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Fundamental Concepts, Dimensions, Measures, and Drivers of Safety Performance in Organisations: A Concise Review

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Abstract

This paper presented the concepts, definitions and various dimensions of safety performance at the organisational level. Safety performance is either a unidimensional or multidimensional concept with numerous definitions and interpretations. Furthermore, safety performance is typically related to accidents, injuries, and absenteeism at work. However, numerous authors opine there is no solitary measure of safety performance and the choice depends on the purpose of assessment of available resources. Despite these views, safety performance plays a vital role in the success of organizations. The most notable description is that safety performance is the most critical measure for examining the rate of accidents, injury, or loss of property. Safety performance describes the safety degree or risk perception of an organisation. Hence, the dimensions of safety performance are measured through objective or subjective means based on the incidents rates, accidents rates, or reported data in organisations. On the contrary, the deficiencies of the objective measures have prompted calls for the adoption of subjective measures. Based on the literature, the most prominent measures of safety performance are; leadership behaviour, styles, climate and culture. Lastly, the review of the literature reveals that there is a positive relationship between safety performance and measures used to examine the concept.

Keywords: *: Safety performance; Organisational safety; Measures; Instruments.*

1. Introduction

The term performance in an organizational setting describes the ability of an organization to effectively utilize scarce resources or assets to achieve its objectives. Similarly, safety performance refers to an organization's capacity to efficiently utilise constrained assets to accomplish its outlined safety goals [1]. At the administrative level, numerous definitions and interpretations of safety performance have been proposed, although the scope is still a challenge for safety assessment. Mostly, safety performance describes the degree of safety within an organization. Sawacha *et al.,* [2] described safety performance as any incidence in which an individual within an organization suffers from an accident thereby resulting in various degrees of injury. However, several researchers have attempted to describe organizational safety performance using accident statistics [3-4]. Similarly, Siu *et al.,* [5], and Huang *et al.,* [6] defined safety performance as self-reported accidents that typically involve occupational injuries. Likewise, Vinodkumar and Bhasi [7] opined that safety performance is the best gauge of the accident rate or injury levels along with the entire discipline within the organization. Hence, it is a practical approach that is used to examine the perception of risk in any workplace. However, the outlined definitions emphasize safety performance as a measure that occurs after an accident or injury, thus depicting failure in an organization.

While underscoring on the rate of accidents, Chang and Yeh [8] avowed that safety performance is the sum of the fatalities, injurious accidents, and the loss or damage to property within an organization. Likewise, Huang *et al.,* [6] stated that safety performance is the safety control strategy of an employee. Stricoff [9] stated that safety performance could be viewed as a measure for process safety evaluation at organizational and individual levels. Hence, the author affirmed that safety performance is a benchmark for competency development and evaluating the effectiveness of safety management within an organization. In theory, safety performance measurement can assist an organization in achieving its safety policies, objectives, and targets [10]. Besides, safety performance is one of the significant measures for protecting workers in an organization [11].

Conversely, Mearns *et al.,* [12] proposed another view of safety performance. The authors defined safety performance as "an assembly of attitudes and characteristics in organisations and individuals, which establishes that, as an over-riding priority, plant safety issues receive the attention warranted by their significance". Likewise, Grabowski *et al.,* [13] acknowledged the role of safety performance as an essential element used to measure the perception of workplace safety in an organisation. Dal Corso [14] opined that safety performance is a fundamental element for cultural change that typically involves stimulating change habits, values, and actions/activities at both individual and organizational levels. For example, the concept ensures workers are responsible, participate, and manage the processes that enable the organisation to achieve its objectives. Wu *et al.,* [15] described safety performance as the "overall performance of the organisation's safety management system in safety operations". Similarly, Wu *et al.,* [16] stated that safety performance could be a subsystem of the safety management system adopted during safety operations in organisations. Nevhage and Lindahl [17] described safety performance as safety-related activities performed to ensure safety and avert financial risks within an organisation. According to de Koster *et al.,* [18], safety performance is a measure of an organisation's capacity to avert the occurrence of injury or accidents and diminish the impact of these unfortunate incidents. Shang *et al.,* [19] defined safety performance as the process achieved "when the safety manager's safety management behaviour creates work and organizational environment where occupational risks are minimised". However, the authors highlighted that such behaviour is limited by resource allocation, safety worthy communications and the management behaviour of the senior safety managers. Holistically, Morrow *et al.,* [20] described safety performance is an umbrella term that represents the numerous consequences of safety. According to the authors, the concept stretches from the observed reported safety behaviours of an employee to the organisational level such as accidents and injury rates. For example, it includes adhering to procedures, using personal protective equipment (PPE), and engaging in safety meetings and outcomes.

Based on the foregoing, the highlighted definitions of safety performance emphasize the need for organizations to prevent accidents and injuries to their workers [21]. The procedures for maintaining safety performance are the responsibility of the organization [15]. According to Hughes *et al.,* [22] such procedures, irrespective of other indicators, are the primary performance determinants in any organisation. Likewise, other researchers even contend that for some organizations, safety performance should be the primary measure of organization performance. However, regardless of the outcome of the other classical measures, safety performance is typically assessed based on the accident rate in the workplace [16]. Consequently, some researchers maintain that the effective prevention of accidents is key to the success of organizations [6, 16].

Based on the reviewed literature, the concept of safety performance is mainly dedicated to the behaviour of the organization. However, the most common definition of safety performance at the organizational level relates to accidents statistics and injury rates. Considering the above, the present paper defines safety performance as the efforts undertaken by organizations with the crucial aim of curtailing accidents and injuries to workers in any organisation. Therefore, it is crucial to explore the various dimensions and measures of safety performance to examine how the accidents statistics, injury rates and organisation behaviours are related to the concept.

2. Dimensions and measures of safety performance

Numerous studies in the literature have identified various dimensions and measures of safety performance. As a result, numerous methods exist for measuring safety performance in organizations [23-24]. Therefore, several techniques can be applied. Typically, organizational safety performance can be measured through either objective [12] or subjective [6] methods. For the objective measures of safety performance, incidents and accidents are typically used as measures of safety performance in the offshore industry [12], underground mines [25], and the nuclear power industry [26]. Other researchers have also employed objective measures such as accidents and injury data to measure the safety performance of organizations. For example, the studies by O'Toole [27] and Vredenburgh [28] employed injury data across selected industries to examine the concept of safety performance.

Over the years, several authors have proposed various measures or determinants to measure safety performance. The study by Cooper [29] proposed injury and accident rates as the most objective measures of safety performance. However, the rate of injury and accidents is infamously challenging to measure due to its dearth of sensitivity and doubtful precision. Also, both rates are retrospective and neglect risk exposures [30] and hence are unstable [31]. The study by Shannon *et al.,* [32] applied injury rates, lost-time injuries, and other reported work-related injuries as measures for examining safety performance. Likewise, Mearns *et al.,* [12] proposed some measures of safety performance based on an offshore environment. The proposed measures included fatality frequencies, significant injuries, dangerous occurrences, and lost time injuries that last over three days.

Due to the inadequacies of the proposed measures, several researchers now advocate for the use of subjective measures. Typically, the new approaches aim to measure the psychological perception of safety. For example, Huang *et al.,* [6] adopted the perception of risk of injury to report safety performance amongst firms. However, some researchers have adopted a dimensional approach for observing safety performance. For instance, Siu *et al.,* [5] studied safety performance in a construction company based on self-reported accident involvement and occupational injuries as dimensions for safety performance. Yang and Lin [33] investigated the safety performance of the health care industry in Taiwan. The authors adopted three safety performance dimensions, namely; safety audit assessment, investigation of accident management, and safety system. Kao *et al.,* [34] examined the dimensions of safety performance among Taiwanese airlines. The findings showed that the injury rate of crew members, rule compliance, and participation are critical to the measurements of safety performance and accident investigation.

Wu *et al.,* [16] investigated the safety performance of universities in Taiwan based on comparable dimensions. The dimensions proposed by the authors were; accident statistics and investigations, safety equipment, and measures. Others include; safety training evaluation, organization, and management. However, the study by Wu *et al.,* [15] developed comparable dimensions including safety inspection, training, and motivation as dimensions for measuring safety performance in the petrochemical industry. Hajmohammad and Vachon [35] and McFadden *et al.,* [36] state that safety performance is a safety outcome in an organization. Therefore, the authors posit that safety performance is viewed as one-dimensional at the organizational level of analysis. Similar measures of safety performance were adopted by Lu and Shang [37], Fernández-Muñiz *et al.,* [38], Fernández-Muñiz *et al.,* [39].

Over the years, numerous measures and dimensions of safety performance have been proposed at the organization level. Feng *et al.,* [40] observed that no solitary measure of safety performance is superior to others. However, the choice depends on the purpose of assessment or the resources presented. Furthermore, organizational safety performance has mostly been measured with accident rates and injuries (objective measures), as mentioned earlier. However, the use of objective measures like accident rates and injuries to examine safety performance has some inherent drawbacks. For example, current studies measure safety performance using subjective measures of organizational safety outcome. Previously, some researchers have employed a similar approach to measure safety performance in

organisations [35-39]. Hence, safety performance is considered a unidimensional variable in the context of an organisation.

3. Safety performance measurement

Various approaches have been proposed to measure safety performance in literature. Mearns *et al.,* [12] investigated the safety climate, performance, and management practices of an offshore environment. The study adopted offshore safety management questionnaires, statistics of the accident, and self-reported accidents. The data were collected and analysed to determine the link between safety climate and the official accident statistics. The findings indicated that the adeptness of safety management practices is linked to lower accident rates. Furthermore, Wu [41] examined the safety performance of university laboratories using a survey questionnaire. The questionnaire consisted of four sections, namely; general information, safety leadership, safety climate scale, and safety performance scale. The results showed that safety performance was best predicted by the safety committee and actions of the managers in the laboratories.

Furthermore, Yang and Lin [33] conducted a cross-sectional study on the connection between the behaviour of leaders and the twin concepts of safety culture and performance in the healthcare industry. The authors employed 350 questionnaires mailed to hospital workers. The findings demonstrated that leadership behaviour significantly influences the safety culture and safety performance in the industry. Likewise, Wu *et al.,* [16] examined the connection between safety leadership and the concepts of safety climate and safety performance using self-administered questionnaires. The four-part survey comprised general information, safety climate, safety leadership, and safety performance. Wu *et al.,* [15] also distributed questionnaires to 23 employees of numerous petroleum plants in Taiwan to investigate the role of safety leadership and safety climate on the theory of safety performance.

Singer *et al.,* [42] examined the safety performance in hospitals using questionnaires, which included questions on the respondents' demographics and safety climate. Kao *et al.,* [34] adopted questionnaires to capture safety performance factors among cabin crew in Taiwan. Shang *et al.,* [19] employed questionnaires to investigate the perception of safety management on safety performance in a container Stevedoring operation. Morrow *et al.,* [20] studied safety performance and its relationship with safety culture using questionnaires, which included demographic questions and safety culture scores.

McFadden *et al.,* [36] employed questionnaires to gather data from the directors of nursing, quality, and risk officers in 200 hospitals. The study examined the drivers of safety performance at the organizational level. McFadden *et al.,* [36] and Hajmohammad and Vachon [35] also employed questionnaires to ascertain the safety culture of manufacturing plants in Canada. Hence, 251 human resource managers were surveyed to examine and propel the firms' safety performance. Similar instruments were employed by Fernández-Muñiz *et al.,* [38], Fernández-Muñiz *et al.,* [39].

4. Drivers of safety performance

Various literature [12, 43-45] have examined safety performance as a dependent variable measured by an array of safety outcomes such as accident rates at the organizational level. Other studies have also highlighted numerous drivers of organisational safety. Examples of such drivers include; high performance work system [46], firm size [47], Lean production [43], quality management [48], and leadership style [36].

The success of organizations is reportedly influenced by high performance work systems such as safety performance. High performance work system (HPWS) is defined as the diverse but related human resource exercises that simultaneously hires, handpicks, motivates, develops and retains employees [49]. The HPWS states that employees are dynamic to an organization and need to be appropriately preserved. The effect is better organisational performance, higher motivation along with reduced absenteeism and lower injury rates [50]. The experiential confirmation from Barling *et al.,* [46] showed that HPWS significantly enhanced organizational safety in Australia. This result was mirrored in the decreased rates of injury

and higher job satisfaction of the firm's employees. Likewise, Zacharatos *et al.,* [50] examined how high performance work system (HPWS) impacts on occupational safety performance in Canada. Hence, data was collected from human resource managers and safety directors in 138 organizations. The findings discovered that the HPWS was positively related to occupational safety performance among organizations in the study. Furthermore, Tregaskis *et al.,* [51] demonstrated that the implementation of the HPWS improved safety performance, as evident in reduced accident rates and times lost from accidents of organizations. Similarly, Camuffo *et al.,* [52] showed that the HPWS played a crucial role in stimulating safety performance in Italian tyre production firms. Therefore, the authors concluded that firms striving to achieve lower rates of accidents and improved quality should imbibe practices that motivate employees. The resultant effect will be decreased number of days lost due to employees' injury.

Another antecedent of safety performance across firms as indicated from the existing literature is lean production of firms. Over the years, analysts have posited that the adoption of lean manufacturing can effectively reduce workplace accidents and enhance employees' motivation in organizations [53]. In principle, the objective of lean production is to decrease production flow and maximize resources such as labour, space, material or equipment required to produce a required product [54]. Nahmens and Ikuma [43] found that safety performance measured through accident rates, the entire day lost, and injury occurrence of construction firms is significantly improved by lean manufacturing adoption. The role of lean manufacturing adoption in improving safety performance during production was also examined by Longoni *et al.,* [53]. The emphasis of the concept is eliminated waste and non-value operational activities in the system [55]. The authors showed that lean production improved the safety conditions of such firms resulting in better safety outcomes. Dobrzykowski *et al.,* [55] found the safety performance of organizations was enhanced by the adoption of lean manufacturing within hospital organizations in the US.

The literature on organizational safety has also indicated that safety performance across firms is affected by the number of its employees [45-56]. Even though arguments exist as to what extent firm size influence safety, there is empirical evidence to support that firms with fewer employees report more accidents and lost time injuries. Fabiano *et al.,* [45] argue that firms with fewer employees have low technology and a weak economy. Hence, there is excellent interaction between employees and machines resulting in injuries. More so, employees in smaller firms are poorly trained as such lack experience. Hence such firms are prone to reporting poor safety outcomes. Lin and Mills [47] revealed that larger firms showed better safety performance compared to smaller ones in Australia. The authors contend that smaller firms lack the economic means to adopt and implement safety procedures. Consequently, smaller firms tend to record more occupational severe accidents, which negatively impacts on their safety performance. This view corroborates the evidence from Jannadi and Al-Sudairi [57] conducted in Saudi-Arabia. The authors reported that the injury rate and lost time due to injury are significantly higher for smaller firms compared to larger firms. Furthermore, Yorio and Wachter [58] also reported that the size of firms influenced how safety practices are related to accident rates among manufacturing establishments. Contrastingly, Leigh [56] reported that the size of firms plays a significant role in determining safety performance. The findings showed that the employees of medium-sized forms experience lower safety performance compared to more extensive and smaller ones. In conclusion, the findings reviewed show that that level of safety is much determined by company size.

Leadership has also been identified as an essential factor in predicting organizational outcomes [59]. Burns [60] identified two leadership styles whereas Bass and Avolio [61] proposed a third. According to the authors, the leadership styles are transactional, transformational [60], and laissez-faire [61]. de Koster *et al.,* [18] investigated the effect of safety specific transformational leadership (SSTL) on safety performance (accidents) among warehouses in the Netherlands. The results revealed that SSTL directly influenced safety performance. The SSTL indirectly influenced the safety performance of the warehouse by mediating the hazard reduction system. Further studies by Yang and Lin [33] among healthcare organizations in

Taiwan also observed that safety performance is influenced by leadership behaviour. Similarly, McFadden *et al.,* [36] investigated the potential of transformational leadership (TL) to foresee the safety outcomes among hospitals in the US. The results showed that the safety outcome could be knowingly projected by the selected style of leadership in the hospital. Furthermore, McFadden *et al.,* [62] observed that the safety outcome of 204 hospitals in the US had improved due to the selected transformational leadership style operated in each hospital. In general, safety leadership has profound effects on safety performance across organizations. In theory, safety leadership as specific to safety is defined as an interaction between leaders and underlings in the workplace. As such, the leaders exercise influence on their underlings to accomplish the related organizational safety goals [41]. In a study on universities in Taiwan, Wu *et al.,* [16] observed that safety performance is influenced by safety leadership. In a similar study but among petrochemical industries located in Taiwan, Wu *et al.,* [15] observed that safety leadership played a crucial role in influencing safety performance. To additionally reinforce the effect of safety leadership on safety performance, Fernández-Muñiz *et al.,* [63] investigated the influence of safety leadership on safety performance based on the mediating role of proactive risk management (PRM) among Spanish firms. The outcomes showed that safety performance was directly and indirectly influenced by the safety leadership of the firms.

Another essential dynamic that impacts on safety performance in organisations is the concept of quality management implementation. According to numerous researchers, the implementation of quality management influences the safety performance of organizations [48, 64]. Quality management practice (QMP) is a method employed by firms to guarantee the continuous improvement of the standard of goods and services delivered by the workforce involved at all levels or functions of the organisation [48]. Some researchers opine that the influence of QMP positively benefits the safety performance of organizations. This notion is based on the premise that QMP enhances the levels of motivation and interest of workers by recognising and eradicating prospective precarious practices to the advantage of the firm [65]. In contrast, Askenazy and Caroli [64] and Brenner *et al.,* [66] state that QMP results in workplace pressures due to increased surveillance and job rotation by employers. As a result, there is an increase in the slack time, which could result in negative consequences on employee safety. The study by Pekovic [48] observed an empirical correlation between quality management and safety performance measured from accident occurrence within firms in France. The author concluded that safety performance in companies is dependent on the approach employed by firms to implement quality practices. Another study by Naveh and Marcus [67] revealed that firms who were quality certified experienced better safety performance than firms without. Levine and Toffel [68] corroborate this assertion based on their findings on the rates of injury in the workplace. The study reports that the injury rates in 1000, California based companies declined after ISO 9001 certification was implemented. Furthermore, Gowen *et al.,* [69] report that the adoption of quality management lowered the medical errors and frequency of accident while enhancing the cost savings in 370 hospitals. Likewise, Arocena *et al.,* [70] affirm that the adoption of quality management tools reduced the injury rate among the industries. The implementation of a flexible manufacturing process increased the rate of accidents. The study investigated how the prevention of risk and organizational factors influenced the rate of occupational injuries among Spanish firms.

In summary, the aforementioned studies found safety performance to be related to accidents, injuries, and absenteeism at the workplace. Additionally, safety performance was revealed to play an essential role in the success of organizations. Numerous studies indicated a positive relationship between safety performance measures and other variables. The findings indicate that sustainable organization practices are beneficial to a firm's safety.

5. Conclusions

The fundamental concepts, dimensions, measures, and drivers of safety performance in organisations were presented. The review of fundamental concept revealed that safety performance is either a uni-dimensional or multi-dimensional concept with numerous definitions. As a result, many interpretations of safety performance currently exist in the literature. Most

notably, it is considered the most critical measure for the rate of accidents, injury or loss of property, which describes the degree of safety or perception of risks with an organisation. Other scholars describe it on a behavioural level as an assembly of individual attitudes and organisational characteristics. The review of the dimensions revealed that safety performance could be measured either through objective and subjective means using the rates of incidents and accidents or reported data in organisations. However, the insufficiencies of the objective measures have prompted calls for the use of subjective measures in the industry. The paper also observes that several measures have been proposed to examine safety performance in the literature. The most important measures include leadership behaviour, safety climate, and safety culture. Other notable measures that influence safety performance in the workplace include; the high performance work system (HPWS), lean manufacturing, company size, leadership style, and the implementation of quality management. The reviewed studies found that safety performance is related to accidents, injuries, and absenteeism at the workplace. As a result, safety performance plays a vital role in the success of organizations. Lastly, the review showed that there is a positive relationship between safety performance and measures such as sustainable organizational practices which are beneficial to a firm's safety.

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Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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