recommendations

1. It was realized that most of the professionals in the oil and gas industry are not popular enough about the safety codes and standards neither the national codes.
2. The oil and gas project can be always incorporated under the green technology where emissions and other health risks materials from it can be eliminated.
3. Data technology such as machine learning and computerization of management can enhance the safety and profitability of the oil and gas projects.
4. Most importantly, the role of third party companies such as health care providers, food industry, transportation, education, etc. is essential for life

safety and cost reduction. All such type of service providers can be involved for establishment good and healthy infrastructures for the oil and gas projects in light of national and global standards.

5. The impact of globalized standards is very important for achievement of green projects and for performance enhancement. From the other hand, national codes are also valid in this regard so both need to be involved according to the planners and designers consultancies.

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APPENDİX

Questionnaires:

Hypothesis 1: Linked questions:

- The remote projects locations are mainly impacting the workers safety as no hospitals or health care units are in those vicinity.
- Remote project locations are amongst those factors that degrade the costs planning as company need to invest a lot on the transportation from and to project.
- Employment of remotely localities and lands (unemployed) for petroleum alike projects may enhance the country income capital.
- Contractors role are important in safety as infrastructures alike hospitals, health care unites can be established within the project locality.
- While establishing a project of oil and gas at far locations, workers can not be prevented from gas poisoning.

Hypothesis 2: Linked questions

- Works safety knowledge is measured by their experience in the profession, the experienced workers can be deployed for training other workers (fresher) for cost constrains support.
- Globalized standards are more efficient than the national codes and standers in terms of safety.
- Safety engineer/ supervisor might take the initiatives for upgrading the safety skills of the workers including the technical skilled workers and engineers at the petroleum sites.
- Globalized standards alike ISO 50001 are considered important for safety since it deploys a modern data technology and monitoring systems in order to enhance the safety.

- Globalized standards are looking after environment refinery norms for creating of environmentally friendly projects.

Hypothesis 3: National and international

- It is difficult for incorporate the modern technology that ensures safety and enhance the profitability of the projects in the petroleum fields.
- National standards concepts are about ensuring of country legal norms in any project established over the land of that particular country.
- International standard organizations have made so many codes that can be used according to project size and purpose and it utilized the computerization in order to enhance the said performance where such concept does not exist on national codes.
- Both national and international standards are technical concerns and need to be judge independently according to the project planning and ground scenarios and none can be preferred on the account of other.
- Both national and globalized standards are concerning about safety technologies and environmental refinery.

Hypothesis 4: Data sciences

- Petroleum field workers can be equipped with special suits that are sensors incorporated where those sensors are part of communication network that used for storing the logs data for professional staff management.
- Machine learning stuff alike neural networks are vital for development of smart management system in perform projects.
- Intelligent technology can o more than management tasks, it can be used for petrol reservoirs prediction as well.
- Computer based technology can replace many human based roles in gas and petroleum projects.
- Intelligent systems in petroleum projects are suffered for the limited data resources hat act against reliability constrains.

Hypothesis 5: Environmental restrictions vs petroleum projects

- Since high profitability rate can be expected from petroleum projects, it is feasible to skip some environmental roles alike smoke filtering and exhausting system constrains.
- Petroleum projects and heavy industry cannot be a part of green and environments friendly projects.
- Environmental regulations are one of the most budget consuming factors in petroleum fields.
- Environment related constrains are vital for workers safety as well as global warmness in the petroleum fields.
- Petroleum projects need to pass from environmental constrains test during the planning stage in order to get the licenses for work commencement.

Biometrical Questions:

- Candidates' gender (male, female).
- Candidates' education (diploma, bachelor, master and above).
- Dose candidate receives professional training such as computer skills courses, human resources, etc. (yes, no).
- Has candidate worked with gas and oil industry?
- Years of work experience (1- 5, 6-10, 11-20, more than 20).

RESUME

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