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Using Safety Accountability to Enhance Construction Safety Performance: The Mediating Roles of Safety Monitoring and Safety Learning Under Inclusive Leadership

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Abstract

Safety performance remains a persistent challenge in the construction industry due to hazardous working conditions, dynamic site environments, and complex organizational structures. Despite regulatory advances and technical safety controls, accident rates remain high, suggesting that formal mechanisms alone are insufficient. Addressing this gap, this study examines safety accountability as a central organizational mechanism and investigates how it influences construction workers' safety performance through behavioral processes and leadership conditions. Drawing on accountability theory and social learning theory, we propose a moderated parallel mediation model in which safety monitoring and safety learning function as mediators, while inclusive leadership behavior serves as a contextual moderator. Data were collected from 629 construction workers employed in large-scale projects in Istanbul and Ankara, Türkiye, using a two-wave survey design to mitigate common method bias. Hypotheses were tested using confirmatory factor analysis and Hayes' PROCESS macro. The results indicate that safety accountability does not exert a significant direct effect on safety performance; rather, its influence is fully transmitted through safety monitoring and safety learning, with monitoring emerging as the stronger mediating mechanism. Moreover, inclusive leadership behavior significantly strengthens the accountability-driven pathways leading to improved safety outcomes. By integrating accountability structures, behavioral processes, and leadership context, this study advances construction safety research and provides evidence-based guidance for enhancing occupational safety performance in high-risk construction environments.

Keywords: safety accountability; safety performance; safety monitoring; safety learning; inclusive leadership; construction safety

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1. Introduction

The construction industry is widely recognized as one of the most hazardous sectors globally, characterized by complex work environments, dynamic site conditions, and a high incidence of occupational injuries and fatalities [1]. Despite continuous improvements in safety regulations, training programs, and technological interventions, safety performance in construction projects remains uneven and often unsatisfactory [2,3]. This persistent challenge has prompted scholars and practitioners to move beyond technical safety controls and explore organizational and behavioral factors that shape workers' safety-related actions [4]. Within this evolving stream of research, safety accountability has emerged as a critical mechanism for influencing individual behavior and fostering collective responsibility for safety outcomes [5]. Safety accountability refers to the extent to which individuals and organizations are held responsible for adhering to safety standards, reporting unsafe conditions, and taking corrective actions when risks arise. In theory, accountability systems should motivate workers to comply with safety procedures and discourage unsafe behaviors by clarifying expectations and consequences [6]. However, empirical evidence from construction contexts suggests that accountability alone does not automatically translate into improved safety performance. In many projects, accountability mechanisms are implemented in a formal or punitive manner, focusing on fault-finding rather than learning, which limits their effectiveness and may even suppress proactive safety behavior [7].

A growing body of research indicates that safety performance improvements depend not only on accountability structures but also on the processes through which accountability is enacted in daily work practices [5,8]. In particular, safety monitoring and safety learning have been identified as two essential behavioral mechanisms that enable organizations to convert safety expectations into observable performance outcomes. Safety monitoring allows organizations to detect deviations from safety standards and respond promptly to emerging risks, while safety learning facilitates the accumulation and dissemination of safety knowledge through experience, reflection, and feedback [2]. Yet, these mechanisms are often examined in isolation, leaving a limited understanding of how they simultaneously and jointly operate within accountability-driven safety systems. Moreover, the effectiveness of accountability, monitoring, and learning processes is strongly influenced by leadership behavior. In construction settings, where hierarchical structures and productivity pressures are prevalent, leadership styles that discourage participation or open communication can undermine safety initiatives [9]. Inclusive leadership, characterized by openness, accessibility, and encouragement of employee involvement, has recently gained attention as a leadership approach capable of enhancing psychological safety and fostering constructive safety dialog [10]. Recent safety research suggests that leadership behaviors promoting voice and participation strengthen learning-oriented safety climates; however, empirical evidence explicitly positioning inclusive leadership as a boundary condition in accountability-based safety models remains limited in construction contexts [11–13].

The existing literature therefore reveals three specific and interrelated gaps. First, although safety accountability has been associated with improved compliance, there is insufficient empirical clarification of the behavioral mechanisms through which accountability translates into measurable safety performance outcomes in construction projects [5,14]. Second, prior studies typically examine safety monitoring or safety learning independently, rather than testing them as parallel mediating processes within a single integrated model [15,16]. Third, while leadership has been widely studied in relation to safety culture and safety climate, limited research has examined inclusive leadership as a contextual boundary condition shaping the effectiveness of accountability-driven safety processes among construction workers [17–19]. Addressing these gaps is essential for advancing theory and offering actionable guidance to construction managers operating in high-risk environments.

Drawing on accountability theory and social learning theory, this study proposes that safety accountability influences safety performance indirectly through safety monitoring and safety learning. Accountability theory suggests that individuals regulate their behavior more carefully when expectations and responsibilities are clearly defined, while social learning theory explains how behaviors evolve through observation, feedback, and shared experiences [20]. Inclusive leadership is positioned as a contextual factor that enhances these processes by creating an environment in which workers feel valued, supported, and encouraged to engage in safety-related communication [17]. Together, these theoretical perspectives provide a robust foundation for examining a double-mediated–moderated model of safety performance. Accordingly, the purpose of this study is to examine how safety accountability affects safety performance among construction workers through the mediating roles of safety monitoring and safety learning, and to investigate whether inclusive leadership behavior strengthens or weakens these relationships. By empirically testing this integrated model, the study seeks to clarify the conditions under which accountability mechanisms are most effective in improving safety outcomes.

This study contributes to construction safety and occupational health research in three important ways. First, it develops and tests an integrated model that simultaneously examines safety monitoring and safety learning as parallel mediators linking safety accountability to safety performance, thereby extending prior single-mediator approaches. Second, it positions inclusive leadership as a contextual boundary condition that shapes the effectiveness of accountability mechanisms, offering a more nuanced explanation of when accountability translates into improved safety outcomes. Third, the study provides empirical evidence from large-scale construction projects in Turkey, a context characterized by rapid urban development, complex subcontracting structures, and regulatory enforcement variability, thereby extending safety accountability research beyond frequently studied Western settings.

The remainder of this paper proceeds by reviewing the relevant literature and developing hypotheses, followed by a description of the research methodology, presentation of the empirical results, discussion of the findings, and concluding implications for theory and practice.

2. Theoretical Framework and Hypotheses Development

2.1. Accountability Theory and Social Learning Theory

This study is theoretically grounded in accountability theory and social learning theory, which together provide a robust explanatory lens for understanding how safety accountability translates into safety performance through behavioral and social mechanisms in construction settings. The present study anchors accountability theory in its broader organizational foundations, where accountability is conceptualized as a social and evaluative process through which individuals anticipate scrutiny and regulate their behavior accordingly [5,21]. Accountability theory posits that individuals are more likely to align their actions with organizational expectations when they perceive clear responsibility for outcomes, combined with the possibility of evaluation and consequences [6]. In organizational contexts, accountability systems clarify "who is responsible for what," thereby encouraging compliance, diligence, and self-monitoring [22].

Within construction environments, safety accountability signals that safety is not merely a formal requirement, but a shared obligation embedded in daily work routines. Recent construction safety research suggests that accountability mechanisms are particularly effective when they move beyond punitive control and instead promote ownership, transparency, and proactive engagement with safety practices [2,10]. However, accountability theory alone does not fully explain how responsibility perceptions are converted into sustained safety performance. This limitation is especially evident in construction projects, where safety behaviors are shaped by ongoing interactions, experiential learning, and situational cues.

Social learning theory, originally developed by Bandura [23], complements accountability theory by explaining how individuals acquire, reinforce, and modify behaviors through observation, modeling, feedback, and reciprocal interactions within a social context. According to social learning principles, behavior is shaped not only by formal rules but also by cognitive processing, peer influence, and observed consequences. From this perspective, safety-related behaviors are learned not only through written procedures but also through continuous exposure to monitoring practices, supervisory feedback, and shared responses to safety incidents.

Integrating social learning theory into the accountability–safety relationship allows for a deeper understanding of the mediating roles of safety monitoring and safety learning. Safety monitoring creates visible feedback loops that reinforce accountability expectations, while safety learning enables workers to internalize safety knowledge and adapt behaviors based on past experiences and collective reflection [24]. Recent empirical evidence from construction safety studies highlights that organizations with strong learning-oriented safety systems are better positioned to transform accountability into meaningful performance improvements [3,25]. The combined application of accountability theory and social learning theory is therefore conceptually appropriate for this study. Accountability theory explains the motivational foundation of safety responsibility, while social learning theory elucidates the behavioral and cognitive processes through which accountability is enacted and sustained over time. Importantly, both theories acknowledge the influence of contextual factors, such as leadership behavior, in shaping how accountability cues are interpreted and acted upon. Inclusive leadership, by fostering openness, trust, and participation, strengthens social learning processes and enhances the effectiveness of accountability mechanisms [26]. By integrating these two theoretical perspectives, this study provides a coherent framework for explaining why safety accountability alone may be insufficient and how its impact on safety performance is realized through learning and monitoring processes embedded within a supportive leadership context.

2.2. Safety Accountability and Safety Performance

Safety performance refers to the extent to which construction workers comply with established safety procedures, avoid unsafe behaviors, and actively contribute to accident prevention and risk reduction [2,8,27]. In high-risk construction environments characterized by physical hazards, time pressure, and subcontracting complexity, safety performance depends not only on formal safety systems but also on how responsibility is distributed and perceived among organizational members [28,29].

From an accountability perspective, when individuals perceive that safety-related behaviors are clearly defined, monitored, and associated with meaningful consequences, they are more likely to regulate their conduct in accordance with organizational expectations [5,6,30]. Accountability clarifies "who is responsible for what," thereby reducing ambiguity and reinforcing safety as a non-negotiable priority. Such clarity can increase vigilance, procedural compliance, and risk awareness.

However, empirical research indicates that accountability does not always guarantee sustained improvements in safety performance, particularly when accountability is perceived as punitive or symbolic rather than developmental [7]. This suggests that while safety accountability may exert a direct motivational influence on safety performance, its effectiveness may also depend on complementary behavioral mechanisms that translate responsibility perceptions into durable safe practices.

Accordingly:

H1. *Safety accountability positively influences safety performance.*

2.3. Safety Accountability and Safety Learning

Safety learning refers to the continuous acquisition, sharing, and application of safety-related knowledge derived from experience, feedback, and incident analysis [31]. In construction projects where site conditions evolve rapidly and hazards vary across tasks, learning plays a central role in enhancing adaptive capacity and situational awareness [32,33].

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Safety accountability contributes to safety learning by legitimizing reflective practices and reinforcing the expectation that workers engage in knowledge exchange and improvement activities. When responsibility for safety is clearly articulated and evaluated, workers are more likely to report near misses, participate in safety meetings, and reflect on procedural weaknesses [34]. Through this process, accountability serves as a motivational catalyst, while learning functions as the cognitive and behavioral mechanism through which safety competence is strengthened.

Therefore:

H2. *Safety accountability positively influences safety learning.*

2.4. Safety Learning and Safety Performance

Safety learning enhances safety performance by strengthening hazard recognition, procedural adherence, and adaptive responses to emerging risks [24]. Workers who internalize lessons from prior incidents are better equipped to anticipate potential dangers and adjust their behavior accordingly [35].

Moreover, learning-oriented safety systems foster collective awareness and shared understanding of risks, thereby reinforcing behavioral consistency across teams [36]. In this sense, safety learning represents a critical pathway through which accountability expectations may be transformed into sustained performance outcomes rather than short-term compliance.

Thus:

H3. *Safety learning positively influences safety performance.*

2.5. Safety Accountability and Safety Monitoring

Safety monitoring involves systematic inspection, observation, and feedback mechanisms designed to ensure adherence to safety standards and detect unsafe conditions in real time [37]. In complex construction environments, monitoring enables early identification of hazards and corrective intervention.

Accountability strengthens monitoring by reinforcing attentiveness and responsibility for safety outcomes [6]. When safety roles are clearly assigned and performance is evaluated, workers and supervisors are more likely to engage in proactive inspection, reporting, and follow-up behaviors [38]. Monitoring therefore operationalizes accountability by converting responsibility expectations into observable safety oversight practices.

Accordingly:

H4. *Safety accountability positively influences safety monitoring.*

2.6. Safety Monitoring and Safety Performance

Effective safety monitoring directly contributes to improved safety performance by reducing unsafe acts and increasing compliance [2,39]. Continuous feedback loops enable organizations to correct deviations before incidents escalate.

By providing visible enforcement and reinforcement of safety standards, monitoring ensures that accountability mechanisms are enacted in daily operations rather than remaining abstract principles.

Thus:

H5. *Safety monitoring positively influences safety performance.*

2.7. The Mediating Role of Safety Learning

Although accountability establishes responsibility and expectations, learning equips workers with the knowledge and adaptive skills necessary to perform tasks safely. Without learning, accountability may generate surface-level compliance; with learning, it fosters sustained behavioral change and risk anticipation [40,41].

Safety learning therefore functions as a mediating mechanism linking accountability to safety performance by translating motivational signals into internalized competence.

Accordingly:

H6. *Safety learning mediates the relationship between safety accountability and safety performance.*

2.8. The Mediating Role of Safety Monitoring

Safety monitoring serves as another behavioral pathway through which accountability influences performance. By reinforcing oversight and corrective feedback, monitoring ensures that accountability cues are enacted through observable safety behaviors [42,43].

Through continuous evaluation and feedback loops, monitoring strengthens the behavioral consistency necessary for translating responsibility perceptions into measurable safety outcomes.

Therefore:

H7. *Safety monitoring mediates the relationship between safety accountability and safety performance.*

2.9. The Moderating Role of Inclusive Leadership

Inclusive leadership is characterized by openness, accessibility, and encouragement of employee voice [26,44]. In construction settings where hierarchical structures and productivity pressures may suppress communication, inclusive leaders foster psychological safety and participatory engagement [11,17].

When leaders promote openness and involvement, accountability cues are more likely to be interpreted as supportive and developmental rather than punitive [45,46]. Under high inclusive leadership, workers are more inclined to engage actively in monitoring and learning processes, thereby amplifying the effectiveness of accountability mechanisms. Conversely, under low inclusive leadership, accountability may lead to minimal compliance without fostering proactive safety behaviors.

Thus:

H8. *Inclusive leadership moderates the relationship between safety accountability and safety monitoring, such that the relationship is stronger under high inclusive leadership.*

H9. *Inclusive leadership moderates the relationship between safety accountability and safety learning, such that the relationship is stronger under high inclusive leadership.*

H10. *Inclusive leadership moderates the relationship between safety accountability and safety performance, such that the relationship is stronger under high inclusive leadership.*

To enhance clarity and conciseness, Table 1 summarizes all proposed hypotheses and their corresponding relationships within the conceptual framework.

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Table 1. Summary of Hypotheses.

Hypothesis	Proposed Relationship
H1	Safety accountability → Safety performance
H2	Safety accountability → Safety learning
H3	Safety learning → Safety performance
H4	Safety accountability → Safety monitoring
H5	Safety monitoring → Safety performance
H6	Safety learning mediates SA → SP
H7	Safety monitoring mediates SA → SP
H8	Inclusive leadership moderates SA → SM
H9	Inclusive leadership moderates SA → SL
H10	Inclusive leadership moderates SA → SP

2.10. Control Variables: Firm and Employee Characteristics

This study incorporates education and gender as employee-level control variables to account for potential confounding influences on safety-related behaviors and performance outcomes. Education has been shown to influence safety awareness, hazard perception, and compliance with established safety procedures, particularly in construction environments characterized by task variability and physical risk exposure [7,47]. Workers with higher educational attainment may process safety information more effectively and demonstrate greater engagement with learning and monitoring mechanisms, thereby potentially influencing safety performance [48].

Gender is included as a control variable due to documented differences in safety attitudes, reporting behavior, and risk-taking tendencies across occupational settings [37,49]. Prior research suggests that gender may shape responses to accountability systems and leadership practices, which in turn could affect safety engagement [50]. By controlling for these demographic characteristics, the study enhances internal validity and ensures that the hypothesized relationships are not spuriously attributed to individual differences.

2.11. Research Model

As illustrated in Figure 1, the proposed research model positions safety accountability as the independent variable, safety learning and safety monitoring as parallel mediators, inclusive leadership behavior as a moderator, and safety performance as the dependent variable. The model reflects a double-mediated–moderated framework, capturing both the behavioral mechanisms and contextual boundary conditions through which accountability influences safety outcomes.

Specifically, the model proposes a direct effect of safety accountability on safety performance (H1), indirect effects through safety learning (H6) and safety monitoring (H7), and moderating effects of inclusive leadership behavior on key structural paths (H8–H10). All hypothesized direct, mediated, and moderating relationships are summarized in Table 1 and visually represented in Figure 1 to ensure structural alignment and conceptual clarity.

By integrating accountability theory and social learning theory, the model provides a structured explanation of how responsibility perceptions (accountability), behavioral processes (learning and monitoring), and leadership context (inclusive leadership) jointly shape safety performance in high-risk construction environments.

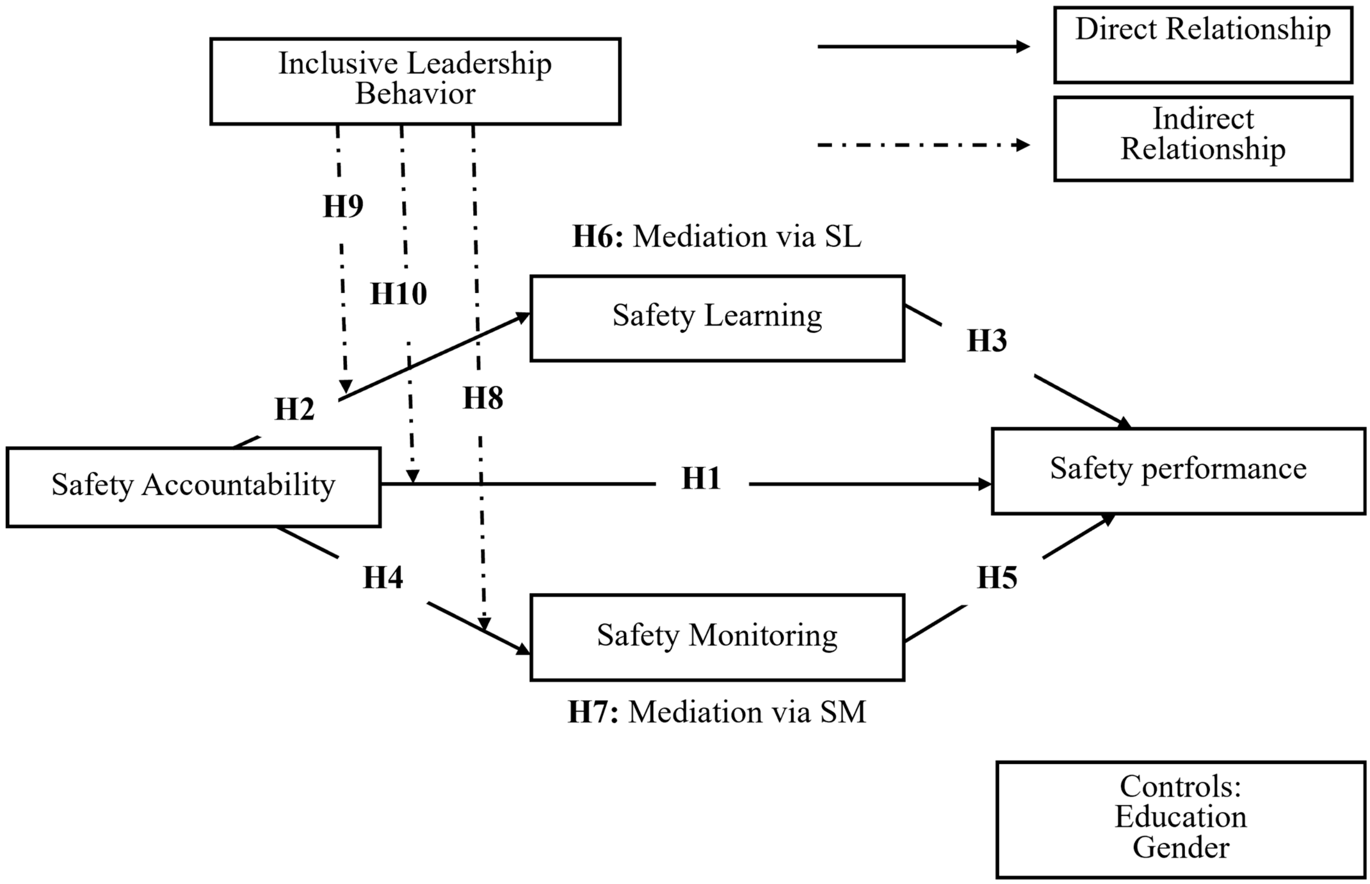

Figure 1. Conceptual research model.

3. Methods

3.1. Sample and Data Collection

This study adopted a quantitative cross-sectional research design to examine the relationships among safety accountability, safety monitoring, safety learning, inclusive leadership behavior, and safety performance within the Turkish construction sector. Data were collected from employees working on large and medium-scale construction projects located in Istanbul and Ankara, Türkiye [51]. A non-probability convenience sampling approach was employed due to the practical constraints associated with accessing geographically dispersed construction sites and project-based workforces. While probability sampling was not feasible, access was formally secured through project management approval, thereby enabling structured and controlled data collection [52].

Survey administration was conducted on-site during scheduled safety briefings and break periods. Trained research assistants distributed the questionnaires directly to participants, and supervisors were not present during completion in order to reduce evaluation apprehension and social desirability bias. No financial or material incentives were offered. Participation was voluntary, and respondents were informed that their responses would remain anonymous and used solely for academic purposes. No personally identifiable information was collected.

To mitigate common method variance, the survey was administered in two temporal waves following the procedural remedies recommended by Podsakoff et al. [53]. In the first wave, participants completed measures of safety accountability, safety monitoring, and safety learning. Three weeks later, the second wave assessed inclusive leadership behavior and safety performance. This temporal separation reduced the likelihood that respondents would rely on cognitive consistency biases when answering related constructs [54,55].

A total of 815 questionnaires were distributed in both paper-based and electronic formats. Of these, 661 responses were returned. After excluding incomplete questionnaires and responses with substantial missing data, 629 valid responses were retained, resulting in a response rate of 77.18%. Respondents were required to meet three inclusion criteria: (1) full-time employment status, (2) a minimum of three years of construction-related work experience, and (3) at least one year of tenure with their current organization. These criteria ensured that participants possessed sufficient exposure to safety systems and leadership practices to provide informed responses.

Table 2 presents the detailed demographic characteristics of the respondents. The demographic composition of the sample reflects the structural characteristics of the Turkish construction workforce. Of the 629 respondents, 611 (97.14%) identified as male and 18 (2.86%) identified as female. Biological sex (male/female) was self-reported and used as a control variable in the analysis. Although female participation was limited, this distribution aligns with national labor statistics indicating that the construction sector in Türkiye remains overwhelmingly male-dominated [56,57].

Table 2. Respondents' characteristics.

Characteristics	Classification	Frequency	Proportion (%)
Gender	Male	611	97.14
	Female	18	2.86
Education	Below high school	141	22.42
	High school	301	47.85
	Bachelor degree	101	16.06
	Others	86	13.67
Marital status	Married	201	31.96
	Single	379	60.25
	Prefer not to disclose	49	7.79
Job roles	Construction workers	431	68.52
	Non-construction personnel	168	26.71
	Legal staff	30	4.77
Experience	3–7	186	29.57
	8–12	101	16.06
	13–17	252	40.06
	18–22	43	6.84
	Above 22	47	7.47
Total		629	100%

With respect to professional roles, 431 respondents (68.52%) were construction workers engaged in manual or trade-related tasks, 168 (26.71%) held technical or supervisory roles, and 30 (4.77%) were administrative or legal personnel associated with project operations. The predominance of site-based workers ensures that the data primarily reflect frontline safety experiences rather than purely administrative perspectives.

Regarding work experience, 252 respondents (40.06%) reported between 13 and 17 years of experience, 186 (29.57%) reported 3–7 years, and 101 (16.06%) reported 8–12 years, with the remainder exceeding 17 years. Overall, more than 70% of participants had at least eight years of professional experience, indicating a mature and experienced workforce sample.

Given the total sample size of 629 respondents, the estimated margin of error at a 95% confidence level is approximately ±3.9% under conservative assumptions of a large population, suggesting adequate statistical precision. Additionally, exploratory subgroup comparisons across job roles and experience categories revealed no substantive structural differences in the key relationships, supporting the stability of the proposed model across respondent groups.

Finally, it is important to situate the study within the Turkish regulatory context. Construction safety practices in Türkiye are governed by Occupational Health and Safety Law No. 6331, which mandates employer responsibility for worker training, hazard communication, and on-site supervision [58,59]. Mandatory safety training and supervisory oversight form the institutional foundation upon which accountability, monitoring, and learning mechanisms operate, reinforcing the contextual relevance of the present investigation.

3.2. Measurement Instrument and Administration

The survey instrument consisted of two sections. The first section collected demographic information, including education and gender. The second section measured the five core constructs: safety accountability, safety performance, safety monitoring, safety learning, and inclusive leadership behavior. In total, the questionnaire included 36 measurement items across all constructs.

All constructs were measured using a five-point Likert-type scale ranging from 1 = strongly disagree to 5 = strongly agree, ensuring consistency across variables. The questionnaire was administered in person at construction sites during scheduled safety meetings, with the assistance of site supervisors who facilitated access but did not influence responses. Participation was voluntary and anonymous.

All items were adopted and adapted from previously validated scales in the safety and organizational behavior literature, thereby enhancing content validity.

Safety accountability was measured using 15 items adapted from [60]. An example item is: "What I do is noticed by others in my organization."

Safety performance was measured using 6 items from [27]. An example item is: "I use the correct safety procedures for carrying out my job."

Safety monitoring was measured using 3 items from [31], such as: "Is alert to safety behavior in the team."

Safety learning was measured using 3 items from [31], including: "Sees unsafe behavior as an opportunity for learning."

Inclusive leadership behavior was measured using 9 items adapted from [61], for example: "My supervisor is open to hearing new ideas."

All scales were originally developed in English and were translated into Turkish following a back-translation procedure to ensure semantic equivalence [62]. Two bilingual experts independently translated and back-translated the items, and discrepancies were resolved through discussion.

Prior to the main data collection, a pilot test was conducted with 30 construction workers to assess clarity and comprehensibility of the items. Minor wording adjustments were made accordingly.

Reliability and validity of the constructs were assessed through confirmatory factor analysis (CFA). Cronbach's alpha values for all constructs exceeded the recommended threshold of 0.70. Composite reliability (CR) and average variance extracted (AVE) also met established criteria, indicating satisfactory internal consistency and convergent validity. The complete list of measurement items is presented in Table 3.

Table 3. Measurement of variables.

Construct	Variable	Number of Substances	Source
Independent	Safety Accountability	SA1: What I do is noticed by others in my organization. SA2: If I make a mistake, I will be caught. SA3: I am constantly watched to see if I follow my organization's safety policies and procedures. SA4: Anyone outside my organization can tell whether I'm doing well in my safety job. SA5: My errors can be easily spotted outside my organization. SA6: People outside my organization are interested in my job performance. SA7: The outcomes of my work are rigorously evaluated. SA8: My work efforts are rigorously evaluated. SA9: I expect to receive frequent feedback from the management. SA10: I could not easily get away with making a false statement to justify my performance. SA11: I am always required to follow strict safety policies or procedures. SA12: I am not allowed to make excuses to avoid blame in my organization. SA13: If I perform well in safety work, I will be rewarded. SA14: Good effort on my part will ultimately be rewarded. SA15: If I do my safety management job well, my organization will benefit from it.	[60]
Dependent	Safety Performance	SP1: I use all the necessary safety equipment to do my job. SP2: I use the correct safety procedures for carrying out my job. SP3: I ensure the highest levels of safety when I carry out my job. SP4: I promote the safety program within the organization. SP5: I put in extra effort to improve the safety of the workplace. SP6: I voluntarily carry out tasks or activities that help to improve workplace safety.	[27]
Mediator	Safety Monitoring	SM1: Is alert to safety behavior in the team. SM2: Scans the environment for unsafe actions by the team. SM3: Let the subordinates know if they are working unsafely	[31]
Mediator	Safety Learning	SL1: Encourages new ways of thinking about safety. SL2: Sees unsafe behavior as an opportunity for learning. SL3: Actively seeks opportunities to learn about new safety protocols and practices	[31]
Moderator	Inclusive Leadership Behavior	ILB1: My supervisor is open to hearing new ideas ILB2: My supervisor is attentive to new opportunities to improve work processes ILB3: My supervisor is open to discussing the desired goals and new ways to achieve them ILB4: My supervisor is available for consultation on problems ILB5: My supervisor is an ongoing 'presence' in this team, someone who is readily available. ILB6: My supervisor is available for safety questions. ILB7: My supervisor is ready to listen to safety requests. ILB8: My supervisor always encourages subordinates on emerging issues. ILB9: My supervisor is accessible for discussing emerging problems.	[61]

3.3. Analytical Procedures

The collected data were analyzed using SPSS 26 and AMOS 24. A two-step analytical approach was adopted [63,64]. First, confirmatory factor analysis (CFA) was conducted to assess the measurement model, including internal consistency reliability, convergent validity, and discriminant validity of the constructs [65]. Second, the structural relationships were tested using Hayes' PROCESS macro for SPSS [66].

To examine the proposed mediation effects (H2–H7), PROCESS Model 4 was employed. Model 4 estimates parallel mediation effects by testing whether the independent variable (safety accountability) influences the dependent variable (safety performance) indirectly through multiple mediators (safety learning and safety monitoring). Specifically, Model 4 tested:

- The direct effect of safety accountability on safety performance (H1);
- The effect of safety accountability on safety learning (H2);
- The effect of safety accountability on safety monitoring (H4);
- The effect of safety learning on safety performance (H3);
- The effect of safety monitoring on safety performance (H5);
- The indirect (mediated) effects through safety learning (H6) and safety monitoring (H7).

To examine the moderating and conditional process effects (H8–H10), PROCESS Model 8 was used. Model 8 estimates moderated mediation by allowing the moderator (inclusive leadership behavior) to interact with the independent variable in predicting both the mediators and the dependent variable. In the present study, Model 8 tested:

- The interaction between safety accountability and inclusive leadership in predicting safety monitoring (H8);
- The interaction between safety accountability and inclusive leadership in predicting safety learning (H9);
- The interaction between safety accountability and inclusive leadership in predicting safety performance (H10).

Bootstrapping with 5000 resamples was employed to generate bias-corrected confidence intervals for all direct, indirect, and interaction effects. An effect was considered statistically significant when the 95% confidence interval did not include zero [67].

3.4. Common Method Bias

Given that data were collected using a self-reported survey design, common method bias (CMB) may pose a potential threat to validity [53]. CMB refers to systematic measurement error arising from the use of a single data source or measurement method, which may inflate or deflate observed relationships among constructs [68,69].

To mitigate and detect CMB, both procedural and statistical remedies were implemented. Procedurally, temporal separation was introduced by administering the survey in two waves, separating measurement of predictors and outcomes. In addition, anonymity was emphasized, no identifying information was collected, and respondents were assured that there were no right or wrong answers [70,71]. These steps were taken to reduce evaluation apprehension and response consistency bias.

Statistically, Harman's single-factor test was conducted [72]. The unrotated exploratory factor analysis revealed that the largest single factor accounted for 40.11% of the total variance, which is below the commonly accepted 50% threshold, suggesting that CMB is unlikely to be a serious concern [73].

Furthermore, a theoretically unrelated marker variable was included to assess potential method variance. The correlations between the marker variable and the main constructs were very low and non-significant (r < 0.03), indicating that shared method variance did not substantially bias the results [74].

Taken together, the procedural and statistical assessments suggest that common method bias does not materially threaten the validity of the findings.

4. Results

4.1. Reliability and Validity Assessment

Prior to hypothesis testing, a confirmatory factor analysis (CFA) was conducted using AMOS 24 to evaluate the measurement model. The objective was to assess internal consistency reliability, convergent validity, discriminant validity, and overall model fit before proceeding to structural analysis [65]. The results are presented in Table 4.

Table 4. Summary of measurement model.

Variables	Item Codes	λ	α	AVE	CR	Skewness	Kurtosis
Safety Accountability (SA)			0.948	0.564	0.951		
	SA1	0.732				−0.572	0.018
	SA2	0.786				−0.690	0.332
	SA3	0.763				−0.673	0.116
	SA4	0.747				−0.825	0.425
	SA5	0.747				−0.904	0.644
	SA6	0.745				−0.676	0.060
	SA7	0.737				−0.709	0.245
	SA8	0.789				−0.565	−0.282
	SA9	0.706				−0.974	0.958
	SA10	0.809				−0.490	−0.090
	SA11	0.682				−0.743	0.566
	SA12	0.747				−0.579	−0.082
	SA13	0.732				−0.490	−0.435
	SA14	0.741				−0.381	−0.479
	SA15	0.761				−0.530	0.025
Safety Monitoring (SM)			0.908	0.781	0.914		
	SM1	0.927				−0.652	0.347
	SM2	0.926				−0.744	0.511
	SM3	0.790				−0.691	0.406
Safety Learning (SL)			0.825	0.625	0.833		
	SL1	0.757				−1.675	−2.966
	SL2	0.854				−1.092	−1.984
	SL3	0.756				−0.813	0.658

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Table 4. *Cont.*

Variables	Item Codes	λ	α	AVE	CR	Skewness	Kurtosis
Inclusive Leadership Behavior (ILB)			0.961	0.735	0.961		
	ILB1	0.828				−0.308	−0.526
	ILB2	0.822				−0.646	0.205
	ILB3	0.833				−0.545	−0.376
	ILB4	0.840				−0.246	−0.544
	ILB5	0.885				−0.444	−0.566
	ILB6	0.874				−0.544	−0191
	ILB7	0.876				−0.245	−0.901
	ILB8	0.874				−0.373	−0.432
	ILB9	0.881				−0.445	−0.800
Safety Performance (SP)			0.956	0.787	0.957		
	SP1	0.857				−0.504	0.716
	SP2	0.886				−0.356	−0.717
	SP3	0.926				−0.433	0.753
	SP4	0.903				−0.512	−0.430
	SP5	0.896				−0.418	−0.644
	SP6	0.854				−0.630	0.299

Internal consistency reliability was examined using Cronbach's alpha (α) and composite reliability (CR). All constructs demonstrated strong reliability, with Cronbach's alpha values ranging from 0.825 to 0.961, exceeding the recommended threshold of 0.70 [75,76]. Similarly, composite reliability values ranged from 0.833 to 0.961, further confirming adequate construct reliability.

Convergent validity was assessed using standardized factor loadings and average variance extracted (AVE). All standardized loadings were statistically significant and ranged from 0.682 to 0.927, exceeding the recommended minimum threshold of 0.60. The AVE values ranged from 0.564 to 0.787, surpassing the 0.50 criterion [77,78], indicating that each construct explains more than half of the variance of its indicators.

Discriminant validity was evaluated using the Fornell–Larcker criterion. As shown in Table 5, the square root of the AVE for each construct (diagonal elements) exceeded the corresponding inter-construct correlations, supporting adequate discriminant validity [77].

Table 5. Discriminant validity, correlations, and descriptive statistics.

Variables	M	SD	SA	SM	SL	ILB	SP
SA	5.424	0.930	(0.751)				
SM	5.675	0.968	0.472 **	(0.884)			
SL	5.723	1.003	0.494 **	0.486 **	(0.791)		
ILB	5.529	0.960	0.509 **	0.428 **	0.505 **	(0.857)	
SP	5.661	0.954	0.552 **	0.494 **	0.601 **	0.499 **	(0.887)

Note: ** correlation is significant at 0.01, two-tailed. Diagonal values (in brackets) represent the square root of AVE.

Multicollinearity was examined using the variance inflation factor (VIF). All VIF values were below 3.0, which is well under the conservative threshold of 3.3 suggested by Kock [79], indicating that collinearity does not threaten the estimation results.

To assess data normality, skewness and kurtosis statistics were examined. Skewness values ranged between 0.245 and 1.675, and kurtosis ranged between 0.018 and 2.966, both within acceptable ranges (±2 for skewness and ±3 for kurtosis) as recommended by Lei and Lomax [80]. These results indicate that the distributional properties of the data satisfy normality assumptions for maximum likelihood estimation.

Finally, model fit indices indicated an acceptable overall fit of the measurement model (CMIN/df = 2.229; CFI = 0.941; GFI = 0.921; TLI = 0.936; IFI = 0.939; NFI = 0.938), suggesting that the proposed factor structure adequately represents the observed data.

4.2. Direct and Mediation Analysis

The direct and mediation hypotheses were tested using Hayes' PROCESS Model 4 [66], which estimates parallel mediation effects. All coefficients reported are unstandardized regression coefficients (B) with corresponding standard errors (SE) and 95% confidence intervals (CI).

First, as shown in Table 6, the direct relationship between safety accountability and safety performance (H1) was examined. The results indicate that safety accountability did not significantly predict safety performance (B = 0.110, SE = 0.056, t = 1.946, p = 0.052). Therefore, H1 was not supported.

Table 6. Direct and Mediation Results (PROCESS Model 4).

Hypothesis	Path	B	SE	t-Value	p-Value	95% CI (LL, UL)	R^2
H1	SA → SP	0.110	0.056	1.946	0.052	[−0.001, 0.220]	0.333
H2	SA → SL	0.874	0.048	18.168	<0.001	[0.779, 0.921]	0.372
H3	SL → SP	0.132	0.055	2.404	0.016	[0.024, 0.241]	0.378
H4	SA → SM	0.855	0.047	18.400	<0.001	[0.764, 0.946]	—
H5	SM → SP	0.322	0.057	5.644	<0.001	[0.209, 0.434]	—
H6	SA → SL → SP	0.115	—	—	—	[0.026, 0.204]	—
H7	SA → SM → SP	0.275	—	—	—	[0.184, 0.368]	—

Note: LL = lower limit; UL = upper limit; CI = confidence interval. All indirect effects were tested using 5000 bootstrap samples.

Second, safety accountability significantly predicted safety learning (H2) (B = 0.874, SE = 0.048, t = 18.168, p < 0.001), providing support for H2. In addition, safety learning positively influenced safety performance (H3) (B = 0.132, SE = 0.055, t = 2.404, p = 0.016), supporting H3.

Third, safety accountability significantly predicted safety monitoring (H4) (B = 0.855, SE = 0.047, t = 18.400, p < 0.001), supporting H4. Furthermore, safety monitoring positively influenced safety performance (H5) (B = 0.322, SE = 0.057, t = 5.644, p < 0.001), supporting H5.

The mediation hypotheses were evaluated using bootstrapping with 5000 resamples to generate bias-corrected 95% confidence intervals [67,81]. The indirect effect of safety accountability on safety performance through safety learning (H6) was significant (B = 0.115, 95% CI [0.026, 0.204]), supporting H6. Similarly, the indirect effect through safety monitoring (H7) was significant (B = 0.275, 95% CI [0.184, 0.368]), supporting H7.

Because the direct effect of safety accountability on safety performance became non-significant after including the mediators, the findings indicate full mediation, whereby safety accountability influences safety performance entirely through safety monitoring and safety learning.

4.3. Moderation Analysis

The moderation hypotheses (H8–H10) were tested using Hayes' PROCESS Model 8 [66], which estimates moderated mediation effects by allowing inclusive leadership behavior to interact with safety accountability in predicting both the mediators and the dependent variable. All coefficients reported are unstandardized regression coefficients (B) with corresponding standard errors (SE) and 95% confidence intervals (CI). Continuous variables were mean-centered prior to computing interaction terms, and education and sex (biological classification) were included as control variables in all models.

In Model 1 of Table 7, where safety monitoring was specified as the outcome variable, safety accountability significantly predicted safety monitoring (B = 0.272, SE = 0.041, $t = 6.641$, $p < 0.001$, 95% CI [0.192, 0.353]). The interaction term between safety accountability and inclusive leadership was also significant (B = 0.102, SE = 0.031, $t = 3.337$, $p = 0.001$, 95% CI [0.042, 0.161]), providing support for H8. Simple slope analysis indicated that the relationship between safety accountability and safety monitoring was weaker at low levels of inclusive leadership (−1 SD; B = 0.186, $p < 0.001$) and stronger at high levels (+1 SD; B = 0.344, $p < 0.001$). Figure 2 illustrates this interaction pattern. Neither education nor sex significantly predicted safety monitoring ($p > 0.05$), suggesting that the moderation effect is robust across demographic groups.

Figure 2. Interaction effect of inclusive leadership behavior on the safety accountability-safety monitoring link.

Table 7. Moderation Results (PROCESS Model 8).

Paths	B	S.E.	*t*-Value	*p*-Value	95% CI LL	95% CI UL	R^2
Model 1: Safety Monitoring							
SA → SM	0.272	0.041	6.641	0.000	0.192	0.353	0.689
ILB → SM	0.756	0.033	23.276	0.000	0.692	0.820	
H8: SA × ILB → SM	0.102	0.031	3.337	0.001	0.042	0.161	
Co: Education → SM	0.047	0.052	0.904	0.775	−0.095	0.067	
Co: Gender → SM	0.019	0.028	0.679	0.865	−0.100	0.059	
The conditional direct effect of SA on SM at levels of ILB							
ILB (−1 SD)	0.186	0.045	3.699	0.000	0.087	0.285	
ILB (Mean)	0.265	0.041	6.420	0.000	0.184	0.346	
ILB (+1 SD)	0.344	0.050	7.679	0.000	0.256	0.433	
Model 2: Safety Learning							
SA → SL	0.309	0.045	6.859	0.000	0.220	0.397	0.649
ILB → SL	0.731	0.036	20.544	0.000	0.661	0.801	
H9: SA × ILB → SL	0.114	0.033	3.411	0.000	0.048	0.180	
Co: Education → SL	0.066	0.039	1.692	0.162	−0.216	0.059	
Co: Gender → SL	0.024	0.042	0.571	0.804	−0.099	0.048	
The conditional direct effect of SA on SL at levels of ILB							
ILB (−1 SD)	0.212	0.055	3.699	0.000	0.103	0.320	
ILB (Mean)	0.300	0.045	6.420	0.000	0.211	0.389	
ILB (+1 SD)	0.389	0.049	7.679	0.000	0.292	0.486	
Model 3: Safety Performance							
SA → SP	0.028	0.034	2.696	0.007	0.025	0.157	
SM → SP	0.207	0.040	5.226	0.000	0.129	0.285	
SL → SP	0.329	0.101	3.265	0.001	0.131	0.527	
ILB → SP	1.292	0.089	0.154	0.878	−0.162	0.189	
H10: SA × ILB → SP	0.122	0.036	3.425	0.001	0.052	0.192	
Co: Education → SP	0.018	0.029	0.620	0.304	−0.119	0.029	
Co: Gender → SP	0.031	0.033	0.939	0.206	−0.102	0.051	
The conditional direct effect of SA on SP at different levels of ILB							
ILB (−1 SD)	0.093	0.057	0.405	0.685	−0.107	0.024	
ILB (Mean)	0.050	0.061	1.602	0.109	−0.082	0.124	
ILB (+1 SD)	0.021	0.052	2.088	0.046	0.089	0.169	

Note: All coefficients are unstandardized (B). Bootstrap samples = 5000. LL = lower limit; UL = upper limit; Co = control variables.

In Model 2, where safety learning was treated as the dependent variable, safety accountability significantly predicted safety learning (B = 0.309, SE = 0.045, t = 6.859, $p < 0.001$, 95% CI [0.220, 0.397]). The interaction between safety accountability and inclusive leadership was significant (B = 0.114, SE = 0.033, t = 3.411, $p < 0.001$, 95% CI [0.048, 0.180]), supporting H9. At low inclusive leadership (−1 SD), the effect of safety accountability on safety learning was weaker (B = 0.212, $p < 0.001$), whereas at high inclusive leadership

(+1 SD), the effect was stronger (B = 0.389, $p < 0.001$). The interaction effect is presented in Figure 3. Education and sex did not significantly predict safety learning ($p > 0.05$).

Figure 3. Interaction effect of inclusive leadership behavior on the safety accountability-safety learning link.

In Model 3, which examined safety performance as the dependent variable, safety accountability had a significant direct effect on safety performance (B = 0.128, SE = 0.034, $t = 2.696$, $p = 0.007$, 95% CI [0.025, 0.157]). The interaction term between safety accountability and inclusive leadership was also significant (B = 0.122, SE = 0.036, $t = 3.425$, $p = 0.001$, 95% CI [0.052, 0.192]), supporting H10. Simple slope analysis revealed that the relationship between safety accountability and safety performance was non-significant at low levels of inclusive leadership (B = 0.093, $p = 0.685$) but became significant at high levels (B = 0.169, $p = 0.046$), indicating that inclusive leadership strengthens the positive effect of accountability on performance. This interaction is illustrated in Figure 4. As in the previous models, education and sex remained non-significant predictors ($p > 0.05$), indicating that the moderation results are not driven by demographic differences.

Figure 4. Interaction effect of inclusive leadership behavior on the safety accountability-safety performance link.

5. Discussion and Implications

5.1. Discussion of Findings

This study demonstrates that safety accountability, by itself, does not directly enhance safety performance in construction settings. Although accountability clarifies roles and expectations, the findings indicate that accountability must operate through concrete behavioral mechanisms to influence performance outcomes. The non-significant direct relationship suggests that accountability becomes effective only when translated into observable safety processes [82].

This result helps clarify previously mixed evidence reported in construction safety research [5,7]. While accountability is often assumed to drive compliance [6], the present findings indicate that formal accountability structures alone may remain symbolic unless embedded within active monitoring and learning systems. Thus, the study highlights the distinction between declarative accountability and enacted accountability within daily site operations.

Second, the results reveal that safety monitoring and safety learning fully mediate the relationship between safety accountability and safety performance. Safety monitoring emerged as the primary mechanism through which accountability influences safety outcomes. Continuous observation, feedback, and corrective actions appear to transform accountability expectations into real-time behavioral adjustments [83]. In dynamic construction environments, where risks evolve rapidly, such monitoring mechanisms play a decisive role in preventing unsafe acts.

Safety learning also contributed significantly to safety performance. Learning processes enabled workers to internalize safety standards, reflect on incidents, and adapt practices accordingly. While monitoring reinforces compliance, learning supports behavioral adaptation and long-term safety improvement [31]. These findings support arguments in prior occupational health literature that effective safety systems combine control-oriented and developmental mechanisms [2,37], yet the present study empirically demonstrates their simultaneous mediating roles within an accountability framework.

Third, inclusive leadership behavior was found to function as a critical boundary condition. Accountability translated into improved safety performance only under conditions of high inclusive leadership. When leaders demonstrated openness, accessibility, and support, accountability strengthened both safety monitoring and safety learning [84]. Conversely, under low inclusive leadership, accountability mechanisms failed to produce meaningful safety gains.

This pattern aligns with social learning principles [17,85], suggesting that leadership behaviors shape how organizational expectations are interpreted and enacted. However, the present findings extend prior work by showing that inclusive leadership does not merely influence safety directly, but conditions the effectiveness of accountability systems themselves.

Overall, the study advances construction safety research by demonstrating that sustainable improvements in safety performance emerge when accountability is operationalized through monitoring and learning processes and supported by inclusive leadership. Rather than treating accountability as a standalone compliance mechanism, the findings position it as a catalytic force that requires behavioral and leadership integration to generate meaningful occupational health outcomes.

5.2. Theoretical Implications

This study offers three focused theoretical contributions to the construction safety and occupational health literature.

First, the findings refine accountability theory by demonstrating that safety accountability does not directly predict safety performance, but instead operates through behavioral mechanisms. The non-significant direct effect and significant indirect effects suggest that accountability functions as a distal governance signal rather than an immediate behavioral driver. This finding challenges assumptions that formal accountability structures alone improve safety outcomes and supports a process-based understanding of safety systems [5–7].

Second, the study advances social learning perspectives in construction safety by empirically establishing safety monitoring and safety learning as parallel mediating mechanisms. Rather than treating monitoring and learning as independent safety practices, the results show that they jointly translate accountability into performance outcomes. Monitoring reinforces behavioral expectations through feedback and control, while learning supports cognitive adaptation and knowledge internalization [3]. This integrated mediation model provides a more nuanced explanation of how safety systems operate in dynamic and high-risk environments.

Third, the findings extend leadership–safety theory by identifying inclusive leadership as a boundary condition that determines when accountability becomes effective. Accountability translated into improved safety performance only under high levels of inclusive leadership, indicating that leadership behavior shapes how accountability cues are interpreted and enacted. This contribution moves beyond examining direct leadership effects and instead positions inclusive leadership as an enabling mechanism within accountability-based safety systems [10,17].

Collectively, these contributions offer a more parsimonious and mechanism-focused explanation of safety performance in construction, emphasizing the interaction between governance structures, behavioral processes, and leadership context.

5.3. Practical Implications

The findings of this study suggest that construction firms should rethink how safety accountability systems are implemented in practice.

First, because safety accountability did not directly improve safety performance, organizations should avoid relying solely on formal rules or punitive controls. Accountability mechanisms must be translated into daily behavioral processes. Practically, this means embedding accountability within structured safety monitoring systems, such as systematic site inspections, real-time feedback, and supervisor-led hazard observations. These practices ensure that accountability expectations become observable and actionable rather than symbolic.

Second, the full mediation results indicate that safety monitoring and safety learning are the mechanisms through which accountability produces performance gains. Therefore, firms should institutionalize both control-based and learning-based practices. Monitoring mechanisms (e.g., routine safety audits, peer reporting systems) reinforce compliance, while structured learning mechanisms (e.g., post-incident reviews, near-miss analysis meetings, cross-crew knowledge sharing) support behavioral adaptation and long-term safety improvement. Treating monitoring and learning as complementary rather than isolated initiatives is essential for sustained occupational health outcomes.

Third, the moderation findings demonstrate that accountability becomes effective only under high inclusive leadership. Construction managers and site supervisors should therefore be trained in inclusive leadership behaviors, including openness to employee input, accessibility during safety concerns, and encouragement of worker voice. Without such leadership behaviors, accountability systems may fail to translate into improved safety performance.

Finally, from an industry perspective, the results support an integrated safety management approach that aligns accountability structures, behavioral processes, and leadership practices. Rather than focusing exclusively on regulatory compliance, firms should design safety systems that simultaneously reinforce responsibility, encourage learning, and cultivate supportive leadership climates. Such alignment is more likely to generate meaningful and sustainable improvements in safety performance.

5.4. Limitations and Future Research Directions

Despite its contributions, this study has several limitations that should be acknowledged. First, the cross-sectional design restricts causal inference, and future research should adopt longitudinal or time-lagged designs to better capture the dynamic relationships among accountability, leadership, and safety outcomes. Second, although procedural remedies were implemented, reliance on self-reported measures may introduce common method variance and social desirability bias. Future studies could incorporate objective safety indicators (e.g., accident records, near-miss data) and multi-source assessments. Importantly, the sample composition presents structural imbalances that limit subgroup inference. The sample was predominantly male, and certain job roles (e.g., construction workers) were overrepresented relative to supervisory or specialist positions. In addition, experience categories were unevenly distributed. These imbalances restrict the ability to generalize findings across gender groups, professional roles, and experience levels, and caution is warranted when interpreting subgroup effects. Future research should employ more stratified sampling approaches to ensure balanced representation across demographic and occupational categories.

Furthermore, the study was conducted exclusively at construction sites in Ankara and Istanbul, two large metropolitan areas characterized by complex project structures and formalized safety systems. As a result, the findings may reflect safety dynamics typical of large-scale, urban construction projects. Construction settings in less urbanized regions or smaller-scale projects may differ in organizational hierarchy, leadership proximity, regulatory enforcement, and resource availability. Therefore, generalizability beyond major metropolitan contexts should be approached cautiously. Future research should replicate the proposed model in rural areas, smaller firms, and diverse project types to assess contextual boundary conditions and enhance external validity.

6. Conclusions

This study examined how safety accountability influences safety performance in construction projects through safety monitoring and safety learning, and under the boundary condition of inclusive leadership behavior. The findings demonstrate that safety accountability does not directly improve safety performance; rather, its influence is fully transmitted through monitoring and learning mechanisms. Safety monitoring emerged as the stronger mediator, highlighting the importance of real-time oversight and corrective feedback, while safety learning contributed through knowledge internalization and behavioral adaptation. Moreover, inclusive leadership was found to strengthen the effectiveness of accountability-driven safety processes, indicating that leadership behavior determines whether accountability translates into meaningful performance outcomes.

The study contributes to construction safety research by advancing a mechanism-based explanation of how accountability systems operate in high-risk environments. Rather than treating accountability as a standalone compliance tool, the findings position it as a governance signal that requires behavioral enactment and supportive leadership to generate safety improvements. At the same time, the results should be interpreted in light of methodological limitations, including the cross-sectional design, self-reported measures, subgroup imbalances, and the metropolitan context of Ankara and Istanbul. Future research should replicate and extend this framework across diverse project types and organizational settings to further validate its applicability and strengthen the evidence base for integrated safety management systems.

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