# Safety House: A developed Framework to Improve Safety Performance among Highly Risky Industries

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*Abstract— The concept and importance of Occupational Health and Safety Management Systems (OHSM) have extensively been discussed in previous literature. This study, however, focuses on reviewing and addressing gaps in some well-known industry-accepted OHSMS models developed between the periods 1990 – 2018 to design a new OHSM framework known as the "Safety House" that addresses all significant gaps in previous models.*

*The findings of this study show that most previous models have either ignored safety leadership or safety commitment as one of the most pivotal elements that can improve the effectiveness of OHSMS and promote workplace safety. The concept of integration and relationships among all previous models was not clearly established.*

*The innovation of this study highlighted the importance of integrating safety leadership and safety commitment into all phases of continuous OHSMS models. The study as well addresses the issue of employees' involvement in safety planning before and after implementation of OHSMS. This is an initiation that has not benefitted the needed attention in almost all previous safety models.*

*Keywords— Safety Performance; Occupational Health and Safety Management; Risk; Safety Models.*

## HIGHLIGHTS

1. The importance of integrating safety leadership and safety commitment into all phases of continuous OHSMS models
2. Addressing gaps in previous well-known industry-accepted safety models
3. Addressing gaps in previous well-known industry-accepted safety models

## I.   INTRODUCTION

The concept of the Occupational Health and Safety Management System (OHSMS) can be traced as far back as the 1400s when physicians advocated for the need for employee safety and disease prevention among mineworkers. However, the adoption, development, and international conceptualization of the OHSMS concept gained momentum in the 20th century after the International Commission for Occupational Health (ICOH) and the Industrial Labor Organization (ILO) was established in 1906. Today, the concepts of OHSM have been expanded by various studies to include the promotion and provision of a wide range of employee health and safety concerns (ILO, 1985). Thus, the concept of OHSMS has been widely recognized and adopted

by many industries to provide or improve health and safety at the workplace.

As Kuusisto (2000) put it, safety is a "reliable control of harm" whiles health refers to the affirmation of physical, mental, and social wellbeing of workers (WHO, 1948). Burrage (1995) described OHSM as "the measures, procedures, and controls applied to working activities that minimize risks and maximize safety". Mitchison and Papadakis (1999) viewed OHSM as an aspect of the overall management function that determines and implements the organization's safety policies. The Hong Kong Labor Department (1999) further described OHSM as "planning, developing, organizing, and the implementing of safety policy which can measure and audit the performance of those functions". From an integration perspective, the European Council Directive 96/82/EC viewed OHSM as an accident prevention mechanism, which should be part of the organizational structure. The council defined OHSM to include the entire organizational structure, responsibilities, practices, procedures, processes, and resources for determining and implementing the major-accident prevention policy (Mitchison and Papadakis, 1999).

As a global organization, WHO defined OHSM as the maintenance of employee wellbeing over a longer period by focusing on occupational, environmental, and social culture determinants of health (WHO, 1999). Thus, WHO emphasized the need for collaboration between employees and managers for the continuous process of improving and promoting the health, safety, and sustenance of employees' wellbeing at the workplace.

Quite recently, Fernandez-Muniz et al. (2007) considered OHSM as "a set of policies, strategies, practices, procedures, roles, and functions allied to safety". Granerud and Rocha, (2011) added that OHSMSs are systematic risk eradication tools used to control health and safety challenges at the workplace. More significantly, OHSMS are supportive tools that promote the wellbeing of employees at the workplace (Ramli, Watada, and Pedrycz, 2011).

The several concepts and definitions of OHSM may differ in the content; however, the focus and motivation behind OHSM remain similar. Clearly, OHSM directly focuses on initializing, developing, and implementing policies that will govern work operations by enhancing work safety and promote employees' wellbeing by reducing or preventing risk and hazardous exposures at the workplace. As briefly described by Koehn, (2000) OHSMS is "a method of controlling the safety policies, procedures, and practices".

In this current study, the definitions by the European Council Directive 96/82/EC, SEVESO II, and WHO, (1999) were integrated. Thus, OHSMS is defined as management responsibilities, practices, procedures, processes, and resources focusing on occupational, environmental, and social culture determinants of health that guide the implementation of accident prevention policies and can maintain the wellbeing of workers over a sustainable period. This definition is in line with all other definitions of OHSMS and as well, captures the research objectives, which focus on the development of a safety framework that can improve safety performance in highly risky industries.

## II. REVIEW OF OCCUPATIONAL HEALTH AND SAFETY MODELS

The OHSM framework is a conceptual structure of ideas established, adopted, or implemented by an organization with an intention to support, guide, and improve the continuance work safety of employees. Over the past 20years, several OHSM frameworks, also known as OHSM standards, guidelines, or models have been developed and disseminated by health and safety experts, organizations, and government as a whole. In this current study, we explored the different forms of models chronologically, highlighted the gaps, and presented a recommendation by developing a safety framework known as the "Safety House" that addresses all gaps in previous models.

### 2.1 The Accident Prevention Advisory Unit (APAU) of the UK Health and Safety Executive (HSE)

The Accident Prevention Advisory Unit (APAU) of the UK Health and Safety Executive (HSE) in 1991 developed one of the first safety frameworks known as 'Successful Health and Safety Management (HSG65) to be used as a practical guide for directors, managers, safety professionals, and employee representatives. The 'Successful Health and Safety Management (HSG65)' OHSM framework proposes a continuous and interconnection of five (5) different areas of safety plans. These include safety policy development, organizational development, safety planning, measuring performance, and review of performance. The framework further proposes feedback loop and safety auditing as key factors in improving organizational safety. Although the model is quite extensive in terms of the coordination among the decision processes in the cycle, it failed to integrate

employee involvement in safety decisions and safety planning. The model is superior centered, thus, it focuses more on implementing and executing safety decisions by management with complete disregard to the role employees play in improving safety results apart from feedback loops. Feedback alone is not enough, particularly, workers who are highly exposed to work-related accidents must be given the channel to move beyond reporting but rather be involved in key safety management decisions. The domino theory of accident causation asserts that workers cause more than 88% of work-related accidents; hence, organizations may fail in the quest to improve the health and safety of employees are not highly consulted. In as much as the emphasis is on management's ability to execute safety plans, the model fails to address managerial commitment level and safety leadership as a major determinant for improving safety outcomes (Clarke, 2013; Yagil and Luria, 2010; Zohar and Luria, 2010; Amponsah-Tawiah, 2016; Zohar and Luria, 2005).

Basically, safety leadership is the exhibition of inspiration and motivation of achievement by leaders to followers in order to promote good safety behavior (Burns, 1978; Chemers, 1997) whiles management commitment has been used as dimensions to predict employees' perceptions on organizations safety climate (Zohar, 2008; Zohar, 2000; Zohar and Luria, 2005). Although current research seems to focus on the effectiveness of individual characteristics of leadership, safety leadership has been identified as one of the major factors that predict positive outcomes (Donovan et al., 2016; Clarke and Ward, 2006, Martínez-Córcoles et al., 2012; Nielsen et al., 2013). The theory of perceived organizational support has been used as well to demonstrate the relationship between organizational commitment to safety and work outcomes (Eisenberger and colleagues', 1986; Judd et al, 2005). This makes safety leadership and management commitment to safety a significant determinant of safety outcomes and production outputs as a whole hence should have merited the needed locus in the APAU model. More importantly, safety training, orientation, and education have long been held as a mechanism to reduce work-related accidents and injuries yet its emphasis has heavily been ignored in the model (Florio, 1979).

## 2.2 The continuous Improvement Model

The National Safety Council (NSC 1994) of the United States developed the continuous Improvement Model on Safety Management Systems also focusing on 5 key phases similar to the UK's Successful Health and Safety Management (HSG65)'. However, in anticipation to achieve the best safety

performance outcomes, the NSC continuous improvement model advanced a step further to integrate management commitment and involvement as a key phase in the cycle. The framework viewed safety systems as a cycle that must be continuously improved through review and adjustment. The model further proposed the integration of safety, health, and environmental professionals as the center holding all the five phases of the cycle. Thus, the emphasis is on the involvement of safety, health, and environmental experts in the planning, goal settings, implementations, and review of safety policies. To some extent, the NSC model faces similar drawbacks just as HSG65. Thus, in as much as safety commitment and involvement forms part of the phases in the cycle, safety leadership has been completely ignored. More significantly, safety commitment and involvement do not seem to be coordinating with the other four phases in the cycle.

## 2.3 The BSI model

The British Standard Institute (BSI) developed the Elements of Successful Safety Management System in 1999. The BSI model is most similar to NSC 1994 as it proposes the same continuous cycle of improving occupational health and safety. BSI however omitted the level of management involvement and commitment in promoting safety, a lapse that was filled by the NSC 1994. The BSI also suffers the drawbacks of emphasizing the integration of safety leadership and management commitment level in the continuous cycle. Other relative models that as well viewed safety frameworks as a continuous cycle include the Australian/New Zealand Standard 4804 (AS/NZS 4804) and the International Labor Organization (ILO) "Elements of the Safety Management Systems." It is worth noting that, all five-safety framework concepts are the same by structure. Thus, the models are more or less proposing continuance safety activities through safety policies; planning, organizing, and implementations; monitoring; review, and audit. As opined by Raglan, (2003), achieving the best safety outcome entails effective planning, monitoring, and evaluation of safety policies. Though these phases in the models are significant determinants of promoting safety behaviors or improving the work environment, they lack some significant parameters deemed necessary to archive the best safety outcomes.

## 2.4 The WHO Safety Model

More constructively and quite recently, the World Health Organization combined five different continual health and safety models (i.e. OHSAS 18001, WHO-WPRG, ILO OSHM, CCOHS, Deming-PDCA) to develop an eight

continual process health and safety framework. This framework focuses on four safety thematic areas. These include the physical work environment, psychosocial work environment, health resource administration at the workplace, and communal health and safety participation (WHO, 2014). The model is known as the healthy workplace continual improvement process and it extensively advanced the Deming-PDCA framework and the concepts propounded by other continuance models by addressing their existing drawbacks. These include mobilizing, assemble, assess, prioritize, plan, do, evaluate, and improve as the key phases in the continuance safety cycle. The need for organizations to improve work engagements with employees through effective leadership and the promotion of workplace culture, values, and promoting sustainable wellbeing was highly emphasized. The framework also traveled a step further to propose the inclusion of non-management employees with equitable gender balance into teams. These groups of workers in teams are to report all safety concerns of workers to their supervisors or managers and highly sort or involved in all aspects of safety planning.

What makes the WHO framework more extensive is the integration of stakeholder commitment, leadership engagement, workers involvement, ethics, and values as integral factors that coordinate all the phases in the cycle. More so, unlike the other continuance safety models that focus on improving employees' wellbeing within the work settings, the WHO framework goes beyond the organization by widening the safety scope to include physical work environment, psychosocial work environment, and communal health. The proposal of mobilizing, assessing, assembling, and prioritizing the interest and ideas of work safety from managers, employees, opinion leaders, union members, and all other stakeholders in addressing health and safety issues within the four thematic areas is a step ahead of all previous models. Distinctively, commitment among all the stakeholders in safety decisions was highly emphasized and elaborated. The strength and complacency of the WHO models lie in the integration of the concept of the five-continuance model into one major framework. Never the less, this framework is anticipated to be time-consuming due to its nature and scope of implementation. As well, the involvement of all stakeholders is expected to create some bureaucracies that management may not be able to control hence may cause delays in achieving the necessary safety objectives.

### 2.5 The (ISO) 45001 International Standard for Occupational health and safety management

Irrespective of the strengths and extensive concepts and ideas proposed by WHO continuance model, the International

Organization for Standardization (ISO) 45001 known as the "ISO 45001" is the world's first International Standard dealing with Occupational health and safety management systems. The ISO 45001 is as well a continuous international framework specifically developed and published in 2018 to meet the standard of safety compliance, legislations, and the dynamic business environment across the world. The core concepts for building the framework was based on the improvement of the existing OHSAS 18001, the conventions and guidelines of ILO OSH 2001, and several national standards. It focuses on seven thematic areas, which include leadership, safety scope, safety planning, safety resourcing specification, implementation of safety policies, safety evaluation, and safety improvement.

Moreover, ISO 45001 addresses the issue of controlling OHS risk exposures through the development and provision of safe and healthy workplaces for employees and other interested parties; improve OHS performance; prevent deaths; reduce work-related injuries and ill-health all over the world. Similar to the WHO framework, ISO 45001 also focuses on the interrelationship between the enterprise and its business environment. It proposes the embedment of OHSMS as a core objective that should be pursued and be coordinated with all other organizational objectives rather than making it a stand-alone objective. The study of Mitchison and Papadakos, (1999); Cheng et al., (2004) supports the integration of safety policies and procedures together with other organizational activities. Most chemical and petrochemical companies have adopted integrated health, safety and environment (HSE) management systems whiles some integrate safety with quality management (Shen and Walker, 2001, Yu and Hunt, 2002; Koehn and Datta, 2003; Yu and Hunt, 2004; Yu et al., 2004) and safety with project management (Cheng et al., 2004). The integration approach has currently gained recognition among large companies such as processing plant clients (e.g. BP, Texaco, Shell, and Exxon Mobil). It has also been found to be effective in reducing workplace accident rates and improving of firm's productivity, economic and financial performance (Health and Safety Executive, 1997; Smallman and John, 2001; Rechenthin, 2004). The additional concept the ISO 45001 introduced which other models failed to address is linking all OHSM responsibilities to organizational leadership. Table 2.1 below presents a brief overview of all the reviewed OHSM frameworks.

*Table 2.1 Overview of Occupational Health and Safety Models*

| OHSM Framework | Year | OHSM Cycle |
|---|---|---|
| The Accident Prevention Advisory Unit (APAU) Successful Health and Safety Management (HSG65) | 1991 | 1. Policy <br> 2. Organizing <br> 3. Planning and Implementing; <br> 4. Measuring Performance <br> 5. Auditing and Reviewing Performance |
| National Safety Council (NSC): The Continuous Improvement Model for Safety Management Systems | 1994 | 1. Management commitment and involvement <br> 2. Establish a baseline <br> 3. Set goals <br> 4. Implement strategies <br> 5. Review and adjust. |
| British Standard Institute (BSI), BS8800: 2004 | 2004 | 1. Policy <br> 2. Planning <br> 3. Implementing <br> 4. Measuring Performance <br> 5. Management Review. |
| Australian/New Zealand Standard 4804 (AS/NZS 4804) | 2001 | 1. Commitment and Policy <br> 2. Planning <br> 3. Implementation <br> 4. Measurement and Evaluation <br> 5. Review and Improvement. |
| Deming PDCA | 1986 | 1. Plan <br> 2. Do <br> 3. Check <br> 4. Act |
| WHO WPRG - Western Pacific Regional Guideline | 1999 | 1. Ensure management support <br> 2. Establish a coordinating body <br> 3. Conduct a needs assessment <br> 4. Prioritize needs <br> 5. Develop an action plan <br> 6. Implement the action plan <br> 7. Evaluate the process and outcome <br> 8. Revise and update the programme |
| ILO-OSHM - Guidelines on Occupational Safety and Health Management Systems | 2001 | 1. Policy <br> 2. Organizing <br> 3. Planning and implementation <br> 4. Evaluation <br> 5. Action for improvement |

| OHSAS 18001 - Occupational Health and Safety Assessment Series | 2007 | 1. OHS policy<br>2. Planning<br>3. Implementation and operation<br>4. Checking and corrective action Management<br>5. Review |
|---|---|---|
| CCOHS - Canadian Centre for Occupational Health and Safety | 2009 | 1. Lead: management commitment, worker participation, OHS Policy<br>2. Plan: legal and other, hazards and risks, workplace health, objectives and<br>3. Do: prevent and protect, emergency plans, train, communicate, procure, contract, manage change, document control, and record control.<br>4. Check: measure and monitor, investigate incidents, audit and inspect, evaluate and correct<br>5. Act: review and improve |
| WHO - Model of Healthy Workplace Continual Improvement Process. | 2014 | 1. Mobilize<br>2. Assemble<br>3. Assess<br>4. Prioritize<br>5. Plan<br>6. Do<br>7. Evaluate<br>8. Improve |
| ISO 45001 - International Organization for Standardization (ISO) | 2018 | 1. Leadership<br>2. Safety scope<br>3. Safety planning<br>4. Safety resourcing specification<br>5. Implementation of safety policies<br>6. Safety evaluation<br>7. Safety improvement |

## III. DEVELOPMENT OF THE "SAFETY HOUSE" FRAMEWORK

It is quite conclusive that, the several OHSMS models or frameworks discussed differ in approaches and guidelines towards improving organizational health and safety yet there exist significant similarities running through them. Thus, safety planning, implementation of safety policies, and review of safety systems to ascertain the required safety outcomes remain pivotal throughout the frameworks. This insinuates that, achieving the best health and safety outcomes need proper planning of safety policies, effective implementation of the right safety programs, and the review of the effectiveness of the implemented safety programs through feedbacks. The WHO model for healthy workplace continual improvement process and ISO 45001 were however extensive in scope, concepts, structure, and focus. They both addressed issues of organizational leadership, support, and commitments towards occupational safety. Again, the emphasis for prioritizing the sustainability of the balanced wellbeing of the worker at the workplace and the work environment were also highlighted.

On the contrary, this current study argues that an effective OHSM framework is a safety management system, which is built on a high level of managerial leadership and commitment

by both superiors and subordinates. Thus, to achieve the best safety outcome, this study proposes that each phase in the safety cycle must coordinate with safety commitment and leadership. Hsu et al. (2007) explain safety commitment as the degree of attention and support exhibited by organizations' top management towards employees' work safety. As the promotion of effective OHSM remains a complex managerial issue, top management must prioritize safety needs and duly intervene in all aspects of safety administration (Steenkamp and Van Schoor, 2002). A positive perception among employees towards a managerial interest in safety needs positively affects safety outcomes (Yule et al., 2007; Ali et al., 2009).

Further, Heinrich in the late 1920s collected and studied a number of industrial accidents–a total of 75,000 accidents studied revealed that 88% of 75,000 accidents were triggered by risky workers' behavior. Likewise, the Human Factor Theory of Accident Causation, accident/incident theory, Behavior-Based Safety (BBS), Turner's model of accident causation, and the Swiss Cheese model confirms the assertion of Heinrich (Andersson, 2012). Clearly, the foundation for most accident causation among industries can be attributed to

human errors, hence, the burden of accident prevention lies on both management and employees to co-operate at work and improve work safety. Thus, as management strives to provide safety systems to improve job safety, employees must also be prepared to participate and comply with these systems. Most of the burden however lies on the organization to support employees through training and education to improve safety knowledge (Shamsul and Juliana, 2018; Vinodkumar and Bhasi, 2010; Abad, Lafuente and Vilajosana, 2013). It is therefore expected that the progress made in each phase of the cycle (i.e. plan, organize, implement, evaluate, feedback, etc.) will be determined by the level of commitment and leadership exhibited by managers to engage, educate and train workers to understand the organization safety systems.

This current study therefore proposes and advances the continuous OHSM framework by prioritizing and integrating safety commitment and leadership as significant factors that must coordinate with six other phases in the occupational safety cycle to aid achieve the best safety outcome. It is worth noting that, both safety commitment and leadership in the model must be pursued simultaneously. Fig 3.1 presents the author's own framework known as the "Safety House."
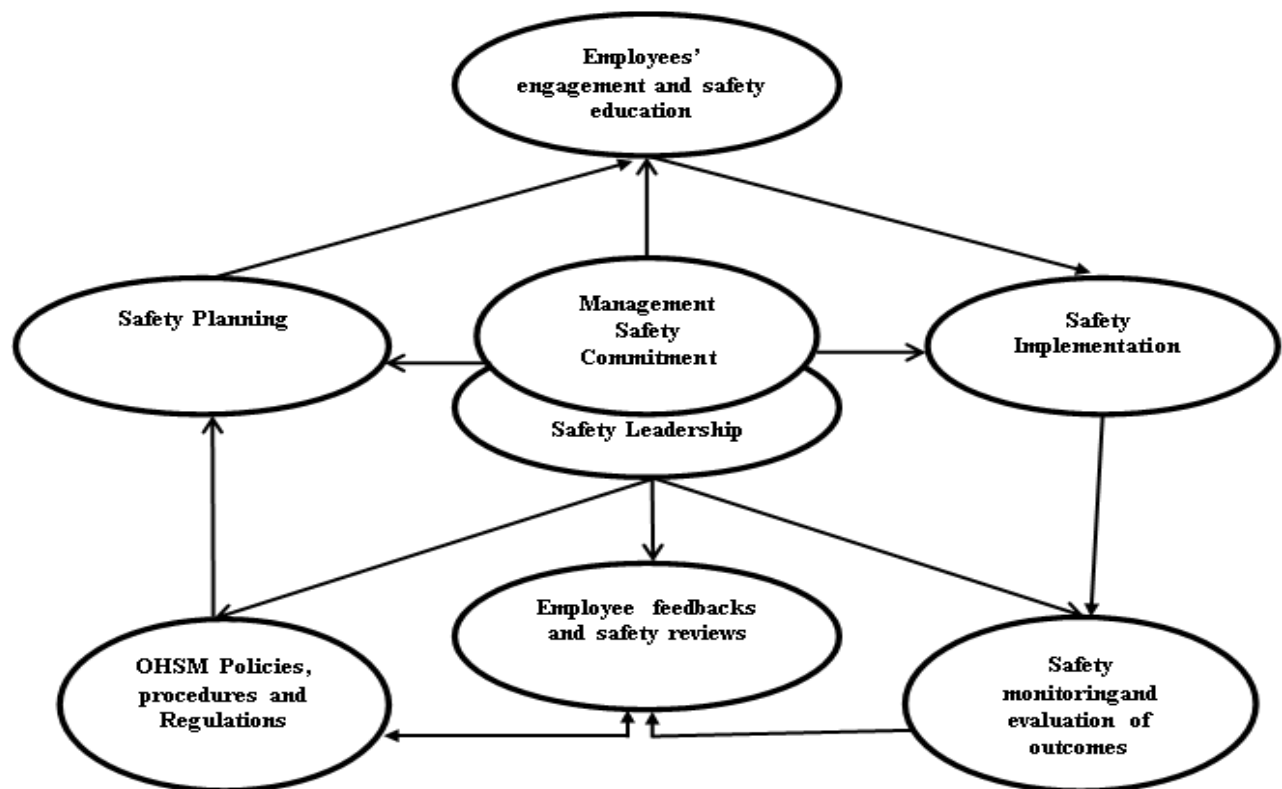


*Fig 3.1 Safety House – The New Developed Safety Framework*

## IV. DISCUSSIONS

The study proposes a health and safety management framework that views safety commitment as a universal factor in safety leadership, which has a direct influence on the safety management processes and administration of the organization. Leadership quality in the organization is expected to influence the work climate, which may directly or indirectly affect the overall performance of the company. This is possible because of group behavior norms about leadership perceptions and the level of interaction between workers and management.

Huang et al. (2006) as well viewed management commitment to safety as a significant pillar of an organization's safety climate that predicts safety performance. Wu et al. (2008) further explained that the safety commitments of the CEOs, the managers, and the employees are essential constituents of health and safety systems. Thus, Occupational health and safety systems with strong management support and employees' engagement at all stages of safety decision making determine the degree of safety outcome at work. Likewise, safety outcomes improve when safety systems are clearly linked to the organization's vision and pursued simultaneously (WHO, World Economic Forum Report, 2008).

Undoubtedly, employees are mostly the victims of occupational injuries and accidents hence their involvement in safety decision-making will yield significant safety improvement and outcomes. In as much as managers assign job responsibilities, employees understand the nature of their job tasks better hence the assembling of workers into safety teams will ease the assessment of workplace safety and improve safety outcomes. Moreover, as safety programs exist to improve job safety, feedback from employees on OHSM system implementation is highly necessary. It allows management to improve existing OHSM policies by integrating the safety outcomes from their point of view and the point of view of the employees.

What makes this newly developed framework quite distinct from other extensive frameworks like the WHO Model of Healthy Workplace Continual improvement process and the ISO 45001 is the focus and attention directed towards the degree of workers' opinions, voice, and involvement in occupational health and safety decisions making at the top level. In most cases, employees understand the nature of risk involved in their job better hence the assembling of workers into safety teams to discuss and report safety issues is

expected to ease the assessment of workplace safety systems and improve safety outcomes. Moreover, as safety programs exist to improve job safety and wellbeing, frequent feedback from employees on OHSM system implementation is highly necessary. It allows management to improve existing OHSM policies by integrating the safety outcomes from their point of view and the point of view of the employees.

Similar to the assumptions of the continual models, this current study supports the assertion that understanding of existing Occupational Health and Safety (OHS) policies, procedures, and regulations precede all other significant factors in the safety framework. Thus, before any effective safety planning can be conducted, managers, policymakers, employees, and all other stakeholders must understand the scope and nature of existing safety policies. More importantly, the safety policies must conform to both national and global standards of improving workplace safety or wellbeing of employees' (i.e. ILO conventions on and standards on Occupational Safety and Health; Factories, Offices and Shops Act 1970 (Act 328). Thus, safety plans should be drawn and built from these health and safety global standards and if possible be immediately communicated to employees. Parker et al., (2001) found safety communication to be significantly associated with management commitment. The sharing of information, persuasion, and workers' engagement about their work responsibilities and the potential risk they face may improve safety outcomes. Siu et al. (2004) as well identified safety attitudes and communication as significant variables that predict the relationship between organizations' safety climate and safety performance.

Again. In most cases, the continual models sought employees' opinions through feedbacks and reviews after the safety plan has been initiated and implemented. This mostly falls within the annual or semi-annual safety reviews hence it takes longer than necessary to engage employees in safety decision making. If this continues, it will take a year to correct the safety lapses and existing risk exposures caused by the implementation of the safety plan. The current framework, therefore, proposes that, before the implementation of safety plans as exhibited by almost all the continual models, employees must be engaged and educated on the objectives of the intended plan. Safety education on safety plans is expected to improve safety outcomes. Employees' engagement and education have been found to mediate the relationship between OHS and safety performance (Griffin and Neal, 2006). In the absence of workers' involvement in the enactment of safety plans, management should educate and

train them before implementations. Thus, workers must understand the scope and specifications of safety plans before implementation, if not; the plan may yield conflicting outcomes. This is an interest, which was not highly addressed by the existing continual models.

Finally, instead of the periodic review and solicitation of feedback immediately after the implementation of safety plans, it is ideal for organizations to monitor the safety behaviors and outcomes produced by the safety plan. Continuance safety monitoring is the frequent inspection of implemented health and safety systems or plans. In most organizations, there exist several electronic systems that monitor workers' safety and prompt supervisors of dangers or hazardous exposures that may occur, however, competent safety officers must as well be involved in continuous safety monitoring during work supervisions. This may serve as an intervention measure that will continuously address key safety issues that need prompt attention. The absence of continuance safety monitoring may alter the expected directions of the implemented safety plans if reviews and feedbacks take longer than necessary.

## V. CONCLUSIONS

In conclusion, there have been extensive contributions and discussions on safety models or frameworks. However, this current framework as proposed was built on the integration of safety leadership and commitment, employees' engagement in safety plans, and inclusion of safety education between safety plans and implementations. Finally, the emphasis on safety monitoring immediately after the implementation of safety plans to serve, as a risk control intervention tool is a significant strength that was ignored in previous models. This current framework is the projection of the reflection of all other health and safety continual frameworks and is expected to enhance and improve workplace safety if well implemented. It is also important to reiterate that, organizations can improve work performance when accidents and injuries are low hence this framework fits the description of accident prevention and hazard control tool.

## CONFLICT OF INTEREST

The authors declare no conflict of interest throughout the conduct of this study.

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