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IMPACT OF SAFETY CLIMATE ON SAFETY PERFORMANCE IN CONSTRUCTION COMPANIES

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Abstract

The construction industry plays a key role in assisting each country's economy to nurture. Due to its distinctive, dynamic, and transient nature), the construction industry is among the most hazardous industry compared to several others. Workplace accidents can have a serious impact on society as a whole because they result in a variety of losses for businesses, society, and wounded workers' families. The expenses of construction injuries have a significant influence on the financial viability of construction organizations and increase the overall costs of building. The current study has used SEM-structural equation modeling to analyze the impact of SC on the SP of employees in construction companies. The SP of employees has been measured keeping in view the safety behavior constituent, safety participation, and safety compliance and how an employee with their safety compliance and participation can promote SC in their company, preventing accident rate in the long run. The data is collected through mixed method approach including descriptive and exploratory analysis. The data is collected by sending questionnaire surveys to 10 private construction companies operating in Karachi, Pakistan. Online questionnaires were sent to the relevant prospects via different social media platforms, especially LinkedIn, and paper-based questionnaires were given during work hours. The results were found to validate the hypothesis that related an organizational SC to its employee's safety participation and compliance. Contrastingly their role in preventing accidents was found insignificant, suggesting future researchers explore further the implications, and recommendations for future research studies are discussed in detail in this study.

Keywords: Safety climate (SC), safety compliance, safety participation, construction industry, Safety Performance (SP)

Introduction

The construction industry (CI) plays a pivotal role in helping every country's economy to grow. Observantly, it is the backbone that contributes significantly to the economic growth of a country (Le et al., 2014). This industry includes raw materials, equipment, energy, and labor, which happen to be the resources that make or break the industry. However, labor is considered the most crucial resource of CI because it uses the labor force in larger quantities to complete construction projects on time. The industry is also considered one of the most dangerous industries for its labor force globally (Nadhim et al., 2016). Construction activities require safety training to prevent accidents and injuries while working on a project, which even the most developed countries of the world do not offer to their employees/ labor force despite their significant contribution to the country's economy (Mearns et al., 2001).

CI in developing countries like Pakistan has seen growth over the years (Mohamed, 2002). Even then, the accident rate at construction sites has increased globally. The rapid increase in the accident rate not only affect labor's health, property, and equipment but also the industry's productivity in the long run, which has been a point of research for researchers throughout the world (Pinto et al, 2011). They have come up with suggestions, ideas, and results that may add to the industry's growth. However, despite extensive research and deep analysis, the outcomes have not been significant in reducing the death rate and injuries while working on a construction plant (Zohar, 1980).

Pakistan's construction industry is considered the backbone of its economy. Pakistan Credit Rating Agency Limited (PCRA) published a study, reporting that the construction industry has seen an expansion of about 92% in the last seven years (Nadhim et al., 2016). There have been several projects under construction in Bahria Town, undertaken by private companies and contractors in the country (Mohamed, 2002). Furthermore, the industry has been reported to have contributed about a total of PKR 1,409 billion, witnessing a growth rate of 14.4% in 2021 (ILO, 2023). The industry is expected to contribute 14.8% in 2022, employing an average of 7% labor force of the total global labor force (ILO, 2023). Despite that, the industry witness accidents every day as its labor force continued to put its life in danger, working on projects on dangerous construction sites. It is because the industry is one of the informal sectors, contributing massively to the economy of Pakistan. Worldwide, this segment is considered crucial operating to expanding a country's economy as it covers quite a significant portion of the total employment rate. Similarly, in Pakistan's economy, this sector employs a major chunk of the workforce, with several total labor forces going unregistered by the authorities.

Construction project success is measured differently by construction firms depending on what the objectives and goals of the project may be. It is important to note that all that is considered a successful measure on one project might not be the same for another project. If objectives and goals are not set according to the nature of the project, the project might not be as successful as one would imagine. Therefore, construction firms and organizations determine their success differently according to the objectives or criteria of the project, which is why the construction industry does not have a specific framework for project performance measurement. It is impossible to establish specific criteria or standard checklists for measuring project success because of the varying characteristics and objectives of projects in terms of location, complexity, uniqueness, and size. Project performance indicators include those related to cost, time,

and quality, also known as the iron triangle; these indicators are commonly accepted to measure construction project success as well.

Problem Statement

Due to its distinctive (Ikpe et al., 2012), dynamic, and transient nature, the construction industry is among the most hazardous industry compared to several others (Fang et al., 2015). Additionally, because of their increasing significance and scope, workplace accidents can have a serious impact on society as a whole because they result in a variety of losses for businesses, society, and wounded workers' families (Ikpe et al., 2012).

Construction is ranked as the 3rd most injury-prone industry; but, ironically, its rate of employment is also the biggest among others. The health and safety standards in the projects of construction have become a global concern (Rafique et al. 2021). According to Zahoor et al. (2015), different accidents taken place because of lifting activity, electrocution, and lessening from height. Additionally, safety climate in the construction industry is not that satisfactory in the developing nations like Pakistan, thus making environmental risk (Rana & Bhatti, 2018; Iqbal et al., 2015). The major rationale for the unsatisfactory environment of the projects of construction is the lack of interest of the client to assign safety budget.

Objectives of the study

(a) To explore how SC affects SP on construction projects in Pakistan

(b) To apply the content analysis of the previous papers to categorize these factors

(c) To develop a framework to illustrate the relationships between identified factors in the construction industry.

Purpose of the study

SC research has attracted a lot of researchers globally, specifically in developed countries. However, the subject matter has not been highlighted in Pakistan. Research studies that have examined the dimensions of SC suggest that SC structure is industry-specific, which is why this study will determine the specific dimensions of SC for the Pakistani construction industry. This research aims to develop an industry-specific causal model that could assist construction professionals to measure evaluating, monitor, and enhance the SP of their employees.

Literature Review

Injuries in CI

Construction companies have long experience high accident rates because of a variety of factors. Past researchers have explained how construction companies operate; their management style and the kind of equipment they use to work on construction projects (Nadhim et al., 2016). Research studies have discussed relevant factors that cause injuries and accidents in CI. Statistics corroborate that there has not been an effective reduction in accident rates in most underdeveloped countries despite the construction company's efforts to improve safety conditions within and outside of the construction sites (Nadhim et al., 2016). This is why safety issues have always been presented as major problems and primary concerns in this industry globally. According to the U.S. Center for Construction Research and Training, construction industries have the fourth highest fatality rate (Nadhim et al., 2016). This research compared the fatality rate in agricultural, transportation, and mining industries, again necessitating further research studies to find out what causes accident rates. Furthermore, conclusions have been drawn from other research studies, mentioning that forty-six percent of fatal occupational accidents occurred in the construction industry (Nadhim et al., 2016).

Previous research studies show that about eighty-five percent of accidents are caused by unsafe acts in construction industries. Reports

validate that safety culture and climate significantly impact the accident rate in CI (Pinto et al., 2011). The result of a study showed that because employees are mostly unaware of their safety, their performance is not up to par.

Safety Climate

Hon et al. (2013) concluded that commitment to safety, its rules and procedures, and how much the workers' willingly participated in promoting safety were the three most found SC factors and thus, according to Dedobbeleer & Béland (1991) equally in construction companies (Mohamed, 2002).As the concept of SC describes employees' perceptions of workplace safety policies, procedures, and practice Zohar (1980), at the organizational level, refers to workers' perception of management's policies, procedures, and practices instead of safety. The findings of a research study concluded that focusing on improving SC can improve SP and decrease the risks of self-reported injuries. Based on past research studies and theoretical observation, a hypothesis was developed, stating:

H1: CI Safety climate significantly improves ***Safety Performance.***

However, to determine the linkage between the two variables, it is paramount to understand the influence of SC on SP. Many researchers have found that the relationship may be gauged differently in different work settings. According to some studies, there is a significant relationship between SP and SC (Siu et al, 2004; Gillen et al, 2002) have established arguments, agreeing with the statements. However, just as some researchers have agreed to the two variables have a strong relationship; others have found their reasons not to agree with the statement (Glendon & Lither land, 2001). Furthermore, as per Clarke's (2010) comprehensive meta-analysis studies and Christian et al. (2009), discussing the relationship between SCand SP, the results concluded that SC significantly affects SP. Clarke's study (2010) explained how consistently and positively, the two variables are related. Another recent study carried out by Christian (2009) found a strong influence of SC on SP and SC, which are the two factors affecting safety behavior and thus SP of an employee. Therefore, establishing that SC has a positive relationship with SPs, it may be postulated that a good SCof an organization improves the SP of its employees.

H2: Construction Company's Safety climate has a negative relationship with self-reported injuries and near misses.

Previous research studies have used statistical data on accident rates and injuries to measure SP. More recent studies have also used alternative data, including self-reported injury data collected through questionnaires (Siu et al., 2004). Self-reported injuries and misses may not be effective indicators of SC because self-reported accident only reflects occurrences of failures and are not linked to SC. Furthermore, as per Glendon & Litherland (2001), they are also ''insufficiently sensitive". Further research has concluded that self-reported may involve dubious accuracy, could be retrospective in nature, and may ignore the amount of risk exposure they have. Lingard et al. (2011) have also validated that injuries could be ineffective indicators of SP and SC, suggesting that a finer and more accurate measure of workgroup SP should be employed for future research. Furthermore, with a dearth of research studies, using injuries as a measure of SP, an increasing number of studies have used safety behavior as an important tool or measure of SP.

As per expectancy-valence and social exchange theory; past research studies and theoretical evidence may help to postulate, predict and explain the relationship between SC and safety behavior as per Neal & Griffin (2006). According to Social exchange theory,

the foundation is that when an organization looks out for the well-being of its employees, its environment may be referred to as positive, forcing the workers to become obligated to perform their roles and duties, with a behavior that may add value to the organization. Furthermore, studies postulate that when there is a positive SCin an organization, employees take it upon themselves to perform tasks not falling into their JDs. They might look forward to performing functions other than their core work activities, which is referred to as organizational citizenship behavior. As per (Neal & Griffin 2006) an organization that centers its environment around safety, its employees consider reciprocating them by becoming efficient at performing their jobs, which has set the basis for the next hypothesis.

H3: CI Safety Climate is positively linked to safety compliance

H4: CI Safety Climate has a positive correlation with safety participation.

SP could refer to evaluative actions or behaviors that individuals may show in their jobs, promoting the health and safety of clients, the public, coworkers, clients, and the overall environment according to Burke (2002). Griffin & Neal (2000) has defined safety compliance as working on rules in core safety activities, including, obeying safety regulations, using appropriate equipment, and following correct procedures according to the research carried out by Neal & Griffin (2006). According to them, safety compliance could be referred to as the primary activities individuals carry out to ensure safety in the workplace. Such procedures may include following standard procedures followed for the completion of work, donning P.P.E., and attending safety meetings (Neal & Griffin, 2006). In contrast, safety participation could be defined as the behaviors of an employee that may not directly be contributing to individual safety. Instead, it may contribute to developing an environment that supports safety for all the employees working in any organization (Neal & Griffin, 2006).

Methodology

The sixth part of this paper is methodology. In this research, different methods to analyze data were used, and the author measured all the data using the recommended tool.

Research Approach

The author used a mixed-method approach to gather data, considering the requirement. The exploratory and descriptive research method was utilized to collect data and understand how the construction companies in Pakistan operate and how safety procedures are implemented. In the initial stages of the research, the researcher opted to study primary data that was already available on the internet. Later, unstructured interviews were carried out by the author to explore construction companies to proceed with their research. Using primary data, this research employs a Qualitative and quantitative (Mix method) approach to gathering data. The main cause of this is that it prompted the investigation into the inverse relationships between factors to comprehend the safety climate's impact on SP in construction companies of Pakistan. A random sample of employees working in private construction companies was considered for this research. Flexible methods, such as interviews, open-ended questionnaire questions, and observations were used to gather qualitative data, and further, the data was validated using the recommended tool (Moen, 2006).

Questionnaire Design

A survey questionnaire was adopted with some modifications to enable the researcher to gather relevant insights from the employees, working in private construction companies. The author adopted an already validated questionnaire for this research. The contents of the questionnaire were designed,

to keep in mind the literacy levels of the labor force employed in construction companies. The language was knowingly kept simple and basic and simple to ensure that all the respondents understood the questions clearly, and answered accordingly. The final questionnaire consisted of three parts. The questionnaire started by inquiring about the gender of the participants and the number of years the respondents had worked in the relevant industry. Then, items were adapted to measure the relevant variables of this research as followed: The questionnaires had 10 items, measuring SC of the private construction companies operating in Karachi. The next part consisted of items related to gauging how much the employees willingly or unwillingly participated in promoting safety environment while they worked on a construction project. The third and last part of the questionnaire had items related to how compliant the participants of the research were for safety measures their companies followed.

Measurement of SC

The author preceded the research by measuring the SC model as developed by Brown & Phua (2011). The author included its nine variables to ensure the variable was measured keeping in view all the critical factors. The variables were considered to represent safety concerns, specifically in the construction sector of Pakistan, which was not identical to the questionnaire developed by (Zohar et. al. 1983). The perception that the employees had of the management was measured, considering items indicating their perceptions of the management's attitude to safety practices, worker's safety, and foreman's behavior towards its sub-ordinates. The attitude of the management toward safety practices was measured by considering what the employees working on a construction project as demanded by their company perceived regarding the pertinence of safety practices. This was measured using a five-point Likert scale. The scale ranged from 1 to 10. Scale 1 and referred to strongly disagree a strongly agree respectively. Whereas Scales 2, 3, and 4 explained if the respondents disagreed, were neutral, or agreed respectively. Similarly, management's attitude toward worker's safety, again, was measured by worker's perception of their attitude, using the same itemized rating scale and Foreman's behavior was measured, exploring the worker's perception of all the actions taken by them to ensure workplace safety, using an itemized scale. Furthermore, to measure employee perception of management, safety activities, including safety meetings and safety instructions were considered as well as their perceptions of the availability of proper equipment to complete projects, involving serious health risks. Safety meetings represented workers' perceptions of how safety was deemed at their workplace. Availability of proper equipment denoted the worker's opinion of proper equipment and how much importance was given to it at the worksite by the management and them. Employee's physical risk perception included the perceived control employees had and how much they were willing to take risks and their perception of how much their job involved risks. Perceived control referred to the worker's perception of control over their safety on the job, which was measured by the Likert scale.

Measurement of SP

In the past, accident statistics were considered an ideal SP measure. However, with new studies pouring in, measuring SP could involve a truckload of difficulties, which is why, researchers (Booth, 1991) agree that accident statistics because for various reasons are not a satisfactory indicator of performance. The factor that organizational SP is affected by different variables and its constituents could be widely diverse. SP in a

workplace depends upon a variety of different factors, and for that the ACSNI Third Report has offered guidelines on this, stating that SP should not be measured by a single variable. Considering this, the author concluded that other measures, as per (Booth & BS 8800), should be used to measure and check SP.

Data Collection Techniques

The researcher collected data by sending questionnaire surveys to 10 private construction companies operating in Karachi, Pakistan. The reason for choosing private construction companies was that in Karachi innumerable construction projects are in process, and local contractors, and unregistered companies, paying no attention to safety matters are responsible for the project's completion. Since the research aims to check the impact of SC on SP in construction companies, and registered companies, following safety protocols needed to be considered. Before the commencement of data collection, the researcher assured all the participants that their identity will not be disclosed, and their responses will be shared anonymously, which was why the results for questionnaire did not have a single question, asking to mention their names. Initially, online questionnaires were sent to the relevant prospects via different social media platforms, especially LinkedIn, and paper-based questionnaires were given during work hours. After the respondents had filled out the surveys, they returned the filled questionnaire directly to the author so that their responses could be recorded.

Software

SmartPLS 4 (Sarstedt et al, 2022) was used to check the correlation between SCand SP. The PLS-SEM model is used to check outer loading and discriminant values of collected responses. Abstracted data from Smart-PLS is then transferred into an excel file to create bar diagrams and pie charts for better presentation.

Data Analysis Technique

The measurement model was reflective, and all outer loadings are analyzed in SmartPLS. The same software also identifies Cronbach's alpha and Construct reliability and validity. Cronbach's alpha is acceptable at the level of .70; in this study, Cronbach's alpha crosses 0.90 (Fornell, 1981). The acceptance rate of composite reliability is 0.60; the three variables in this research have Composite Reliability between the ranges of 0.84 to 0.94, which is considered a satisfactory result. After analyzing data, the value of average variance extracted (AVE) was above 0.7 for all three variables, which is considered a highly satisfactory result. Fornell, (1981) stated that if composite reliability is higher than0.60 and the value of AVE is less than 0.5, the value may be accepted. However, since the values for AVE were above 0.7; between, 0.698 and 0.807 for the three constructs, the model has accurate reliability and validity. The data analysis has been divided into two parts. First, we evaluated the measurement model and structural model. The measurement model was used to find out the reliability and validity of the model itself. The analysis of latent variables and their measures was carried out by the measurement model. The other part is a structural model evaluation where we run two tests one is variance explained R-square and the other is for the hypothesis for each construct and independent and dependent variable. To identify the predictive relevance of the model and its construct we run the calculations for Q- square.

Results and Discussion

Inferential Statistics, Measurement Model

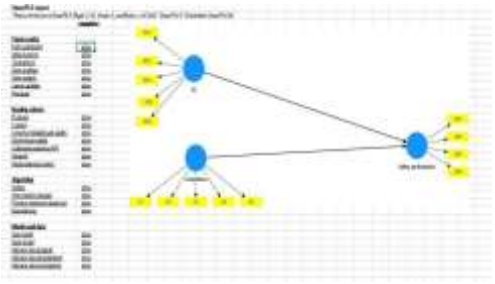
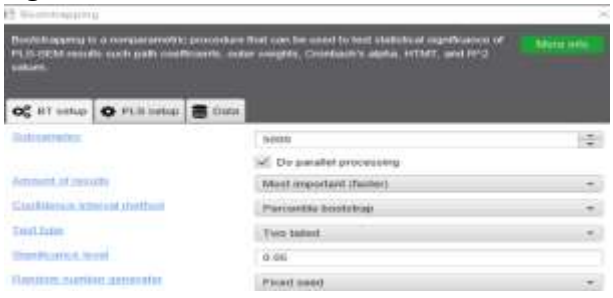


Figure 1: Measurement Model

The reflective model is derived from SmartPLS version 4, indicating the relationship of each variable with the other variables. The software SmartPLS 4 is highly acclaimed software in research for statistical analysis. It is 3rd generation multivariate tool that has aided researchers in successfully managing, analyzing, and interpreting their data and its findings. Its test, predicts unprecedented theories and hypotheses and defines checks how much they are proven through the data given (Peng & Lai, 2012). The Study has resorted to running thePLS–SEM to estimate the validity of the data gathered. The data was coded and measured by the Likert scale and extracted from the file to smart pls 4. There were initially 19 items used to measure data, the details have been discussed in data analysis techniques. The R square of Safety Participant is 0.813 and the f- square between safety participation and SC is shown as 0.236 and 0.514, indicating a good result. F-square is the change in R-square whenever we remove an exogenous variable from our model, since our results are more than 0.35, the effect size is massive (Cohen, 1988).

Assessment of Structural Model

Figure 2: Structural Model



Path Coefficient

A path coefficient is used to indicate the effect of one variable on another, the causal relationship in short, denoting the direct impact of one variable on another variable. The path coefficient is estimated from correlation because a path regression coefficient is unstandardized.

Compliance -> Safety Participation	0.561
Safety Compliance -> Safety Participation	0.380

Figure 3: Path Coefficient

Total Effects

Matrix	**Total effects**
Compliance ->Saftey participation	**0.561**
SC ->Saftey participation	**0.380**

Figure 4: Total Effects

The results of the path analysis co-efficient are shown in the table above, representing the correlation between the included variables. SEM technique was used to test whether the relationship between SC and SP was causal or not. Neil & Griffin (2009) concluded in their research that safety compliance and safety participation were two critical constituents of safety behavior. Taking their research into consideration, the author proceeded to gauge the relationship between the dependent and independent variables of this research, SC, and SP. The reason the author considered structural equation modeling was that it examines a wide range of separate variables. Its strengths in measuring multiple regression and interdependent equations are such that it analyzes the structural mode, keeping all the aspects of it into consideration. It notes the latent variables and comes up with explicit calculations of error variance parameters. Since the two variables in this research study were latent variables, the author did not observe and measured them directly. Using SEM, several latent variables were tested against empirical data that was collected during the process of this research. Similarly, we checked the interdependencies of

observed variables and latent variables simultaneously. Data distribution was checked using different tests in Smart-PLS. Excess Kurtosis, skewness, Cramer-von Mises test statistic, and P-values were taken to see how the data was distributed.

The data set of this study was extensive, expanding over different construction companies in Karachi, which is why the author considered Satorra–Bentler scaled chi-square (v2) to check for the goodness-of-fit of the SEM model. It was adjusted v2 statistic and corrected all the biased involved because of the non-normal data distribution (Satorra & Bentler, 2001). The author observed that the test does not disagree with the hypothesized model.

Construct Reliability and Validity

Reliability and validity are paramount to verify the relevance of questions. The questions are used in measuring correlations and analysis of data. In this study, Cronbach's alpha has crossed 0.90 (Fornell, 1981), and the three variables in this research have Composite Reliability between the range of 0.84 to 0.94, which is considered a satisfactory result.

After analyzing data, the value of average variance extracted (AVE) was above 0.7 for all three variables, which is considered a highly satisfactory result. Since the AVE, Fornell, (1981) stated that if composite reliability is higher than 0.60 and the value of AVE is less than 0.5, the value may be accepted. However, since the values for AVE were above 0.7; between, 0.698 and 0.807 for the three constructs, the model has accurate reliability and validity. The table below has the results of reliability and validity.

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average Variance extracted (AVE)
Safety Compliance	0.940	0.943	0.954	0.807
SC	0.892	0.895	0.920	0.698
SP	0.839	0.840	0.893	0.677

Figure 5: Validity and Reliability Test

Discussion and Conclusion

According to statistics, the construction industry employs twenty-nine percent of all industrial workers yet is responsible for forty percent of workplace accidents, making the destructive effects of construction accidents significantly worse than those of all other industries combined (Chua & Goh, 2004). As an example, the construction industry accounts for about six percent of U.S. workers but twenty percent of reported deaths, the most of any industry sector has had (Hallowell & Gambatese, 2009). Similar circumstances exist in Pakistan. Therefore, as the construction industry is a crucial component of a country's prosperity and development, extra attention should be paid to promoting SC in CI. The fact that time, money, and quality of performance are not the only factors for the timely delivery of a project (Jitwasinkul & Hadikusumo, 2011), stakeholders should also promote site safety. This is also important because the expenses of construction injuries have a significant influence on the financial viability of construction organizations and increase the overall costs of building by up to fifteen percent (Hallowell et al. 2011). This is why inadequate safety measures can have ramifications beyond death and health risks. This study, therefore, focuses on studying the impact of safety climate on SP and how it leads to accidents when employees operate in a company with a poor safety climate.

Taking the study of Beus et al. (2010) into consideration, this study shows that the impact of SC on SP is generally analyzed in the context of construction companies because employees risk their lives for completing a

research project. The nature of the job in construction companies is considered deadly and dangerous globally. In this research, SC in construction companies was found to have a positive impact on SP. The relationship was checked considering the two behavioral constituents as per the research carried out by Neil and Griffin. The results showed that the hypothesis proposed by the author for this research is valid and could open new doors for further research.

As per the suggestions of Beus et al. (2010), several potential moderators are present to moderate the impact SC has on SP and future research studies should be carried out accordingly. However, to establish a solid argument, more research would be required to draw any conclusions. About Christian (2009), it was concluded that SC somewhat has a stronger relationship with safety participation, compared to safety compliance. He suggested that complying with safety rules and regulations should be the obligation of workers so that SC could be promoted in organizations where the nature of the jobs could risk their lives. Since we have measured SP against employees' ideas of safety compliance and participation in promoting safety, the results of this study show that the SC of construction companies does not exert a strong influence on their willingness to participate in safety. However, its influence on safety compliance is major, indicating that safety participation may be affected by variables other than safety climate. However, the findings of this research have validated that a well-maintained safety climate, compared to poor SC of an organization will have a significant impact on the SP, preventing accidents while working on construction projects. Thus, we may conclude that construction companies that can establish a positive SC may yield lucrative results, especially in terms of safety participation and safety compliance. With a positive safety climate, organizations will also note a sound reduction in occupational injuries and accidents.

Practical Implication

The results indicate that the influence of SC could be different in unique work settings. The impact of SC on an employee's SP may vary in mining or the chemical industry, depending on various factors. However, further research must be carried out to develop a valid argument as available data is insufficient to estimate this further. It is paramount to include moderators and mediators to gauge the relationship of the variables taken in this research. To add to this, this relationship must also be examined, keeping in view the organizational and individual levels as per (Zohar & Luria, 2005). We could also analyze the nature of supervisory priorities and practices carried out while a project is being carried out (Zohar, 2000) and whether a group of employees or an individual's SP contributes more to the safety climate (Hofmann & Stetzer, 1996).

Practical Limitation

A major limitation for this was the insufficient number of cases available for data analysis even though researchers have shown interest in exploring the role of SC in accident prevention, and improving SP, also because individual performance is yet to be studied to conclude anything. Furthermore, since the research was based in Karachi, participants' unwillingness to participate in the survey and their inability to understand the author's idea of SC and SP were other major hindrances. Although the questionnaires were sent to 500 to 600 employees working in the private construction sector, only ninety of them could record their responses, which proved to be a major obstacle in carrying out this research.

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