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M. G. Soundarya Priya

K. S. Anandh

Sathyanarayanan Rajendran

K. N. Sen

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M G Soundarya Priya[1], K S Anandh[1*], S Rajendran[2] and K N Sen[3]

[1] Department of Civil Engineering, College of Engineering and Technology, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur – 603 203, Tamil Nadu, India
[2] College of Education and Professional Studies, Central Washington University, Ellensburg, WA 98926, Washington, United States of America
[3] Larsen and Toubro Limited, Kolkata, India

[*]anandhk@srmist.edu.in

Abstract. The construction sector is India's second-largest industry, contributing to the country's economy and providing many job opportunities. However, construction has been described as a hazardous industry with a high rate of injuries, accidents, and fatalities compared to other sectors worldwide. The "psychological contract of safety (PCS)" is one of the safety climate (SC) variables that influence worker safety behavior (WSB) actions on construction sites to improve safety. This research investigates the influence of SC factors on PCS and PCS on WSB in construction site safety. A quantitative research method has been adopted in this study, and the data is collected from the construction professionals working in South India. Statistical analyses were performed for the collected data; consisted of stepwise regression analysis and structural equation modelling (SEM) analysis to determine the significance of PCS. The findings disclose that in direct effect, four out of six SC factors contribute to enhancing PCS, namely supervisor safety behavior, co-worker safety behavior, worker involvement, and safety system, and it shows that PCS influences WSB. In indirect effect of SC factor on WSB two factors positively influence namely: supervisor safety behavior, co-worker safety behavior and remaining two negatively influences. The outcome of this study helps the construction professionals to improve safety performance by fulfilling their obligations and improving WSB in construction sites.

1. Introduction

According to the Construction Industry Development Council [1], India's construction sector employs around 31 million people, making it its second-largest employment after agriculture. In India, the construction industry (CI) has much higher death rates than other industries [2]. The human factors and their safety risk are neglected in CI [3,4]. The health and safety of construction workers is a key social concern, and obtaining zero accidents on construction sites worldwide is a difficult task. Each year, about 60,000 fatal incidents occur on construction sites worldwide [5,6]. The distinctive socio-cultural fabric of India provides an intriguing backdrop for studying social exchange connections. Furthermore, as one of the world's most dynamic and fast-growing regions, India now has more multinational corporations (MNCs) than ever before [7–9]. The "Zero Accidents Vision" was recently adopted, especially in firms with minimal occupational accidents. A truncated accident sequence is characterized

as an accident precursor [10,11]; thus, the idea of accident precursor might encompass Near Miss occurrences, Unsafe Acts by personnel, and Unsafe Workplace Conditions [12].

The term "safety climate (SC)" describes "a summary of the beliefs that employees share about their work settings… a frame of reference for guiding suitable and adaptive task actions" [13]. The idea of SC has evolved since this seminal paper, and SC is defined as "individual impressions of the policies, procedures, and practices relevant to workplace safety" [14,15]. One of the most important SC variables influencing worker safety is "Psychological Contracts of Safety (PCS)." PC refers to an individual's beliefs about the terms and circumstances of their employment relationship [16], some of which are written and others implicit and not part of a formal contract. The Superior- subordinate relationship is the primary working relationship in CI that directly forces individual and productivity [17,18]. When an individual feels that both the employer and the employee are responsible for their safety, it becomes PCS. It is referred to as the individual views on mutual safety obligations derived from implicit or explicit pledges. PC research is minimal in India, based on a framework imported from the West. In the Asian environment, the share of PC research is even lower [19]. As a result, it is timely to consider the employment relationship in the context of India. Accidents are caused by unsafe acts in 88 %, unsafe conditions in 10%, and accidents that cannot be stopped or avoided in 2% of cases [20]. The psychological contract is about doing their duty; at many times, workers are blamed for the professionals' fault/mistake/carelessness. So safety actions should come from professionals. This study focuses on safety behavior to reduce unsafe acts that contribute to a significant proportion of accidents and prevent such accidents by using PCS as a mediator between SC factors and workers' safety behaviour (WSB).

2. Literature Review

This literature review aims to figure out the factors that affect PC in construction site safety (CSS) and to study any other variables or challenges encountered in adopting PCS in Indian CI. The summary of previous research is given in table 1.

Table 1. Summarization of previous research

Author (Year)	Key Points
D. M. Rousseau (1990)	Investigates the evolution of employer and employee obligations at the initial phase in the framing of PC. Some factors were identified. The discussions are to perceive relational obligations, and all expectations are not obligations. This research focused only on the new hire's perception and not the employer's perspective [21].
S. Mohamed (2002)	Addresses empirical studies on the SC and WSB in construction sites. The findings highlight the relevance of management commitment, communication, worker participation, attitudes, competency, and supervisory environments in developing a positive SC [22].
S. L. Morrow et al. (2010)	Individual workers' stated safety behavior was evaluated in relation to three aspects of the SC. All three characteristics were found to be strongly linked to safety behavior. The relative relevance of each feature in connection to the outcome was determined using dominance analysis, and the most robust association with safety behavior was found with work-safety tension [23].
R. P. Zhang et al. (2015)	A multilayered SC measurement method was devised, with five key safety agents identified. The tool assesses (1) clients' overall safety priorities and activities, as well as major contractors' overall commitment to safety, at the organizational level (2) supervisors' safety actions and expectations, as well as coworkers' general safety principles and practices, at the group level. The tool would help construction organizations discover any weaknesses in their safety

Author (Year)	Key Points
	management procedures and create a social and cultural work environment that supports safety on all levels [24].
M. T. Newaz et al. (2016)	Many academics have been interested in the impact of different levels of management on safety management. On construction sites, Senior managers have limited contact with 'workers,' who are instead directed by lower-level managers regularly. As a result, managerial effects on organizational safety results are little understood [25].
M. T. Newaz et al. (2018)	The study provides a five-factor model to diagnose and quantify the safe atmosphere. The most prominent themes in the research analyzed were management commitment, the supervisor's role, workers' involvement, and group SC. The study can be tailored to each country's CI, which is distinct and has its own set of characteristics [26].
S. Bhattacharya et al. (2018)	The goal is to identify significant elements that contribute to PC usage and the influence of socio-demographic parameters among IT workers in India. The PCS scale is ineffective since it does not account for Breach and Violation. There were 12 factors discovered, 3 of which were deleted and considered 9 variables [27].
M. T. Newaz et al. (2019)	This study investigates the association between several SC characteristics and individual safety behaviour as mediated by the PCS in construction. Safety management is reciprocal, and PCS is a fundamental component that drives worker safety behavior, according to the relationship between the impact of safety agents and mutual duties fulfilled [28].
M. T. Newaz et al. (2019)	This study aims to see how the PCS affects construction workers' safety behavior in terms of cognitive base. Affirmative PC can have an important role in influencing people to follow safety procedures. There are no theories for how supervisory behavior influences worker safety. The PCS idea in CSS is established in this study, which improves construction site safety behaviour [29].
M. T. Newaz et al. (2020)	This study aims to assess the effects of supervisory behavior on worker safety behavior using the PCS concept. Supervisors who are referred to as "front line" play a significant role in establishing a safe work environment and influencing WSB. Organizations and top-level senior managers can concentrate on PCS to increase CSS [30].

From the literature review, the factors affecting PCS were identified and listed. Later through an online survey to construction professionals, the listed factors were asked to rank based upon its impact on the construction industry. After ranking, the chosen factors are safety system, management safety commitment, supervisor safety behavior, worker safety behavior, co-worker safety behavior, psychological contract of safety, workers' involvement and work pressure.

3. Methodology

Based on the identified factors from the literature review, a structured questionnaire has been designed to measure the SC of the construction organization and PCS's influence in improving WSB based on standard questionnaires found in the literature [14,22,24,30–34]. The questionnaire was revised based on experts' advice and using rated factors validated using exploratory factor analysis. Before surveying, the draft questionnaire was pre-tested through a pilot study with construction professionals, and the required changes were made in the research instrument. The professionals working in the private CI in metropolitan cities across South India are the study's target population. The questionnaire is divided into

five sections, namely organization safety climate (SC) (33 items), psychological contract of safety (PCS) (24 items), worker safety behaviour (WSB) (6 items), visibility of the study (4 items) and socio-demographic details (11 items). The questionnaire has a 7-point Likert scale and close-ended questions (1-strongly disagree to 7-strongly agree). The survey method of data collection is chosen for primary data collection, whereas the literature survey is utilized to acquire secondary data [35]. Data collection was done through an online survey method to deliver the questionnaires to 420 construction professionals (like senior site executives, site engineers, supervisors, project managers, safety engineers, and safety executives), and oral interviews were also conducted with the respondents. The survey received 300 valid responses, with a response rate of 71.43 %, and the data were analyzed using statistical methods.

4. Results and Discussion

4.1. Descriptive Statistics

From figure 1, the descriptive statistical analysis, it is observed that the majority of the sampled respondents are male, which accounted for nearly 80 %, and 64 % of the respondents fall under the age group of 18 to 28 years. Likewise, 68 % of respondents are single, and 32% of respondents are married. Furthermore, regarding the educational qualification, it is found that 56 % of them are postgraduates in construction-related engineering disciplines and that 68 % have less than two years of work experience in the present organization, and 60 % of respondents' accounted to junior level of management.

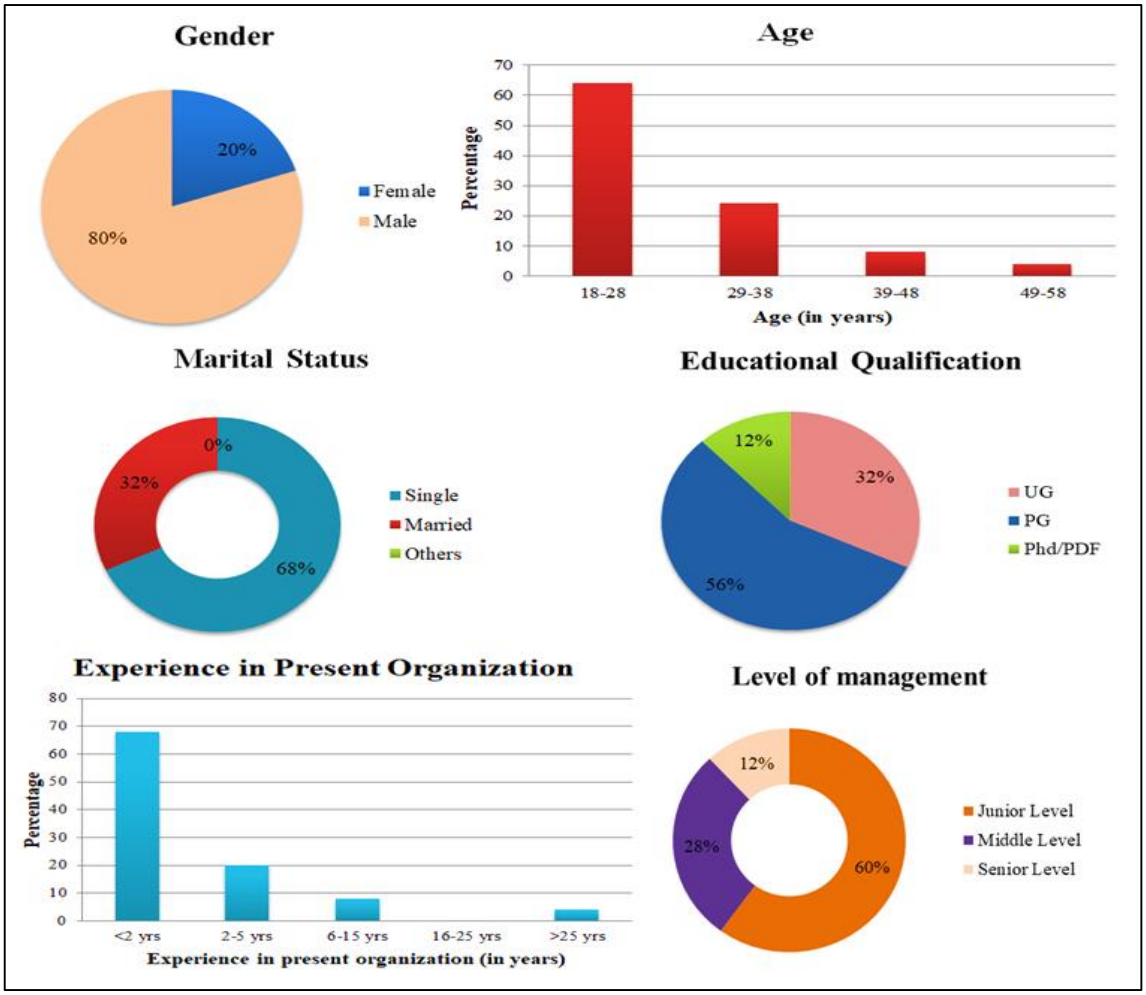

Figure 1. Demographic Profile

4.2. Reliability Test

A reliability test is performed to verify the reliability of data before it gets analyzed. The Cronbach's Alpha value is 0.980, with 63 items. The data collection has a robust internal efficiency of more than 0.7 for Cronbach's Alpha [36].

4.3. Stepwise Regression

Predictor specified would like to add in the SPSS statistical software and then inspect which of these predictors contribute to our dependent variable forecasting and remove those that do not. Typically end up with fewer predictors than listed [36,37].

4.3.1. Regression model-I

The stepwise multiple regressions were conducted to evaluate whether the six independent factors were necessary to predict PCS in Indian CI. Table 2 provides the required statistics to predict PCS from the independent variables and determine whether they statistically contribute considerably to the model. Looking at the coefficients in table 2, it can be seen that the PCS entered into the regression equation is significantly related to only five out of the six factors. The PCS is found not to be significantly related to one factor with a p-value greater than 0.05, and therefore, worker involvement is excluded from the regression equation.

Table 2. Stepwise regression model-I coefficient

	Coefficients	Standard Error	t Stat	p-value
(Constant)	-0.440	0.242	-1.815	0.074
Safety System (SS)	0.560	0.058	9.596	0.000
Management Safety Commitment (MSC)	0.123	0.034	3.578	0.001
Supervisor Safety Behavior (SSB)	0.191	0.078	2.459	0.016
Co-workers' Safety Behavior (CSB)	0.344	0.067	5.148	0.000
Work Pressure (WP)	-0.160	0.042	-3.805	0.000

[a] Dependent variable: Psychological contract

4.3.2. Regression model-II

The stepwise multiple regressions were conducted to evaluate whether the PCS factors were necessary to predict WSB in Indian CI. Table 3 provides the required statistics to predict WSB from the independent variables and determine whether they statistically contribute considerably to the model. The coefficients table 3 shows that the WSB entered into the regression equation is significantly related to PCS factors.

Table 3. Stepwise regression model-II coefficient

	Coefficients	Standard Error	t Stat	p-value
(Constant)	1.017	0.285	3.566	0.001
Psychological Contract of Safety (PCS)	0.847	0.052	16.252	0.000

[a] Dependent variable: Worker safety behavior

4.3.3. Regression equation

The multiple linear regression equation is expressed as in equation (1).

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \ldots\ldots\ldots\ldots b_pX_P \quad (1)$$

Based on table 2, equation (1) using stepwise regression approach for predicting PCS among the Indian CI is:

$$\text{Predicted PCS} = -0.440 + 0.560 \times \text{SS} + 0.123 \times \text{MSC} + 0.191 \times \text{SSB} + 0.344 \times \text{CSB} + -0.160 \times \text{WP}$$

Based on table 3, equation (1) using stepwise regression approach for predicting WSB among the Indian CI is:

$$\text{Predicted WSB} = 1.017 + 0.847 \times \text{PCS}$$

The PCS was found not to be significantly related to one factor with a p-value > 0.05 and, therefore, excluded from the regression equation. The factors which are excluded are 'worker involvement.'

4.4. Structural Equation Modelling (SEM)

To *(1)* determine the influence of SC factors on PCS, SEM approaches to validate the association among observed variables such as PCS. Independent variables are safety system, MSC, SSB, worker involvement, co-worker safety behavior, work pressure, and *(2)* to check whether SC and PCS influence WSB. The proposed model of the research gets depicted in figure 2. The below-mentioned hypotheses are formulated based on the proposed model and tested through the SEM approach. *Hypothesis for (1):* H_0: SC factors have a significant effect on the PCS predictors, H_1: SC factors have no significant impact on the PCS predictors. *Hypothesis for (2):* H_0: PCS and SC have a significant effect on the WSB, H_2: PCS and SC have no significant impact on the WSB.

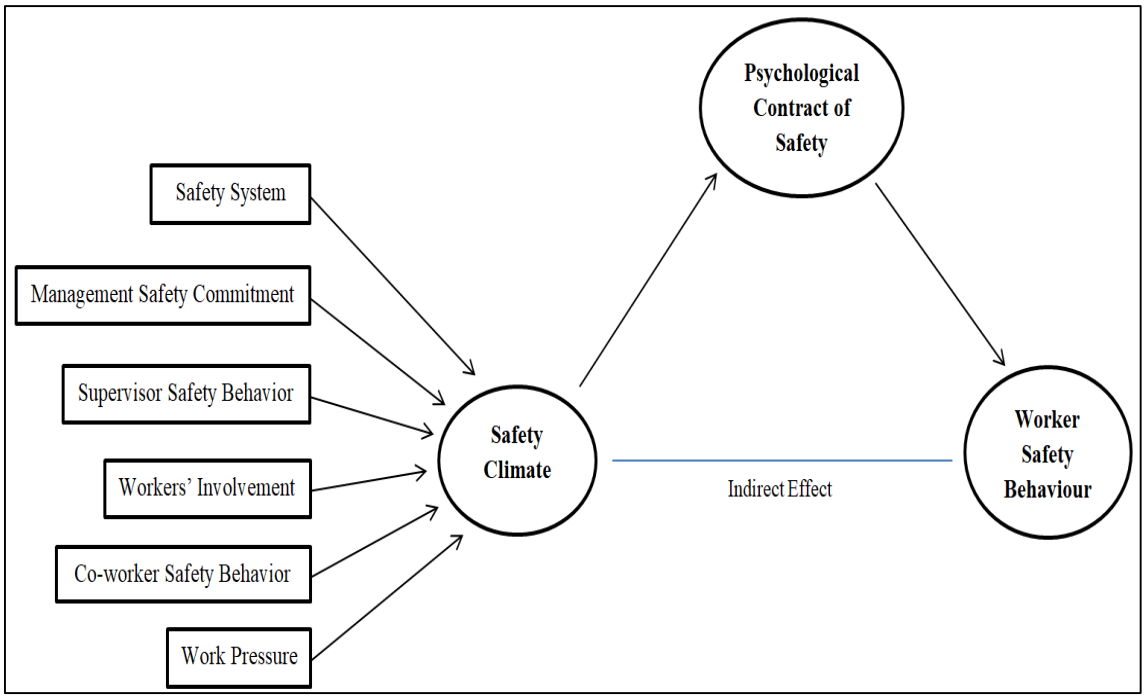

Figure 2. Proposed model

4.4.1. SEM Analysis

The goal of the model is to see if SC impacts PCS and influences WSB, and if so, what kind of impact it has. The SEM for the above-mentioned conceptual model is developed and tested using IBM AMOS 23.0 and presented in figure 3 as a standardized co-efficient for the PCS among the CI. The below-mentioned SEM model has 12 variables, out of which 6 are observed variables, 6 are unobserved variables, 6 are exogenous, and 6 are endogenous variables.

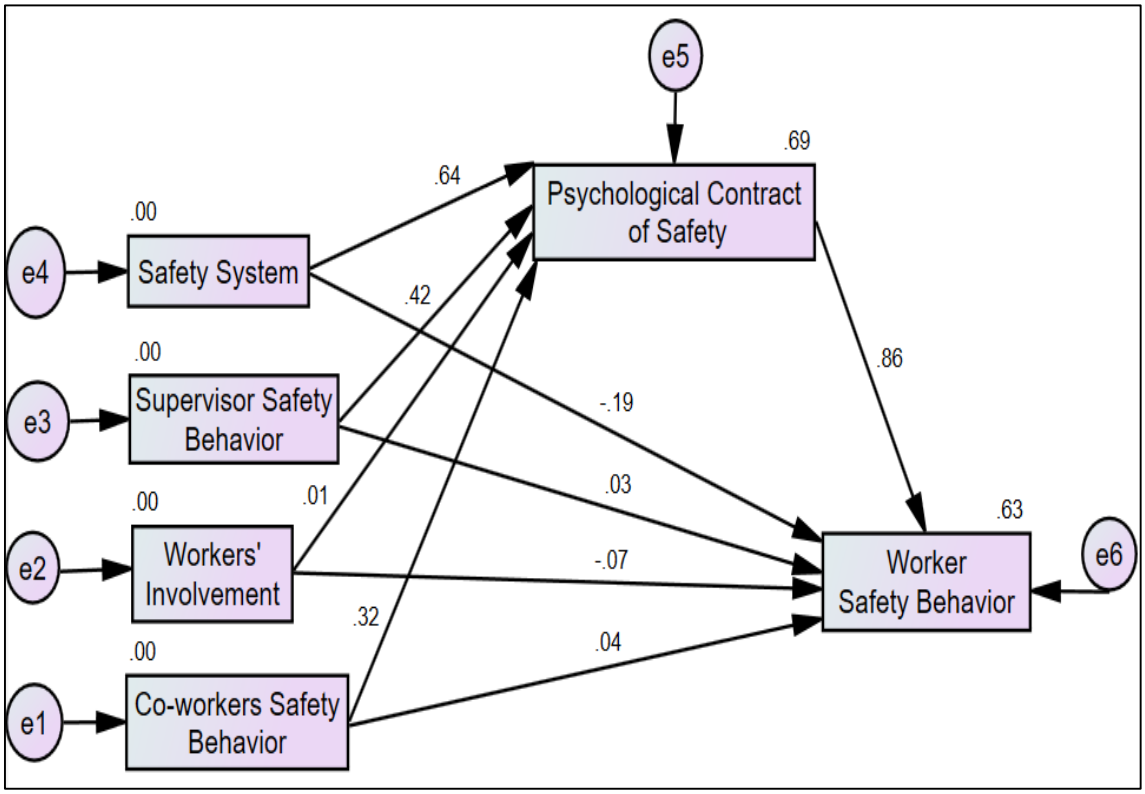

Figure 3. SEM for PCS in Indian CI based on standardized coefficients

The SC factors influencing PCS have significant positive factor loading on its four latent variables with the standardized coefficients of direct effect are 0.639, 0.418, 0.007, 0.322, and PCS influencing WSB is 0.861. The indirect effect of the SC factor on WSB is 0.33, 0.43, and its significant negative factor loading with the standardized coefficients is -0.075 and -0188. The SEM model also reveals that the conceptual model's complete hypothesis is significant at a 5 % level. Among the given SC factors, supervisor safety behavior acts as a significant role in the PCS of the organizations, and it's clear that PCS strongly influences WSB. Therefore, according to the results of the SEM model, it is concluded that the CI should focus on the factors as mentioned above to provide better WSB to enhance the safety outcome of the organization, and the hypothesis is supported, indicating that PCS mediates the relationship between SC factors and WSB.

4.4.2. Model fitness abstract

The abstract of model fitness indices values and their reference range are given in table 4. From table 4, it is instituted that all the given model fitness indices fall under the reference range, i.e., the Chi-square / Degrees of freedom index is 3.642, which falls in the range of 2 to 5, which signposts good fit. Likewise, the significance value of the SEM model is 0.096, which is above 0.05 that gives a benchmark for the references [36]; earlier research shows total fit. In contrast, the GFI index and AGFI index values are 0.985 and 0.972 [38,39]. The CFI values should be greater than 0.90, from which the value from the study indicates total to fit the CFI index is 0.991 [38], which indicates that it is a good fit. Moreover, the RMR and RMSEA values are 0.04 and 0.01, respectively less than 0.08, which denotes a good fit [40]. Therefore, it is established that the overall SEM integrates factors that determine the influence of PCS in enhancing the construction safety is found to be fit.

Table 4. Abstract of model fitness indices

Model fitness index	Value	Reference range
Chi-square / Degrees of freedom	3.642	Between 2 to 5
Significance value	0.096	Greater than 0.05
The goodness of Fitness index (GFI)	0.985	Greater than 0.90
Goodness of Fitness index (AGFI)	0.972	Greater than 0.90
Comparative Fit Index (CFI)	0.991	Greater than 0.90
Root Mean Square Residuals (RMR)	0.04	Less than 0.08
Root Mean Square Error of Approximation (RMSEA)	0.01	Less than 0.08

5. Conclusion

According to PCS definition, it is about the individual doing their safety obligation, so the most important in the construction site supervisor role is to fulfill their obligations. Then the work-related safety attitudes and behaviors of those subordinates change how their superiors treat them. Another important factor is WSB; in the PCS approach, finally, it's about the workers' safety, and so if their behavior is changed safety outcomes can be attained. This autonomy is central in achieving the objective of influencing PCS changes in WSB in construction sites. The goal of improving safety by supervisor showing or seeing in employee view on safety obligation is attained with this result, so WSB is enhanced. The conceptual model gives the roadmap for the CI to improve policymakers, the human resources management department, and the company's active supervisor, i.e., middle and junior level management. The study helps to understand the actual situation of the CI throughout south India. The study also finds that the demographic profile of the construction professionals such as age groups, genders, educational qualification and overall experience also influences the safety outcome of the construction organization. Organizations having a good relationship between employer and employee and fulfilling their mutual safety obligation could achieve the safety goals and sustain the gaining position also reputation in the competitive market through the better performance of their employees, because it emphasizes the importance of prioritizing safety and mutual relationship among the professionals according to their designations which generates positive energy in the individuals and spread across the employee's community.

Due to inadequate reporting and misrepresentation of work-related injuries and accidents, including fatalities, proper documenting of incidents is difficult in CI, limiting our study [41]. The current study employs cross-sectional research, which can only discover relationships or associations within the scope of the study, i.e. professionals working in the south Indian construction industry and only white-collar professionals have been targeted. So, further research can be done based on labour since it is hard to collect data from them and focus on other collar professionals and sectors. More research is needed into the changing nature of the psychological contract (PC) between the employee's quality of work-life (QWL) and the employee's actions in the CI. To bridge this knowledge gap, the author of this study conducting research will hopefully have a more significant impact on the target audience's ability to manage their employees in their organizations. The outcome of the research study is consistently related to the previous literature and proved the positive relationship between PCS and WSB, and the PCS study mainly focuses on the relationship between employer and employee mutual safety obligations. The impact of the PCS factor will enrich the fulfilment of obligations and help the workers be conscious at the workplace.

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