A Systematic Approach to Improving Safety Culture

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Abstract

This report aims at developing an understanding of the term "Safety Culture" and its parameters and uses the findings to present guidelines that aim at developing the Safety Culture within an organization. The understanding of the terms was done through research from international sources on the origin and adaptations of Safety Culture and what are its indicators. The report details findings on what Safety is in general and how it relates to Safety Culture. As well as what signs of a positive or negative safety culture are within an organization. It also includes a thorough look into Safety incidents data and information that justify the need to develop a positive Safety Culture. Finally, the report details procedures that can be implemented to develop a positive safety culture within any organization while providing guidelines on how to monitor and improve the process explained.

Keywords
Safety Culture, Roles and Responsibilities, Accountable Senior Manager, Responsible Senior Manager Employee's Representatives.

1. Introduction
According to the Health & Safety Executive (HSE) in the United Kingdom (U.K.), in 2020-2021 around 1.7 million workers are suffering from Job associated Diseases, and around 450,000 workers out of the 1.7 million, were injured during this period and only in the United Kingdom. Most of these injuries or job-related illnesses could be eliminated by following health and safety measures (HSE 2020).

Regardless of the presence of the hazard, there are other key players in the process of eliminating or reducing risk. These key players are Safety Culture and the organizational policy or procedures. Examples of big incidents that

occurred in relation to Safety Culture were Chernobyl and the fire at King's Cross (Hudson et al. 2003). Both accidents resulted in huge loss of money and lives. Therefore, this paper is going to discuss the literature review of Safety Culture findings and based on the findings it will implement universal implementation and monitoring plans. These plans are classified in the meantime as pilot plans, which are subject to modifications & improvements.

1.1 Objectives

The objective of the project is to define and explain the components and markers of a beneficial safety culture, as well as the steps required to establish such a culture in a structured approach. The next step is to apply the conclusions to develop a set of protocols and resources that businesses can utilize to cultivate and enhance their safety culture in a consistent manner.

2. Literature Review

Safety Culture is a terminology that has been used frequently in recent years, especially after 1986. However, to be able to well define Safety Culture, it is required to define each word individually first. Secondly, to discuss different definitions in the literature to cover different perspectives. This will support the final step, which initiates the final definition of this paper to Safety Culture to be implemented.

2.1 What is Safety?

Safety can have more than one definition as it depends on the provider of the definition. For example, Phil Huges and Ed Ferrett define safety in "Introduction to Health and Safety at Work" as "The protection of people from physical injury. The borderline between health and safety is ill-defined and the two words are normally used together to indicate concern for the physical and mental well-being of the individual at the place of work" (Hughes et al. 2011). In other words, Safety is defined in NEBOSH as preventing physical injury by implementing defensive measures away from the long-term sickness that an occupational condition could cause. Another example is the way that Daniel Crowl and Joseph Louvar defined safety in "Chemical Process Safety – Fundamentals with Applications" in a simple way as "A strategy for accident prevention" (Crowl et al. 2001). This means that it is the approach of protecting people from incidents. after combining all safety definitions that were cited, the following is how to define safety. So, Safety is the approach and procedure of protecting people either as employees or the public and preventing injury or loss from happening. The terminology of safety culture is described by using different words. This synonym of safety culture is "HSE Climate or HSE atmosphere", which is "a scale of temporary situation of Safety Culture and common perception of individuals of that organization" (Reza et al. 2007). But the main question after reviewing multiple definitions is when or where such lexicon started to be used in the modern industrial and occupational world.

2.2 Origin of safety culture term:

Safety Culture or Safety atmosphere is a set of shared subjective values, aims, manners, and traditions to achieve the strategy of protecting people as employees or the public and preventing injury or loss to happen within a work environment or in public due to work activities, which was established basically in 1986 after Chernobyl accident that was caused by a poor safety culture. So, to avoid such accidents occurring, it is required to be able to identify and indicate a poor safety culture in the workplace.

2.3 Safety Culture Indicators:

Safety Culture or Safety Culture indicators are a set of embedded strategies that contribute to the overall safety of the workplace through a set of procedures done by the employer or the employees. Therefore, many researchers and workplaces are looking into these indicators. Reza et al. identified nine scopes that indicate the safety culture in the workplace which include commitment Management, Communications, Primacy HSE, Rules and regulation of HSE, Supportive Environment, Participation in HSE, Personnel Priorities and Needs to HSE, Perception personnel of Risk, and Work Environment (Reza et al. 2007).

Cox et al. stated eleven points that indicate a safety culture including the involvement of safety concerns, the environment of physical work, prioritizing safety over other issues, safety management actions, management commitment to the safety of employees, no blame culture, safety procedures or system, accident reporting, attitudes to personal safety by workers, training, and safety legislation (Cox et al. 2000).

Another field where minor mistakes can lead to a global disaster has been looked at for its indicators as suggested in the literature. This field is the nuclear industry where basically there are a total of seven main safety indicators of healthy culture in the workplace. These 7 indicators are: Safety is socially valuable to workers, safety is an essential part of the whole system, awareness of one's effect on other's safety, management awareness of potential hazards,

management commitment to eliminate hazards, daily readiness of eliminating risks, and the social interactions involve the enhancement of safety in the workplace (Reiman et al. 2010).

3. Methodology

Taking into consideration that this paper is aiming to have a universal guide toward promoting safety culture in any workplace, thus, our Safety Culture indicators to be presented at any workplace are a total of ten which are as follows:

- Commitment of the management toward safety.
- Well established communication within the entity.
- Internal rules and regulations of HSE.
- Safety management actions.
- Supporting environment and management systems to promote safety needs.
- Employees participate in arranging HSE guides.
- Employees prioritize HSE.
- Understanding of personnel perception of risk in the workplace.
- Assessment of work environment.
- Repetitive drills & training.

After identifying ten indicators of safety culture, the next step is to implement these indicators into the universal guideline of this paper to be able to identify the health of the work environment at a place or time. Therefore, it is required that the workplace management is committed to promoting the safety of the employees and taking safety management actions. In addition, the workplace environment shall be supportive and promote safety where there is a well-established safety assessment of the working environment that will proceed in having training for the employees. Not only that but the workplace should communicate with the employees to arrange HSE guides and where personnel prioritizes safety. In other words, there are three main levels or requirements which are: 1) Management level. 2) Personnel level. 3) Work environment level.

3.1 Management level requirements:

On this level, the workplace management should comment on safety where they are aware and take action to promote the safety of their workers. Another point is that the management must establish the right way to communicate with their employees to identify potential threats, which will promote their commitment to safety. However, in some cases, not all workers abide by the safety measures. Therefore, the management needs to establish strict internal rules and regulations. However, such regulations should not be set to blame the employees for unintentional incidents but only to promote safety in the entity.

3.2 Personnel level requirements:

At this level, the guideline should be able to identify and indicate by initiating a survey on the employee to understand their willingness to participate in arranging HSE guides in the company or to assess their perspective of risk. Also, this guideline should be able to assess the level of prioritizing of HSE to the workers.

3.3 Environment level requirements:

The environment at any workplace requires to be supportive to promote safety needs, and as mentioned above not a blaming environment, where workers are intimidated to state any hazards that might threaten their safety due to the non-supportive environment. Another significant point is that the work environment should have safety assessment plans periodically to avoid the existence of any emerging risks. The safety assessment will help the management to plan drills and training to avoid any future threats to the workplace. As a result, this project requires a well-defined guideline that assesses the previous ten points to promote the safety culture at any workplace, industry, or entity.

3.4 Implementation justification:

Most managers prioritize understanding the ramifications of their new position and building strong relationships with team members as soon as they begin working for a new company. Health and safety concerns are frequently not the primary or even second priority. This will mark the initial stepping stone and influence on team members that the team will be objective driven, without fully comprehending and assessing the risks and identifying the hazards in their workplace. Therefore, to emphasize that Health & Safety is as important as achieving milestones, there are three basic drivers that will enforce the implementation of a holistic health and safety management system; these are, legal, moral, and financial reasons.

- Moral: The necessity to safeguard people against illness and harm while they are at work is at the heart of moral arguments.
- Financial: The financial justifications stem from violations of health and safety laws and the ensuing fines, compensation payments, associated expenditures, and in certain severe circumstances, jail.
- Legal: The legal justifications are incorporated in both criminal and civil law.

4. Case Studies on Consequences of Poor HSE Culture:

In the IAEA report made by the International Nuclear Safety Advisory Group "INSAG" in response to the Chernobyl Incident in 1986, it was clearly stated that one of the main contributors to the crisis is the lack of safety culture in the nuclear field locally and nationally. But the main question raises what happened that made the INSAG point to safety culture? To understand the huge impact on the whole globe and the reasons that poor safety culture does contribute to the crisis, let's have a brief look at what Chernobyl Incidents are and what are the consequences that occurred as a result (INSAG 1991).

Regardless of the flaws in reactor design, the poor culture safety had strongly contributed to the incident. There was insufficient safety assessment regarding different modes of the reactor, and inadequate attention to a safety review. Another point related to safety culture is the weak communication between operators themselves and between designers and operators. Furthermore, the personnel did not respect or prioritize the requirements of operational and test procedures and weaknesses in related safety training (INSAG 1992).

In other words, this incident occurred due to major four contributors which are the lack of safety training and understanding of the measures, weak safety analysis, poor communication, and personnel perspective of risk. Thus, our systematic approach or guideline is meant to improve safety culture by anticipating exactly the points that cause the Chernobyl incident and similar accidents.

5. Results and Discussion

This section provides guidelines on actions to be implemented by an entity to develop and improve the Safety culture internally. The procedures detailed below are based on the findings in the literature review and what was identified as safety culture indicators. The procedures address multiple indicators at once and are designed to be applicable for implementation by entities from different sectors and business scopes.

5.1 Safety governance structure

The Chernobyl disaster highlighted the importance of clear roles and responsibilities within the safety management system. At Chernobyl, there was confusion and ambiguity regarding who was responsible for safety, and this contributed to the accident. To prevent similar incidents, organizations must ensure that there are clear lines of authority and that all individuals understand their roles and responsibilities. As identified by the indicators, management commitment and staff participation and communication are key components to improving the safety culture within an organization. Safety Governance Structure details the roles and responsibilities of the Safety Management System, as well as the reporting lines and how an entity governs and communicates Safety matters internally. Figure 1 shows the HSE Governance flow illustrating the HSE governance roles and responsibilities.

5.2 HSE committee meetings:

The purpose of the HSE Committee meetings is for Senior Management and employee representatives to discuss HSE matters and updates on the HSE-related feedback from the employees. The HSE Committee members shall include at least two Executive/Senior Management members and two Employee representatives and employees of all levels are welcome to attend. The HSE Committee shall meet on a quarterly basis on the second week of the month. The agenda shall be sent at least one week in advance by the Employee representatives. The meeting shall be organized by the Employee's representatives and to be attended at a minimum by the HSE Committee members, the Employee representatives and the Responsible Senior Manager. Upon the completion of the meeting, the Employees Representative shall send a Minutes of Meeting Report to the HSE Committee and the Responsible Senior Manager. The Employees' representatives shall record actions assigned and follow up on them accordingly.
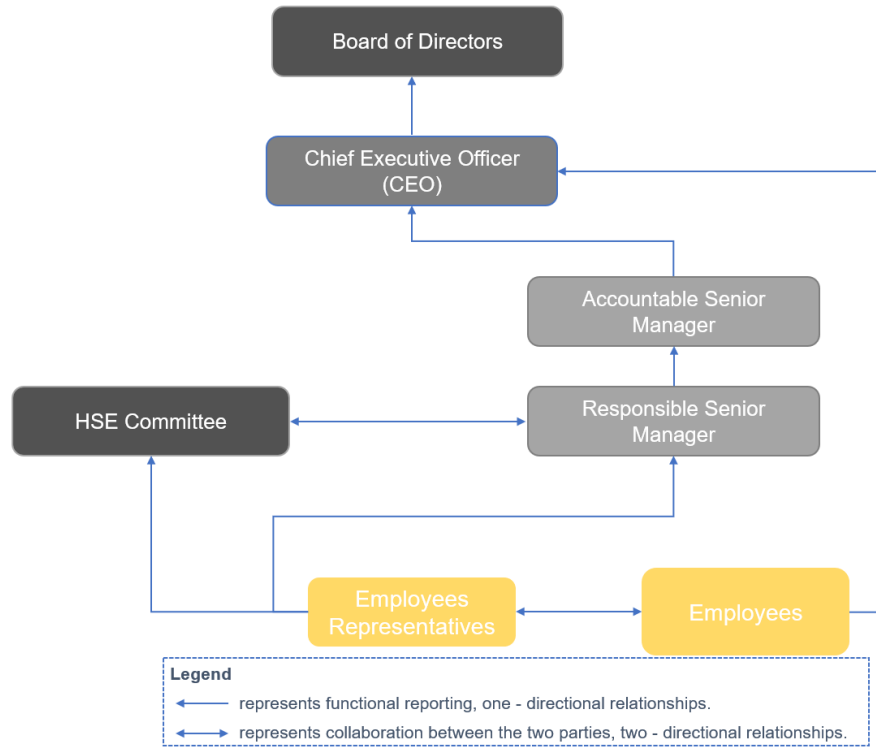
Figure 1. HSE Governance Flow

5.3 Weekly management walk-down

On weekly basis, nominated members of the senior management shall conduct a walk down around different locations in the workplace. As shown in Table 1, The walk-down shall be planned by the employee's representatives to ensure that all areas in the workplace are covered in a cycle process. Chernobyl underscored the importance of a strong safety culture in hazardous industries. Safety culture is the set of shared values, beliefs, and behaviors that influence an organization's approach to safety. In general, the Management Walk-down process is an informal approach in which management participates in a regular program of onsite visits and engagement with workers as they go about daily work tasks. The contractor's management shall be invited to attend Management Walk downs and to provide their feedback. Participants shall take an active interest in workers' HSE concerns, achievements, and observations.

Table 1. Management Walk-down Roles and Responsibilities

Accountable Senior Manager	- Hold leaders accountable for spending time in-field as required. - Establish and enforce relevant KPIs. - Remove barriers to the successful implementation of the procedure. - Role model in the Management Walkdowns behaviors for other leaders to follow. - Show visible commitment to the Management Walk-down process and attend once every month.
Responsible Senior manager	- Attend on-site Walk downs on a weekly basis - Engage with employees during the walk-down using a positive and consultative approach. - Encourage safe behaviors and discourage unsafe behaviors observed during the walk-downs. - Communicate observations and lessons to other leaders or work areas.

Employees representatives	• Complete the post-visit Walk-down report and submit it to Responsible Senior Manager. • Provide coaching/guidance to leaders around effective safety conversations and onsite requirements. • Facilitate manager visits to the Workplace by liaising with work areas and arranging logistics (access, escort, PPE, etc.).

It is an opportunity for the worker to speak more than listen. The Employee's representatives shall prepare a report detailing the below:
- Date and time of the Walk-down
- Location of the Walk-down
- Participants of the Walk-down
- Safety concerns identified
- Actions assigned and deadlines
- Safety Improvements identified

The report shall be prepared and shared with the walk-down location team leader and the Responsible Senior manager. Actions assigned shall be recorded in the HSE Observations record and be followed up by the Employee's representatives. Data on Management walk-downs and pending actions shall be discussed in the Monthly HSE Committee with the Committee members.

5.4 Competency development:

Chernobyl highlighted the importance of proper training for workers in hazardous industries. The operators in charge of the reactor at Chernobyl were poorly trained and did not have a good understanding of the system's design. As a result, they made critical errors that contributed to the disaster. As shown in Table 3, the managers should ensure that their workers receive regular and comprehensive training that covers all aspects of their job, including potential hazards and emergency procedures. This is done by conducting a training needs analysis to identify, fulfill and monitor HSE training and competency requirements. Training analysis is done through the HSE training program which highlights all internal and external training needed. The subjects are identified based on legal and professional requirements, which are identified based on communication between the Employee's Representatives and the Managers (Saenko et al,, 2001).

Table 2. Competency Development Roles and Responsibilities

Managers	• To provide support in identifying training needs and to ensure that staff within their department have received the required training to perform their duties in a safe manner
Employee's Representatives	• To support Managers in identifying and facilitating the training needs of Employees and contractors (where applicable) • To ensure that all external training providers meet the legal requirements and the specific requirements identified by Managers • To manage and follow up with the implementation of the training plan • To maintain training records • To receive feedback from Employees on the quality of the external training providers
HSE Committee members	• To support HSE in ensuring that all external training providers meet the legal requirements

5.5 Training types

Safety induction sessions are provided to new joiners and highlight the HSE arrangements that apply to all Employees equally. This may include but may not be limited to emergency response; HSE communication channels; HSE observation reporting; HSE compliance references; and any other relevant information displayed in this HSE Policy. Emergency response training is provided to staff members who have a role during an emergency. Internal training

includes Emergency Response Plan training and emergency simulation sessions. External training is also provided to the relevant team members such as First Aid training and basic firefighting training. Role-specific training is identified by the Managers and aims to increase the competency of specific employees who are specialists in their roles. Job-specific training may include electrical safety; risk assessment; defensive driving; HSE audit; amongst others. The necessary training will be identified by the Managers and/or the Employees Representatives.

Leadership training (e.g., IOSH Managing Safety) is training provided to team leaders and managers to increase their competency in dealing with staff members and to be able to take a leading role in HSE matters.
HSE Training for Employee representatives shall aim at increasing the competency of the Employees representatives in HSE matters and HSE regulations. This training shall include but not be limited to HSE audit training and incident investigation training. HSE training records are to be maintained and retained with the Employee's representatives and the Managers, of areas where specific HSE requirements may exist as evidence of staff competency. These areas will be identified and notified by the Responsible Senior Manager, and a record of such notification will be retained. The relevant Managers will share responsibility in ensuring their Employee's HSE training record is valid.

5.6 Safety culture measuring tool

Chernobyl underscored the importance of a strong safety culture in hazardous industries. A safety culture is the set of shared values, beliefs, and behaviors that influence an organization's approach to safety. The Chernobyl disaster was caused, in part, by a lack of safety culture. The management was more focused on meeting production targets than on ensuring safety (Beresford et al. 2016). It is therefore important to foster a strong safety culture that prioritizes safety over other goals. The measuring of the Safety Culture within the organization will aim at assessing the performance of the organization using the indicators as parameters as well as standard HSE performance indicators. The measuring tool will display the progress of an organization's HSE performance indicator as shown in Table 3.

Table 3. Sample Safety Culture Measuring Tool

Metric	Description	Year 1	Year 2
Reporting of HSE Observations	Total number of HSE observations reported divided by the total of employees		
Closing of HSE observations	% Of closed unsafe act and unsafe conditions		
HSE incidents	# Of HSE Incidents Investigated / Reported		
Safety Management Walkdowns	% Of Safety Walkdowns completed annually		
Completion of assigned actions	% Of actions assigned from the Walkdowns		
HSE training	% Of HSE trainings completed		
HSE Committee meeting	% Of completion of actions from the Committee Meeting		
HSE notices	# Of HSE violation notices received from external parties		

Safety Culture assessment tools are also to be used such as the "Score Your Safety Culture" checklist developed by transport Canada. Other assessment tools are listed in Table 4

Table 4. Other Safety Culture Measuring Tools

Title of tool (kit)	Developer/ owner (Author)
Score Your Safety Culture Checklist	Transport Canada (James Reason)
Hearts & Minds program - Understanding Your Culture Checklist	Energy Institute (Shell in collaboration with Leiden and Manchester Universities)
Safety Climate Assessment Toolkit and User Guide (LSCAT)	Loughborough University, Health & Safety Executive (HSE), and a number of offshore organizations

Safety Health of Maintenance Engineering (SHoMe) Tool	UK Civil Aviation Authority (developed by Health and Safety Engineering Consultants (HSEC)

5.7 Monitoring plan & continual improvements

Annually, Employee representatives shall conduct a Safety Culture assessment activity using the Safety Culture Measurement tool. The findings shall be provided to the Responsible senior manager and the HSE Committee members during the Q4 HSE Committee meetings. The responsible senior manager shall report the findings to the Accountable Senior Manager as per the reporting lines in the governance structure. The CEO shall communicate the report findings to all staff during February annually.

Every January, an HSE Management meeting shall be organized by the Responsible Senior Manager to develop an action plan to ensure continual improvement of the Safety Culture of the organization. The attendees shall be all members of the management and at least one employee representative.

The action plan shall be based on the outcomes of the Safety Culture assessment activity. All actions shall be recorded, assigned, and followed up on during the quarterly Committee meetings. The procedures mentioned are developed based on the findings of the team and are selected considering budget restrictions and organizational size. However, the table below shows some examples of further actions that can be considered based on resource availability and organizational needs.

Table 5. Resources availability and organizational needs

Item	Description
Safety Recognition Programs	Programs that detail employee Safety performance evaluation and criteria that include regular awarding.
Observation Cards	Providing all employees and visitors with observation cards that can be filled to report any HSE observations anonymously
HSE Townhall	A reoccurring event that invites all internal and external parties such as contractors and regulators to discuss HSE matters and display management commitment towards HSE
HSE theme of the month	A planned monthly awareness campaign that aims at sharing information and raising awareness in HSE-related topics on a monthly basis
Safety KPIs	To develop and cascade Corporate HSE KPIs to individual KPIs for all staff members. KPIs to reflect involvement in the Safety Culture Program.

5.8 Bowtie outcomes

As depicted in Figure 2, the bow-tie analysis provides a comprehensive overview of the various measures and controls that are implemented to prevent and mitigate HSE (Health, Safety, and Environment) incidents and their associated consequences. The bow-tie diagram illustrates how unsafe behaviors can lead to HSE incidents, and the proposed measures can effectively prevent such incidents from occurring or minimize their consequences. The visual representation helps stakeholders to identify the critical controls that are needed to prevent and mitigate incidents effectively. By analyzing the factors that contribute to HSE incidents and their consequences, stakeholders can identify potential weaknesses in their system and implement appropriate measures to address them. Additionally, the bow-tie analysis provides insights into the relationship between various controls, such as preventive and mitigating measures, and their impact on incident prevention and management. Furthermore, the bow-tie diagram serves as a valuable communication tool, allowing stakeholders to share information about their HSE management system and its effectiveness in preventing and mitigating incidents. It can also assist in identifying areas that require improvement and help stakeholders to develop strategies to enhance their system's performance.

The bow-tie analysis is a powerful tool for visualizing HSE management systems' effectiveness and identifying critical controls required for incident prevention and management. It provides insights into the relationship between different measures and their impact on HSE incidents, allowing stakeholders to make informed decisions to improve their system's performance.
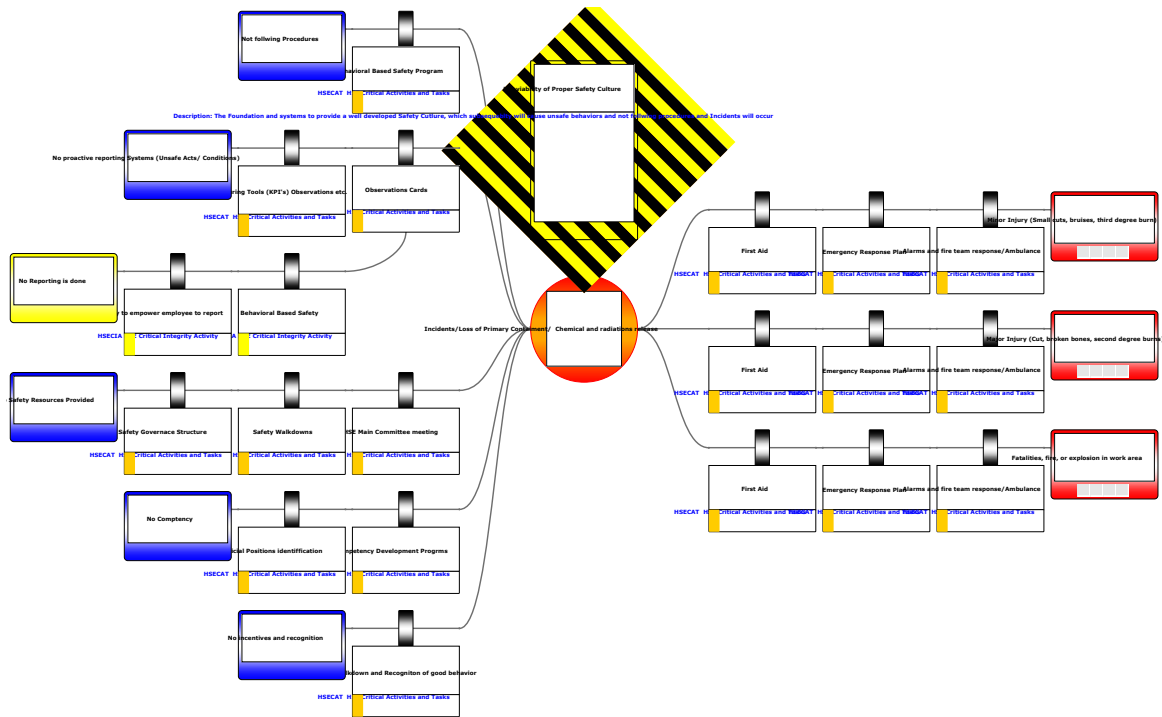
Figure 2. Bowtie Outcomes

5. Conclusion

The report explored the term "Safety Culture" and its origins of it. As well as its use in recent history. As detailed in the report, there are many different indicators and parameters identified by different resources. This shows how abstract the term is and hence the group has identified nine parameters that will be used as the basis for the development of a Safety Culture within an organization. The report also explores development justification by presenting moral, legal and financial justifications where consequences of different categories can occur due to a poor safety culture. The report also presents examples of incidents that occurred with severe consequences such as the Chernobyl Incident in 1986.

The nine identified parameters were used as pillars to develop a set of procedures that improve the Safety Culture of an organization. These procedures are subject to assessment using monitoring and measurement tools. In conclusion, it was identified that Safety Culture is tied to human behavior and not administrative parameters, and to develop it, the actions shall address human behavior, interactions and competencies which are reflected in this report.

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Biography

Saed Talib Amer earned his Doctor of Philosophy in Computer and Information Systems Engineering in August 2012 from Tennessee State University, USA. Dr. Amer is currently a faculty in the Department of Industrial and Systems Engineering at Khalifa University and leading research endeavors on the advances in Health Safety and Environment engineering, training, and HSE education. Other research fields that Dr. Amer is involved in are Human Factors simulation and validation, Seat comfort analyses, and the assimilation of the human into Industry 4.0. Previous work includes sustainability assessments, systematic measures to enforce engineering sustainability education, and autonomous solutions for Unexploded Ordnance (UXO) remediation. Finally, Dr. Amer worked on simulation solutions for hybrid renewable energy research.

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Abdulla Hussain AlShabibiA mechanical Engineer graduated with bachelor's degree from Khalifa University, specialized in reviewing, conducting, and implementing Health, Safety, and Environmental impact assessment and relevant recommendations rising from long spectrum of studies. Moreover, implementing the health and Safety management system across all Major projects in ADNOC while ensuring meeting the expectation of ADNOC policies/standards. Furthermore, providing guidance to all related process safety & HSE design issues that might arise during all the project lifecycles. Alongside the technical profession, I supported the implementation of Social Risk Management in ADNOC by developing and advising on the respective studies.