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The impact of various safety leadership styles on construction safety climate: A case of South India

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Abstract. The Indian construction industry is the second-largest job-providing sector in the country, which comprises many investments. According to the International Labour Organization (ILO) report, India is a significant contributor to construction site accidents and fatalities among world nations. The poor Safety Leadership (SL) style and the diminished leader's commitment to quality safety outcomes have caused misfortunes in construction sites. This paper aims to identify the impact of various safety leadership styles on the Organisational Safety Climate (OSC) predictors and propose a conceptual model explaining the relationship between SL styles and OSC. The study identifies six leadership styles from the works of literature: Leader-Member Exchange (LMX), Distributed leadership, Contingent reward, Laissez-faire leadership, Management-by-exception, and Superior's empowerment leadership. Structured questionnaires were circulated for data collection among construction professionals working in metropolitan cities in south India. The collected data were analysed using the stepwise regression analysis and Structural Equation Model (SEM) analysis to identify the SL styles influencing OSC predictors. The findings revealed that four out of six SL styles are optimistic. On the other hand, two of them are pessimistic, namely laissez-faire leadership and management-by-exception leadership style, which leads to an increase in construction site misfortunes. The outcome of this study helps the top-level management personnel build and develop a positive safety leadership trait to achieve quality safety outcomes of the construction organization.

1. Introduction

According to the International Labour Organization (ILO) statistics, occupational accidents and diseases result in more than 2.78 million deaths and 374 million non-fatal work-related injuries and illnesses each year. The annual economic cost of such deaths, injuries, and diseases is estimated to be 3.94 per cent of worldwide GDP (https://www.ilo.org/global/topics/safety-and-health-at-work/lang–en/index.htm) [1]. Statistics differ between various geographical contexts. For example, there are fewer occupational injuries and deaths in affluent countries, but employees in undeveloped and developing countries confront a significant number of such health difficulties [2,3]. In construction, workplace safety is exceptionally high, with a substantial risk of fatality or death [4]. The construction sector is distinct from

other industries due to specific characteristics, including the building process, management methods, organisational structure, work environment, and worker behaviour traits [5,6]. Workplace accidents occur during a job that might result in property damage or injury, particularly common in high-risk industries like construction [7,8]. Accidents can have devastating social and economic consequences for businesses, individuals, and families [9,10].

1.1. Indian context

Occupational diseases affect 924,700 to 1,902,300 people in India each year, with 121,000 deaths [11]. More than 4.4 crores (44 million) employees in India are employed in unorganised construction activity [12]. Construction workers in India account for 7.5 per cent of the worldwide workforce, yet they experience 16.4 per cent of all occupational dangers. In small construction sites, 62.8 per cent of construction employees were involved in accidents, but in major construction sites, 47.4 per cent of construction workers were involved in accidents [13]. It means that workplace safety and health conditions are worse than the global average, resulting in a more significant proportion of accidents.

Furthermore, the majority of this information is under-reported [14]. The construction industry's working environment in India is a massive difficulty because building work is primarily manual and requires many workers to complete it [15]. In addition, the job's temporary nature makes it one of the most complicated work environments [3,16]. Despite establishing Occupational Health and Safety (OHS) laws, building accidents continue to be prevalent. As several researchers have pointed out, continued dangerous situations are mainly attributable to management commitment and poor alignment of subordinates' behaviours [17]. India has many laws, acts, rules, and regulations to address safety concerns, but they are primarily on paper, and the area's geography is constantly changing [18].

Several empirical research studies have been accompanied to clarify the importance of leadership in terms of safety [19]. Fang *et al.* 2015 [20] argued, for example, that the organization's top management was to blame for the high number of accidents. Management safety has remained chiefly a concept that has not been successfully transmitted to subordinates, and managerial measures alone cannot guarantee a successful construction site outcome. The construction manager's lack of safety leadership was attributed to these shortcomings [19]. In a nutshell, excellent safety outcomes may be accomplished by engaging safety leaders in the organisation regularly; thus, safety and leadership are inextricably linked in CI to improve construction site safety and worker safety behaviour [21]. As a result, this research aims to look into the effects of safety leadership in the construction industry in south India and suggest a framework for describing the leadership aspects that enable effective leadership to increase site safety.

2. Literature review

The systematic method of collecting the literature from two major databases, namely SCOPUS and Web of Science, was performed by using appropriate keywords related to the research. For example, some of the keywords combinations used for the literature search are "Safety leadership, Safety leadership and Construction, Construction Safety Leadership, Safety leadership and Construction and India". Table 1 shows the selected literature works that focus on all the subtopics discussed in this article.

Table 1. Summarisation of previous studies.

Authors (Year)	Summary
S. Kanchana et al. (2015)	Studied the existing state of workplace safety and established a safe working environment for construction company personnel. The Indian context of CI is clearly shown in the study by explaining the drawbacks prevailing and the government's rules and regulations [13].
Timothy M. Lewis and Hector Martin (2014)	The findings demonstrate that construction managers are unaware of the safety leadership traits, reducing subordinates' risk-taking behaviour on construction sites [22].

Authors (Year)	Summary
C. Wu et al. (2016)	The noteworthy findings demonstrate an essential relation between the safety leadership of various project stakeholders, with project safety culture acting as a primary facilitator. The top-down stimulus of management commitment to safety is a significant impediment to construction safety improvement [23].
C.M. Cheung et al. (2021)	Explore the factors that contribute to construction safety leadership and the barriers that have hampered the development of effective interventions for developing SL [24].
H. Liang and S. Zhang (2019)	The study distinguishes between incidental and routine safety infractions. In addition, situational violations have an indirect effect through leader-member exchange relationships. Future research can examine the supervisor's safety leadership in detail and provide methods to prevent different safety violations [25].
Peter Graham et al. (2020)	This study connects a construction leadership notion to broader leadership theories. It was suggested that CI cover a diversity of leadership styles and a look at the proposed balanced leadership framework [26].
C. Pilbeam et al. (2016)	The safety leaders use transformational and transactional leadership approaches, which are not appropriate in this situation. So, this paper suggests a new leadership style like distributed leadership that disperses the leading powers among every person, thereby making each person take accountability and motivate them to achieve safety compliance as an organisation [27].
Helen Lingard et al. (2019)	Investigate the impact of communication methods and leadership on the OSC and conduct of construction workgroup supervisors in the Australian CI. The study suggests that supervisors of primarily subcontracted workgroups play an essential role in fostering suitable safety climates and persuading workers' H&S deeds by their communication techniques and leadership styles [28].
L. Zhang et al. (2018)	The importance of SEM is underlined and its ability to be an excellent instrument for testing and studying inter-relationships across postulated models [29].
Hester Hulpia et al. (2009)	States that the Distributed Leadership Inventory (DLI) was created and tested in big secondary schools; to look into leadership team characteristics and the allocation of leadership roles between nominally defined leadership positions [30].

2.1. Safety leadership

"An interaction between members of a group that often entails a structuring or reconstruction of the environment and the participants' perceptions and expectations," according to Avolio and B. 1991 [31]. A subsystem of leadership is safety leadership [32]. It's defined as "the process of interaction between leaders and followers by which leaders can influence followers to achieve organisational safety goals within the conditions of organisational and individual factors" [33].

Managerial leadership is crucial in reducing the risk of workplace accidents and enhancing safety performance [34]. According to Schwatka *et al.* 2019 [35], safety leadership is a multifaceted process displayed through specific acts that directly improve workplace safety. Furthermore, Esterhuizen and Martins 2016 [36] suggest that safety leadership is the most crucial aspect in establishing a positive safety culture, whereas Goncalves Filho and Waterson 2018 [37] contend that safety culture is the essential factor in determining project safety performance [10].

Effective leadership is essential to alleviate the specific complexities, unknowns, and uncertainties of construction projects due to the crucial role of leadership in the success of construction projects.

Furthermore, Famakin and Abisuga 2016 [38] advised construction project managers to put their leadership style first to impact employees' commitment and establish a friendly, psychologically supportive workplace [39].

2.1.1. Styles of construction safety leadership

According to Graham *et al.* 2020 [26], the various styles of CSL are interpreted in figure 1 below. Vertical leadership is defined as a process of influence between a leader and followers, in which the leader's influence moves amongst people at different levels of a hierarchy [40,41]. Horizontal leadership is defined as an emergent process of social interaction in which leadership power transfers between persons at the same level of a hierarchy or between individuals cooperating without a hierarchy [42,43]. Balanced leadership is also defined as an individual and group/shared interaction led by structures, processes, and shared frameworks that generate a shared social cognitive space. This type of leadership influence travels between groups of people at the same hierarchy level and groups at different levels [44,45].

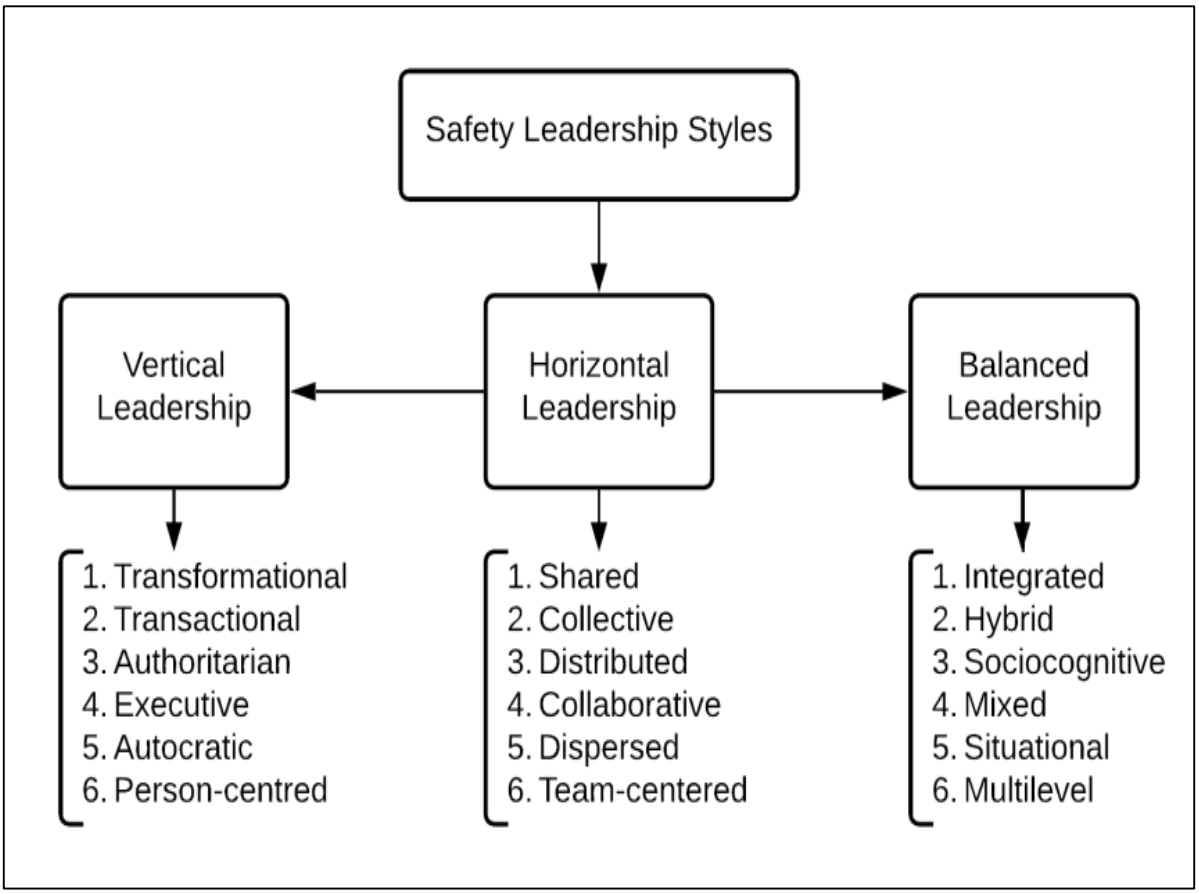

Figure 1. Styles of CSL [26]**.**

Based on the literature review, the objectives of this research study are framed as: (i) To identify the safety leadership factors and styles that enable safety in construction sites. (ii) To investigate the influence of safety leadership factors and styles. (iii) To propose a framework for explaining the safety leadership factors and styles which enable effective leadership to improve site safety. The study focuses on only some specific types of leadership styles and factors that impact organisational safety climate due to the knowledge gap prevailing over those types, which is evident from the previous studies. Figure 2 represents the factors and styles of safety leadership involved in this study.

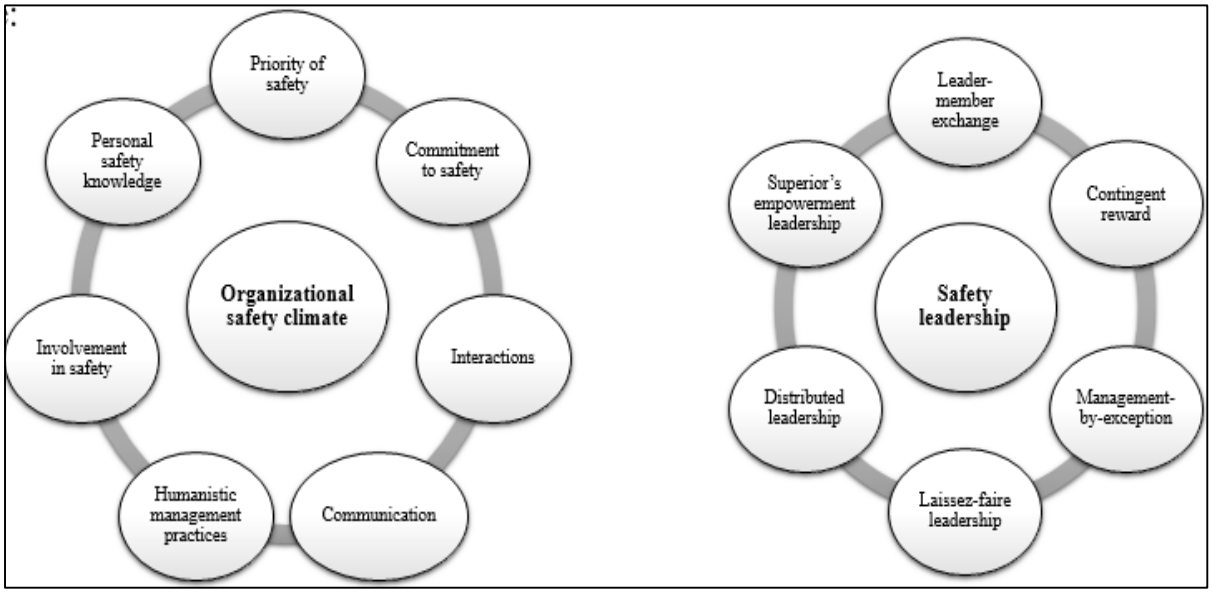

Figure 2. Predictors of organizational safety climate and styles of safety leadership.

3. Research methodology

The methodology adopted for this study: a literature review, identification of several SL styles that influence organisational safety climate (OSC) constructs, questionnaire design, data collection and analysis, and conclusion and discussion. Initially, after finding some SL factors and styles that influence OSC from the literature survey, the authors, to narrow down the SL factors and styles to a limited number, conducted face to face interviews to get suggestions from the experts in the domain and then the final list of variables is fixed for this study. The questionnaire consists of 67 items under four sections. Section I deals with the organizational safety climate and its seven predictors: priority of safety, commitment to safety, interactions, communication, humanistic management practices, involvement in safety, and personal safety knowledge [46]. Section II deals with the leadership styles and factors, namely leader-member exchange [47], contingent reward, management-by-exception, laissez-faire leadership, superior's empowerment leadership [48] and distributed leadership [49]. Section III finds the visibility of this study among the respondents, and Section IV inquires the respondents' demographic details. The survey was built with rated elements validated using exploratory factor analysis. A pilot study was conducted before the survey in a construction firm in Chennai, chosen for the pilot research because sampling was simple. Following the pilot study, construction professionals from various private construction businesses in India were surveyed using a questionnaire survey with a convenient sampling method and authors estimated to circulate questionnaires among 500 construction professionals. Based on the experts' recommendations, the final questionnaire was separated into four sections: (i) organisational safety climate (OSC), (ii) safety leadership characteristics and styles, (iii) visibility, and (iv) demographic profile. The questionnaires were distributed to 500 construction professionals through an online survey platform with site engineers, senior site executives, project managers, safety engineers, and safety executives. The poll received 396 valid responses, with a response rate of 79.20 per cent, and the data were analysed using statistical methods. The professionals working in the construction industry in India's metropolitan cities are the study's target audience.

4. Results and discussion

4.1. Descriptive Statistical Analysis

From the percentage analysis shown in figure 3, most of the sampled respondents are male, which accounted for nearly 88 %, and 51.5 % of the respondents fall under the age group of 18 to 28 years.

Likewise, 57.6 % of respondents are single, and 42.4 % are married. Regarding the educational qualification, it is found that 51.5 % of them are postgraduates in construction-related engineering disciplines and that 51.5 % have less than two years of work experience in the present organisation.

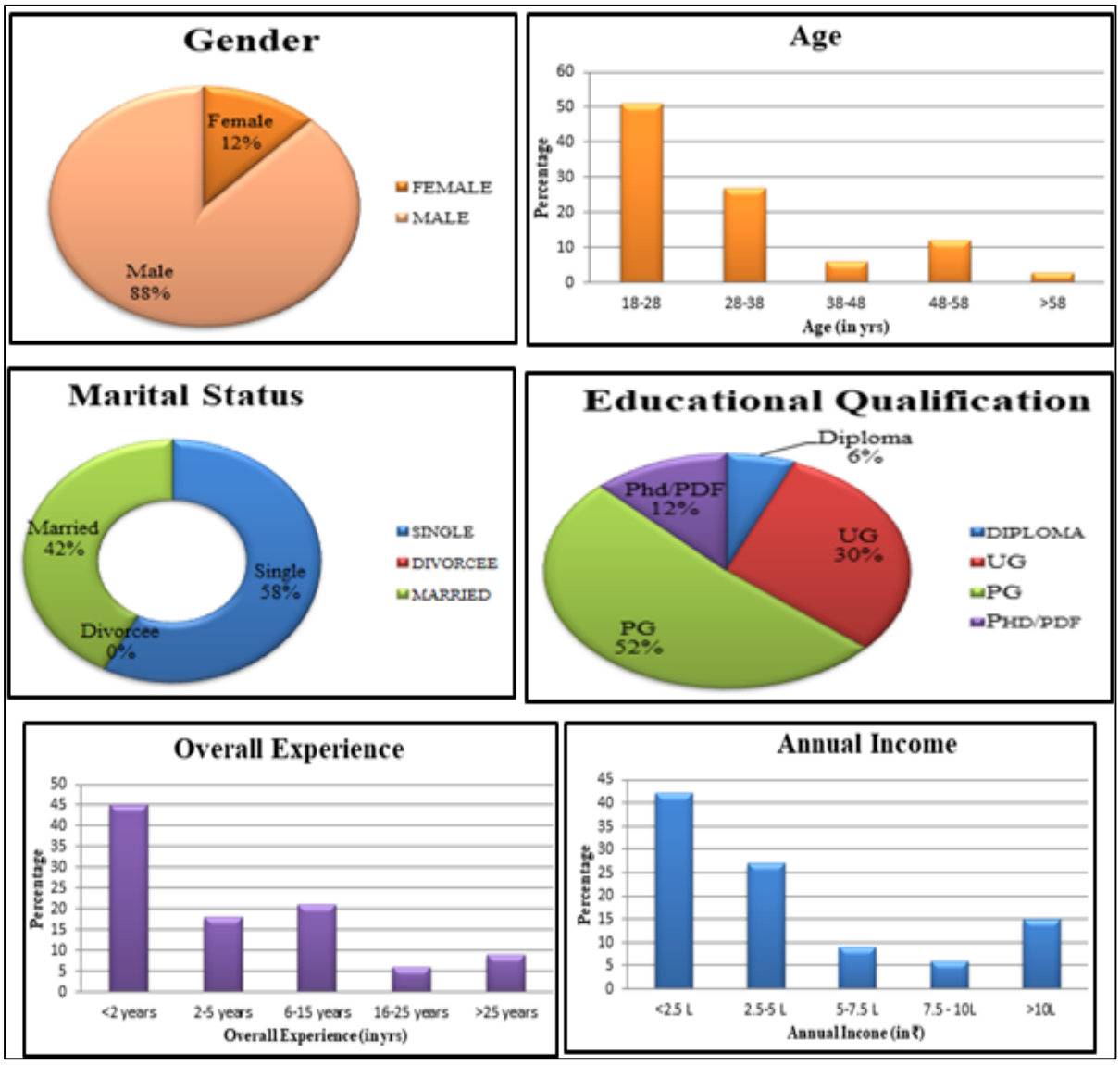

Figure 3. Graphical interpretations of descriptive statistical analysis (Please see the graphs from left to right).

4.2. Reliability Test

The coefficient of reliability usually varies between 0 and 1. The closest to 1 means the higher the accuracy in the scale within the internal consistency. The Cronbach's Alpha value is 0 .973 as shown in table 2, with 67 items, i.e. the 67 questions provided in the questionnaire under different sections are reliable and can be used to proceed with the study. The data collection has a robust internal efficiency of more than 0.7 for Cronbach's Alpha [50].

Table 2. Cronbach's alpha reliability test.

Cronbach's Alpha	Cronbach's Alpha based on standardised items	Number of items
0.973	0.976	67

4.3. Stepwise Regression Analysis

The required statistics to predict OSC from the independent variables and determine whether they contribute considerably to the model are shown in table 3; T is t statistics. The regression equation is also derived from table 3. Factors included are Contingent reward, Management-by-exception, Distributed leadership, Superior's empowerment leadership. The OSC is unrelated to two components with p-values more than 0.05 and is removed from the regression equation. Factors excluded are leader-member exchange and laissez-faire leadership.

Table 3. Stepwise regression coefficient.

	Coefficients	Standard Error	t Stat	p-value
Intercept	1.202	2.398	0.501	0.617
Contingent reward	1.186	0.515	2.300	0.024
Management-by-exception	2.459	0.707	3.476	0.001
Distributed leadership	1.842	0.517	3.564	0.001
Superior's empowerment leadership	2.631	0.654	4.024	0.000

The multiple linear regression equation is expressed as in Equation 1.

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

Based on results using stepwise regression approach for predicting OSC among the construction professionals is:

Predicted OSC = 1.202 + 1.186 × (Contingent reward) + 2.459 × (Management-by-exception) + 1.842 × (Distributed leadership) + 2.631 × (Superior's empowerment leadership)

4.4. Structural Equation Model (SEM) Analysis

To determine the influence of SL styles and factors on the organisational safety climate factors, SEM approaches validate the association among observed variables such as OSC.

4.4.1. Development of Hypothesis

The hypotheses are formulated based on the concepts and the identified factors and tested through the SEM approach.

(Null hypothesis) H_0: Safety leadership styles and factors have no significant effect on the organisational safety climate predictors.

(Alternative hypothesis) H_1: Safety leadership styles and factors significantly affect the OSC predictors.

4.4.2. Summary of SEM Analysis

The goal of the model is to see if leadership quality impacts safety measures and what kind of impact it has. As a result, leadership attributes such as leader-member exchange, contingent reward, management-

by-exception, laissez-faire leadership, and distributed leadership are independent variables. The abbreviations used in the model are given in table 4.

Table 4. Abbreviations used in SEM.

Latent Variable	Identifiers
AA – Distributed leadership	L1, L2, L3, L4, L5
BB – Superior's empowerment leadership	M1, M2, M3, M4, M5, M6, M7, M8
CC – Leader-member exchange	H1, H2, H3, H4, H5, H6, H7
DD – Contingent reward	I1, I2, I3
EE – Management-by-exception	J1, J2, J3
FF – Laissez-faire leadership	K1, K2
AAA – Organisational safety climate	A1 – Priority of safety B1 – Commitment to safety C1 - Interactions D1 - Communication

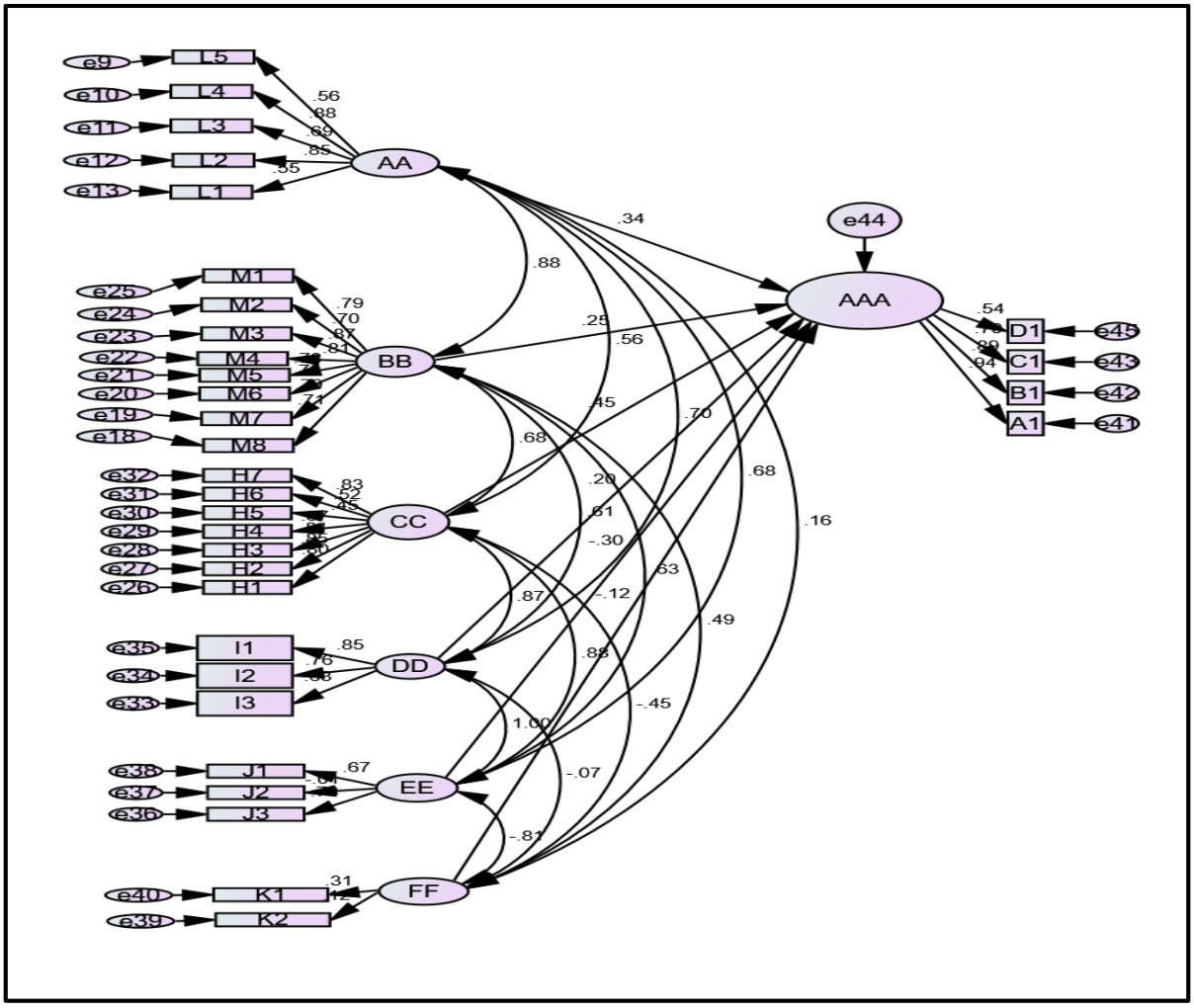

Figure 4. SEM for OSC in Indian CI based on Standardized Coefficients.

The SEM model is developed and tested using IBM AMOS 26.0 and presented in figure 4 as a standardised co-efficient for the OSC among the CI in metropolitan cities. The above-mentioned SEM model has 72 variables, out of which 33 are observed variables, 39 are unobserved variables, 33 are exogenous, and 39 are endogenous variables. From figure 4, it is apparent that the standardised coefficient for the effect of distributed leadership on OSC is 0.605, which indicates the partial impact of distributed leadership on OSC by having other variables as constant. The positive sign of the coefficient indicates that one unit of increase in distributed leadership has 0.605 units of increase in OSC. Similarly, the standardised coefficient for the superior's empowerment leadership on OSC is 0.388, which indicates the partial effect of management on QWL by having other variables as constant. The positive sign of the coefficient indicates that one unit of increase in empowerment leadership has 0.388 units of increase in OSC.

Likewise, the standardised coefficient for the effect of leader-member exchange on OSC is 0.805, which indicates the partial impact of leader-member exchange on OSC by having other variables as constant. The positive sign of the coefficient specifies that one unit of increase in leader-member exchange is 0.805 units of increase in OSC. The standardised coefficient for contingent reward on OSC is 0.397, indicating the partial effect of contingent reward on OSC by having other variables as constant. The positive sign of the coefficient indicates that one unit of increase in contingent reward has 0.397 units of increase in OSC. Finally, the standardised coefficient for the effect of management-by-exception on OSC is -0.537, indicating the partial impact of management-by-exception on OSC by having other variables as constant. The negative sign of the coefficient indicates that one unit of increase in management-by-exception is 0.537 unit of decrease in OSC.

Similarly, the standardised coefficient for laissez-faire leadership on OSC is -1.590, which indicates the partial effect of laissez-faire leadership on OSC by having other variables as constant. The negative sign of the coefficient indicates that one unit of increase in laissez-faire leadership has a 1.590 unit of decrease in OSC. Therefore, the null hypothesis for the SEM analysis is rejected.

The factors influencing OSC have significant positive factor loading on its four latent variables with the standardised coefficients of 0.605, 0.388, 0.805, 0.397 and significant negative factor loading on its two latent variables with the standardised coefficients of -0.537 and -1.590. The SEM model also reveals that the complete hypothesis stated in the conceptual model is significant at a 5 % level.

4.4.3. Model Fitness Abstract

From table 5, it is instituted that all the given model fitness indices fall under the reference range, which denotes a good fit. Furthermore, the root mean square error of approximation is 0.000, which is less than 0.08, stressing the absolute fit of the model. Further chi-square degree of freedom is also 0.000, less than 3.84, emphasising a good fit. Therefore, it is established that the overall SEM integrates factors that determine the assessment on the effectiveness of safety leadership styles in enhancing the construction safety is found to be fit.

Table 5. Abstract of model fitness indices.

Statistic measurement	Test indices	Test standard	Results	Model fit verification
Absolute fit Measurement	RMSEA	≤0.05	.000	Good fit
	CMIN	≤3.84	.000	Good fit

5. Conclusion

The research on assessing the effectiveness of various leadership styles and its' factors in enhancing construction safety has initiated the brainstorming in different construction organisations inside South India for reviewing their leadership styles and the safety norms of their organisation to achieve good safety outcomes. As a result, the construction safety leader has to adopt new leadership styles such as 'distributed leadership' and 'superior's empowerment leadership,' which will effectively handle

complex and risk-based operations and help the company achieve its safety goal. Hereafter, team coordination and distributed leadership enhance safety performance. SEM study proved that four out of the six chosen leadership styles and factors contribute better to the OSC of the organisation, where the remaining two factors diminish the OSC, such as management-by-exception and laissez-faire leadership, which means that CI has to focus on improving these factors to enhance the OSC of the respective organisation. Henceforth, it is found and emphasised that standard OSC is essential for the construction industry/companies to improve performance as these performing employees are responsible for enhancing their individual and organizational performance.

5.1. Limitations and future scope

The researcher identifies certain limitations during the progress and when concluding this research study. The sample taken for this study is skewed towards the younger construction professionals as the authors cannot reach more senior-level and aged professionals. Therefore, future studies can focus on other age group professionals handling top-level positions more prominently. The limitation faced by the researcher is due to the presence or the impact of the HR or senior managers from the chosen construction companies during the distribution and filling of the research instrument. Certain employees were unwilling to participate in the survey because answering the questionnaires was time-consuming and did not benefit them.

Further research investigations could take place in the study issue areas such as OSC and the impact of leadership styles on Absenteeism, Modern slavery, Motivation, Work stress, Productivity, Construction 4.0. Another research that can be explored is the well-being of 'people-in-construction'. Safety is not only a top-down approach; therefore, future research can be done on the bottom-up approach of safety behaviour among professionals. Furthermore, there is still a need to administer pre-test and post-tests longitudinal research to compare the extent of employee performance change due to enhancement of OSC in the organisation where a longitudinal study is advised. The study is focused only on the selected construction companies present in South India's metropolitan cities; hence, the task can be extended to the rest of India.

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