

## Organizational Factors, Critical Dimensions, and Measurement Instruments for Safety Culture: A Concise Review

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### Abstract

Safety culture is broadly termed the attitude of employees regarding safety issues within an organization. It also refers to the fundamental beliefs and convictions of the employees of any organisation. Consequently, it is regarded as one of the drivers of safety performance in organisations. However, there are numerous definitions of safety culture, with no clear consensus on the definitions, influencing factors, and measurement instruments for the concept. This indicates that there is an urgent need to review the various definitions of safety culture, its various dimensions, influencing factors and instruments typically employed to measure the concept. Therefore, this paper presents a concise review of the proposed definitions, organizational factors, critical dimensions, and instruments for measuring the safety culture of organisations. Safety culture is a complex concept to define by even experts, despite its importance to the safety of industrial operations, systems and the public. Hence, researchers have proposed numerous dimensions (typically between 3 and 10) to examine safety culture. The paper also revealed that although there are numerous dimensions, the most consistently measured are management commitment and employee involvement. The proposed methods or tools used to measure safety culture are either quantitative or qualitative, which include semi-structured interviews, Q-sorts, surveys, questionnaires, and peer observations. In general, the paper observed that safety culture is a reflection of employee involvement and management's commitment to safety. Lastly, the review showed that safety culture is a multi-dimensional but complex concept that involves numerous dimensions, factors, and instruments.

**Keywords:** Safety culture; Organisational management; Commitment; Employee involvement.

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## 1. Introduction

The concept of safety culture is considered one of the drivers of safety performance in organisations [1]. Safety culture is typically expressed in the attitude of employees with regards to safety in an organization. Intrinsically, safety culture refers to underlying beliefs and convictions of the attitude of an organisation's employees [2]. However, Schein [3] stated that although such beliefs are difficult to observe but are typically enshrined in the life of an organization and expressed in the attitude of employees. Furthermore, the safety culture of an organization cannot be easily measured but is rather a more feasible concept that reflects the perceptions and attitudes of employees [4-5]. Likewise, Zhang *et al.*, [6] noted that safety culture is a time-based measure that focuses on the individual perception of the organization.

Over the years, several research studies have highlighted the critical importance of safety culture to the development of positive outcomes during the work process. For example, Harvey *et al.*, [7] examined the components of safety culture in nuclear plants by administering questionnaires to 1,550 staffs of two nuclear facilities. The findings showed that the six (6) factors (management and communication style, responsibility and commitment, risk-taking, job satisfaction complacency and risk awareness) are common to the shop floor and management

staff of nuclear plants. Håvold [8] investigated the safety culture of shipping companies in Norway. The findings showed that factor analysis of the safety culture and safety perceptions of employees' revealed four (4) factors. These include management and employee attitude towards safety and quality, knowledge, attitudes towards safety rules or instructions and quality and safety experiences. The authors surmised that there is a consensus between respondents on safety culture irrespective of nationality, vessel or occupation.

Other researchers have observed that the existence of a safety management system in an organisation is critical to the safety culture [9]. According to the authors, the implementation of a safety culture in any organization is a function of a strong commitment to safety exhibited by managers. Hence, the interest shown to the employees working conditions by high ranking staff is an integral part of the safety-related events. The findings also indicated that managers can significantly reduce the number of dangerous activities that affect employees, hence lowering the risk rate of accidents. This view is corroborated by O'Toole [10], who showed that the reduction of any organisation's rate of injury is particularly influenced by the positive perceptions of the employees on numerous critical factors. The study also stated that the commitment of any organisation's management to safety is greatly and positively influenced by the perception of the employees involved.

Ek *et al.*, [11] conducted a study on the safety culture of two air operating units in Sweden. The findings highlighted the importance of organisational safety culture in the operating units. In addition, the authors showed that safety culture features are influenced by a high commitment to ideas and a low degree of conflicts. The study showed that aircraft operating units exhibited a higher safety culture score when compared to shipping and airport handling. Ali *et al.*, [12] employed questionnaires to collect data for six (6) management practices on safety culture. The authors observed that feedback selection, management commitment, organisational rewards decreased the injury rate. Likewise, Wu *et al.*, [13] investigated the predictive factor of safety culture using stepwise regression. The authors reported that the factors that significantly influence safety culture include; safety notification by operations managers, safety caring by employees, safety coordination and safety regulations by a safety professional. In particular, the study showed that the most significant predictive factor on safety culture is safety informing by operation managers.

Wang and Liu [14] studied safety culture in a railway company. The results showed the relationship between several dimensions of safety culture. These include; safety commitment and safety training, safety training and contractor management, safety system and management of change and risk management. However, the post-examination of dimensions of safety culture revealed that employees attach importance to safety awareness, attitudes and safe behaviours. However, the employees consider that safety encouragement, procurements, punishment and safety rules proposed by management have greater roles to play.

Biggs *et al.*, [15] employed qualitative thematic analysis to analyse the interviews and descriptive statistics of respondents to safety leadership and their perceptions of safety culture. The findings showed that leadership is critical to a positive safety culture in organizations. The authors stated that the focus and commitment of the organisation's leaders to safety also plays a critical role in the safety culture. The study also recognised the barriers to the improvement of safety culture in any organisation. The authors surmised that safety culture is a complex construct that is difficult to define by even experts in the organization.

Based on the review of safety literature, it can be surmised that safety culture is crucial to ensure the safety of industrial operations, systems and the public. However, the definition of safety culture has still not been fully established [2, 16]. Furthermore, there is an urgent need to review the various dimensions of safety culture along with the influencing factors, and instruments typically employed to measure the concept in the literature. The author envisions that this short review will avail researchers in academia, industry and government policy with critical insights into the concept of safety culture.

## 2. Dimensions of safety culture

Over the years, numerous researchers have examined organisational safety culture and proposed several dimensions for the concept. For example, the structure of employee attitudes on safety was examined in the literature [17]. The authors proposed five (5) dimensions of safety culture, namely; safety attitude, responsibility, and efficacy of management on safety, environmental safety, and personal exemption. The study also proposed a safety model that distinguishes four (4) objects, namely; hardware, software (procedures and rules, policy and safety management), people/liveware (i.e. workers, management, authorities, supervisors, specialists, safety committees, unions and risks (i.e. work environment's safeness, risky behaviour and its regulation). Likewise, Pidgeon [18] contends that decent safety culture has four (4) key features. These include; commitment to safety by senior management, flexible and realistic practices for managing both ill-defined and well-defined hazards. Others are continuous organizational learning, and concern/care for hazards shared by the workforce. Guldenmund [2] argued that management commitment to safety is a prime factor of safety culture. However, Cox and Cheyne [19] posited that management commitment, management actions concerning employee safety and involvement as well as the physical environment are key components of safety culture. Lee and Harrison [20] stated that the attitudes and behaviour of employees are critical elements of safety culture, which is due to the influence on the elements on norms of the group within the organization.

O'Toole [10] examined the correlation between the perception of the safety of employees and organizational culture. The author observed that safety management and commitment, involvement of employees, communication and training, emergency response are critical indicators of safety culture. Arboleda *et al.*, [21] observed that safety input feedback, safety training, and management commitment to safety are perceived as indicators of safety culture for drivers, dispatchers, and safety directors, which represent the three levels of management in the trucking industry. Vecchio-Sadus and Griffiths [22] stated that management commitment and employee involvement in safety issues are essential to fostering an organizational safety culture. Fernández-Muñiz *et al.*, [9] examined the connection between the dimensions of safety culture. The authors recognised that the commitment of managers and participation of employee are key determinants of safety culture. Furthermore, Díaz-Cabrera *et al.*, [23] proposed seven (7) dimensions of safety culture, namely; training, accident and incident reporting system, appraisal of performance and promotion of safety. Others include motivation, communication and information systems, standard operating procedures/rules, and leadership styles based on the critical assessment of safety culture, values, and practices in an organisation. Similarly, Ek *et al.*, [11] integrated nine (9) dimensions of safety culture in the assessment of the safety culture of air traffic control in Sweden. The dimensions examined in the study included; communication, work situation, justness, learning, attitude towards safety, reporting, flexibility, safety-related behaviours, and perception of risk. Likewise, Choudhry *et al.*, [24] stated that a positive safety culture should incorporate five (5) aspect. These include; commitment to safety by management, concerns of management for the workforce, credibility and mutual trust amongst employees and management. Others are workforce empowerment, and constant monitoring, remedial actions, systems review, and persistent enhancements to reflect safety at work.

Yang *et al.*, [25] observed that the behaviour of leaders on safety culture in the health industry. The findings showed that safety culture has three (3) dimensions, namely; the managers' commitment, safety communication, and organization system. Wu *et al.*, [13] also suggested three dimensions of safety culture including; supposed risk, employee involvement and emergency reaction. Similarly, Frazier *et al.*, [26] recognised three (3) aspects of safety culture, namely; management concern, personal responsibility, and peer support for safety. Mannan *et al.*, [27] recognised four (4) dimensions of safety culture, namely; leadership, initiatives and policies, culture and values, organisational structure and goals. Feng [28] advocated that safety culture comprised of 10 indicators. These include; employee involvement, management

commitment, feedback and communication. Others are supportive setting, regulatory environment, risk obligation, and work pressure. Lastly, the competence level and training, work hazards appraisal, safety procedures and rules of the organisation are considered critical to safety culture. dos Santos Grecco *et al.*, [29] claimed that safety culture has six (6) dimensions, including; top-level commitment to safety, emergency preparation, awareness, organizational flexibility, impartial culture, and organizational learning. Similarly, Morrow *et al.*, [30] investigated the safety culture of nuclear power operations in the US. The following dimensions of safety culture such as safety commitment by management, willingness to raise concern, quality of training, and decision making are considered crucial to the concept. In addition, the questioning of attitude, safety communication, supervisors' safety responsibility, personal accountability for safety, and safety prioritizing was also outlined as critical to safety culture.

In summary, numerous dimensions have been reported for safety culture in the literature. However, there is a lack of consensus between researchers on the most critical indicator(s) of positive safety culture in the literature. However, literature has revealed that the most consistent measured dimensions are management commitment, and employee involvement [9, 19, 22, 24, 31]. Hence, the next section explains the two indicators that not only constitute safety culture but are also employed across various work settings to describe the concept.

### **3. Factors that enhance safety culture**

#### **3.1. Management commitment to safety**

The perception of employees on the commitment of the management to safety can stimulate considerable outcomes on safety [32]. The commitment of the management to safety denotes the persistence and commitment of organizations to safety programs along with the prevention of occupational accidents. This can be achieved by training employees and management to participate in safety outcomes and the follow-up safety designs of work [21]. Likewise, the commitment of the management to safety is denoted as the employees' perception or management attitude to safety [4] and organisation safety system [33-34]. The management's commitment to safety identifies with senior management and is in addition line with the management leadership style and resources, which is required to achieve the safety objectives of the organization [35]. Besides, the management commitment to safety is a crucial component that impacts the achievement of the organization's safety programs [4, 36]. The management commitment is essential for the organization to support, create, and preserve attitudes and behaviours in the work environment [37-38].

The commitment to safety by the management deals with undertakings that are set up by the top management to ensure that all parts of operations like training, procedures, selection, equipment and work projects are evaluated managerially and changed to enhance safety [39]. When management is focused on safety, it creates support and resources for safety activities [40]. Unquestionably, the commitment to organizations at the higher levels accounts for an enormous increase in the safety culture of an organization [41-42].

The empirical connection between management commitment to safety and safety outcomes have been discovered by researchers in the literature. For instance, Cox and Flin [33] examined the safety culture and safety commitment of manufacturing and commercial enterprises in the UK. The findings showed that the commitment of management to safety is crucial to antedating safety behaviour. Likewise, O'Toole [10] revealed that the commitment to safety by management impacts employee perception towards safety issues. Cox *et al.*, [43] examined the behavioural approach to safety management in UK reactor plants using semi-structured interviews, observations and questionnaires. The findings revealed a positive relationship between the management's commitment to safety and behavioural safety at all levels in the organization. Abudayyeh *et al.*, [44] investigated the connection between management commitment to safety and the relapse of related illness and injuries in a construction company in the US through questionnaires. The authors observed that a statistical correlation exists between the commitment of management and illness or injury rates.

Fernández-Muñiz *et al.*, [9] examined the relationship between safety culture measurements. The study revealed that management shows commitment through their positive attitude to avert accidents at work, which positively impacts employee's involvement and active participation in safety exercises. Ali *et al.*, [12] discovered that the commitment of management to safety is part of a safety culture that decreases injury rates. Mearns and Yule [45] showed that management commitment to safety affects workforce behaviour and rates of the accident. Geldart *et al.*, [46] investigated the organizational practices and the health and workplace safety in manufacturing organizations in Canada using questionnaires. The study revealed that management commitment to safety significantly impacts the incidence of injury at the workplace.

Huang *et al.*, [47] examined the relationship between commitment to safety by management and the components of safety training and future injury outcome in restaurants utilizing surveys. The findings showed that individual perception of management commitment towards safety is an enormous indicator of the future outcome of injury. The study also indicated that workers are encouraged by management's high state of commitment to safety, and in such cases will perceive that the safety training of the organization is great which will then predict future injury. Al-Refaie [48] studied the impact of organization, safety management and workgroup level components on safety, self-efficacy, safety awareness and safe behaviour in Jordan. The results from structural equation modelling revealed that management commitment fundamentally influences safety in the organisation. In summary, it can be seen from the literature above that management commitment to safety is a key part of an organizations safety culture and positively influences safety issues.

### **3.2. Employee involvement**

This refers to a circumstance whereby employees engage in the decision making and events related to safety [49]. Employee involvement is a practice that is based on behaviour and involves individuals and groups in the upward flow of communication and decision-making processes in any organization [50]. It is important in an organization as it is critical to achieving organizational accomplishments. It can be defined as the behaviours of employees, which helps to create a safe workplace. It includes employees taking part in policy setting and making decisions to foster safety, attendance in safety training and accommodating health checks [13].

Previous empirical studies in occupational safety show that employee involvement is the principal to accomplishing organizational goals. For instance, O'Toole [10] discovered that the government objective of curbing work-related injuries in the UK manufacturing sector can be achieved when firms are stirred to increase employee participation in the safety process. Similarly, Vassie and Lucas [51] investigated measures in which UK manufacturing companies can tackle safety management issues using semi-structured interviews. The findings showed that employee involvement was a key safety management factor with team leaders and self-managed groups. Furthermore, Seo *et al.*, [49] found a negative correlation between accident, near-miss experience, and employee participation. Likewise, Hahn and Murphy [52] found employee job involvement to be related to better adherence to safe work practices, reduced exposure to environmental stressors, the presence of more safety policies and procedures and decreased accident rates.

Fernández-Muñiz *et al.*, [9] established that employee behaviour and involvement in safety can positively influence the management's commitment to safety. Aksorn and Hadikusumo [53] found that worker involvement is a critical success factor in the implementation of safety program in the construction industry of Thailand. Furthermore, Ali *et al.*, [12] found a positive relationship between employee participation and injury rate in Malaysia. Vinodkumar and Bhasi [50] using structural equation modelling found worker involvement in safety to be negatively correlated with self-reported accident rate in the chemical industry in India. Likewise, Boughaba *et al.*, [54] found employee involvement as a key indicator of safety culture in the workplace.

In summary, the safety culture of any organization is reflected in the management's commitment to safety and employee involvement. Hence, this study defines the safety culture of



any organisation as a situation whereby managers show commitment to safety, reinforce safety as the organization's priority. It also involves the adherence of the employees to the safety rules and procedures and their participation in the improvement and establishment during the process [31]. In light of the above definition, the present study views safety culture as a multi-dimensional measure that is examined through management commitment to safety and employee involvement. Hence, various studies on organizational safety culture have viewed the concept of safety culture in this regard [31, 55].

#### 4. Measurement instruments of safety culture

Numerous instruments have been used by researchers to measure safety culture. In general, the most commonly used instruments include observations, surveys or interviews [56]. According to Cox and Flin [33], there are no standard tools measuring safety culture within a single domain. However, the proposed methods or tools can be classified as quantitative and qualitative. Choudhry *et al.*, [24] reported that the culture of an organization is measured by applying qualitative methods such as interviews and observations. However, Cooper [35] opined that the three major aspects of safety culture (namely; psychological, situational and behavioural) dimensions can be measured by a combination of quantitative and qualitative methods. The author argued that the situational dimension of safety culture is perceived in the organisation's structure, working procedures, management systems, and policies. The behavioural dimension of safety culture is measured via self-reporting and measures of outcome, and peer observations. Cooper [35] stated that the safe behaviours are placed on observational checklists and then observations are regularly taken by trained observers. Ultimately, this translates into the percentage of safe scores providing information to those being observed. However, the psychological facets are observed through safety culture questionnaires, which measure the safety perceptions of people.

Wiegmann *et al.*, [57] posited that the quantitative method statistically measures culture through systems that are precisely calibrated and standardized. Examples of such include; structured interview, Q-sorts, surveys, and questionnaires. In the quantitative method, individuals in the organization serve as respondents to normal questions or sets of enquiries from the researcher [58]. However, some researchers claim that safety culture cannot be assumed totally through traditional quantitative means that attempts to disrupt down a phenomenon to study individual components. As a substitute, it is presumed by means that capture the nature or root of the activities that are being studied [57]. The study by Cox and Cheyne [19] examined safety culture in an offshore environment using questionnaires, focus group, behavioural observations focus group discussions and situational audits. The study also employed both onshore and offshore personnel in three separate organizations at sixteen various locations.

Likewise, O'Toole [10] administered a total of 3,116 questionnaires including 41 items on the safety perception survey to all employees. The study aimed to investigate the correlation between the employees' perception of safety and organizational culture. Hence, each item presented the employee a choice of responding by either stating yes or no. In addition, Fernández-Muñiz *et al.*, [9] and Díaz-Cabrera *et al.*, [23] used questionnaires to examine the dimensions of safety culture and measure its impacts on organizations. Ek *et al.*, [11] used both questionnaires and semi-structured interviews to obtain baseline data of safety culture and the relationship between safety culture and organizational climate.

Yang *et al.*, [25] administered questionnaires that included 20 items of safety culture to study leadership behaviour, safety culture and performance of the health care industry. Likewise, Wu *et al.*, [13] administered questionnaires to predict the employer's safety culture, safety leadership scale, operation managers' safety leadership scale, and safety professional safety leadership scale. Wang and Liu [14] employed a questionnaire composed of 18 safety dimensions to evaluate safety culture in the railway industry. Similarly, Morrow *et al.*, [30] employed questionnaires to investigate the relationship between safety culture and safety performance in nuclear operations. On the other hand, Biggs *et al.*, [15] employed both semi-

structured interview and questionnaires to examine the perception of an organization's safety leaders on safety culture in Australia.

It can be concluded that questionnaires and surveys have been used generally to measure safety culture within various industries, which include nuclear power, chemical processing, and construction along with the aviation, transportation and manufacturing industries. However, what is key in a safety culture improvement program is the development of an effective measure that can evaluate the current state of safety culture, and also determine if interventions have been effective in achieving the desired change in culture. As such both qualitative and quantitative approach can contribute to achieving this goal.

## 5. Conclusion

The paper presented a concise review of the organizational factors, critical dimensions, and instruments for measuring the safety culture of organisations. The review of literature in this paper revealed that safety culture is a complex construct that is difficult to define by even experts in the organization. Nonetheless, safety culture depends on the underlying beliefs and convictions of the attitude of an organisation's employees. As a result, it is considered one of the major drivers of safety performance and it is crucial to the safety of industrial operations, systems and the general public. Due to the complex nature of safety culture, numerous researchers have proposed various dimensions ranging from 3 – 10 to examine the concept in organisations in the literature. Despite the numerous dimensions reported in the literature, there appears to be no consensus among researchers on the most critical indicator(s) of positive safety culture. However, the most consistently measured dimensions are management commitment and employee involvement.

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