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The Interplay Between Safety Leadership and Construction Workers' Safety Behavior: Do Perceived Employer Safety Obligations Matter?

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Abstract: In an industry where safety is paramount yet frequently compromised, the transformative impact of safety leadership on workers' safety behavior illuminates a path to reducing construction hazards and fostering a culture of proactive safety practices. Combining transformational leadership theory, social exchange theory, and the theory of planned behavior, this research examines the complex interplay between safety leadership and safety behavior through the mediating role of safety knowledge, specifically investigating how perceived employer safety obligations moderate these relations. Based on 359 cross-sectional data obtained from construction industry professionals in Istanbul, Turkey, it was found that safety leadership significantly boosts safety behavior and safety knowledge, with safety knowledge serving as an effective mediator. Although perceived employer safety obligations did not moderate the affect the safety leadership on safety knowledge, they significantly moderated the link between safety leadership and safety behavior, as well as between safety knowledge and safety behavior, emphasizing the crucial role of perceived employer safety obligations in enhancing safety practices and outcomes. This study substantially enhances the construction safety management literature by elucidating the intricate dynamics between safety leadership and safety behavior and the pivotal role of perceived employer safety obligations. It offers robust theoretical advancements and practical strategies, enabling construction firms to leverage safety leadership for improved workplace safety outcomes and organizational performance.

Keywords: construction industry; safety leadership; safety behavior; perceived employer safety obligations; safety knowledge

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1. Introduction

The construction sector rises as a fundamental pillar of the economy, driving dynamism and sustainability alongside its related subsectors. In Turkey, this sector is rapidly expanding due to government policies, socio-economic demands, and diverse supporting subsectors. Turkish companies are more and more involved in major projects, with hi-tech expansion boosting their competitiveness [1] However, scarce safety measures at many construction sites lead to frequent occupational accidents.

The construction sector in Turkey has an accident rate of at least 6.5%, which is 6–10 times higher than other sectors in Turkey and Europe. Each year, approximately 400 workers die and another 400 are permanently disabled due to construction-related accidents. The Turkish construction industry is notorious for its poor safety performance, exhibiting significantly higher accident rates compared to other sectors. This situation adversely affects both the national economy and the financial health of construction organizations [2]. Despite existing safety measures, the industry's safety performance remains inadequate. Conducting this study was essential to identify gaps in current safety practices and propose effective strategies to enhance safety compliance and performance, ultimately aiming to reduce the high rates of accidents and fatalities.

With the challenges posed by tight schedules, financial limitations, and the intricate nature of construction endeavors, safeguarding the health and welfare of construction workers emerges as a critical imperative [3]. Over 80% of workplace accidents stem from unsafe employee behavior [4]. A small sub-section of employees bears the impact of accidents caused by unsafe actions [5,6]

Understanding individual differences, particularly personality traits, is crucial for predicting safety behavior [7]. In response to the imperative to enhance safety practices, construction organizations have devised and implemented various safety measures [7,8]. These safety obligations encompass a comprehensive framework of regulations and activities aimed at improving safety [2,7]. Despite efforts to enhance safety leadership, research reveals that safety performance often falls short of the ideal level within enterprises [9–13].

Effective leadership becomes paramount, especially for temporary construction onsite organizations navigating high levels of uncertainty [14]. Safety leadership plays a pivotal role in enhancing construction safety behavior, especially in countries where the construction industry grapples with significant safety challenges [15]. Leadership, characterized by the ability to exert social influence, inspires individuals to unite and accomplish shared objectives [16], holding immense importance. Within the Occupational Health and Safety (OHS) literature, safety leadership has emerged as a critical construct in construction safety management [17]. Workplace supervisors wield considerable influence over the safety performance of their staff.

Despite abundant research exploring safety leadership as a precursor to trailing indicators [18], understanding accident causes and mechanisms remains paramount for both academic study and practical application in construction management. Safety knowledge, which is essential for performing jobs safely, encompasses the skills and understanding employees require to navigate various safety situations at work [19]. Managers recognize that providing safety knowledge reduces the likelihood of on-the-job injuries [20,21].

When it comes to perceived employer safety obligations, employees' positive safety behavior pivots on their perception. If employees believe their employer's safety obligations are met, there is a higher likelihood of reciprocation with positive safety behavior and fulfillment of their perceived employer safety obligations. Conversely, when employees perceive that employers fail to meet perceived employer safety obligations, their commitment to safety behaviors decreases [22]. Qualitative evidence from research highlights this reciprocity between perceived employer safety obligations and employee's safety behaviors [23]. However, theoretical and empirical studies [24] have illuminated a multitude of factors operating at both organizational and individual levels. These factors significantly influence decision-making processes, sometimes leading to conflicting outcomes [25]. This study integrates three theoretical frameworks: transformational leadership theory, social exchange theory, and the theory of planned behavior. While mainstream leadership theories may not seamlessly apply to the construction context, understanding how transformational leadership behaviors practically manifest within the context and effectively applying mainstream leadership theories to enhance the significant gap in shaping safety procedures is important within the construction sector in Turkey [26].

Social exchange theory stands as a cornerstone in examining workplace relations, exerting influence across various fields [27]. Social exchange theory revolves around ongoing reciprocal resource exchanges between parties, which are interdependent and generative of future obligations [28]. The theory of planned behavior does not grapple with the attitudinal ambivalence arising from conflicting factors that contribute to unsafe behaviors. Consequently, the theory of planned behavior presents a partial image of the latent link between safety leadership and safety behavior. While the picture remains incomplete, ongoing research continues to investigate both positive and negative factors and their impact on safety behavior [25]. This research endeavors to fill the gap by identifying strategies to enhance perceived employer safety obligations, ultimately fostering improved safety behavior. Moreover, limited studies have explored the mediating role of safety knowledge in these relations or examined how perceived employer safety obligations moderate these

dynamics. Addressing this gap is crucial for developing strategies to promote a safe work environment in the construction sector.

Hence, this empirical study intends to explore the following research questions:

1. How does safety leadership influence safety behavior?
2. Does safety knowledge mediate the link between safety leadership and safety behavior?
3. How do perceived employer safety obligations moderate the link between safety leadership and safety results, such as safety knowledge and safety behavior, both directly and indirectly?

A meticulous examination and comprehensive analysis of the research questions' elements provides insight into the essential motivations driving the inquiries. Theoretically, this research intends to provide a wide range of existing frameworks, including transformational leadership theory, social exchange theory, and the theory of planned behavior. By contextualizing these frameworks within the realm of safety leadership and their impact on safety behavior, this research enhances our understanding. The theory elucidates how leaders can inspire, motivate, and drive behavioral change among followers regarding safety practices by going beyond mere transactional exchanges. Particularly, this investigation concentrates on both the similarities and disparities among autonomous and dependent variables concerning the mechanisms by which strongly perceived employer safety obligations fortify safety.

These insights, from a pragmatic perspective, can serve as a guide for enterprises in the service and manufacturing sectors, assisting them in optimizing their limited resources more efficiently. The paper's organization unfolds as follows: The literature review segment explores theoretical foundations and hypothesis development, followed by the data collection and methodology segment, which elucidates the research data and outlines the methodology. Subsequently, we examine the outcomes, presenting a thorough examination and interpretation of our study's discoveries. Finally, the conclusions and implications segment delineates the practical consequences derived from our research.

2. Theoretical Background and Hypotheses Development

2.1. Underpinning Theory

2.1.1. Transformational Leadership Theory

Transformational leadership is a prominent structure in organizational psychology that focuses on effective leaders who play a crucial role in inspiring and motivating their groups to attain elevated stages of performance and enhance organizational effectiveness. This research considers transformational leadership in the context of fostering a positive safety climate, clearly communicating safety expectations, and providing support and resources to facilitate safe work practices [29]. Safety leadership significantly impacts safety behavior, as widely observed [30]. Research specifically shows that transformational leadership influences safety in various workplace contexts, including construction. While evidence supports the significance of both transactional and transformational leadership for safety, there remains a gap in understanding how to effectively apply these leadership styles within specific contexts [26]. Exploring the manifestation of transformational leadership within the construction workplace holds significant practical value. It ensures that construction leaders exhibit behaviors aligned with safety and suitability, thereby positively impacting construction sites. Furthermore, this newfound understanding advances our theoretical comprehension of leadership, recognizing its context-specific nature within distinct industries and workplaces [31].

Investigating how transformational leadership manifests within the construction area holds significant practical value. It guarantees that leaders in construction align their behavior with safety and appropriateness, thereby positively influencing construction sites. Furthermore, this novel understanding advances our theoretical comprehension of leadership, recognizing its context-specific nature within distinct industries and workplaces [26]. Promoting safety behavior among construction leaders to exemplify transformational leadership in support of construction safety is crucial. While mainstream theory offers

some insights, scant evidence exists regarding the specific appearance of transformational leadership behaviors within the construction context [32]. Significantly, there has been a call for advancing leadership thinking by contextualizing it within the specific industry or workplace where the leadership process unfolds [33]. Research on leadership context suggests that understanding a person's behavior requires understanding the environment in which they operate [34].

Safety leadership is an influence that materializes differently across various situations. Consequently, effective leader–member interactions and leadership behaviors may diverge based on the specific industrial context in which leadership unfolds. This underscores the importance of leadership effectiveness and outcomes [35]. While it is known that safety knowledge regarding transformational leadership contributes to safe outcomes, the effectiveness of specific safety leadership behaviors in supporting safety within the construction sector is less studied. Furthermore, understanding the behaviors that align with or diverge from typical leadership theory poses a challenge [36].

Specifically, we question if safety leadership behaviors should be classified as a mechanism of transformational leadership [37]. Transformations manifest in the context of the workplace and hold substantial practical value. They ensure that construction leaders exhibit behavior aligned with safety and appropriateness, thereby positively impacting construction sites. Furthermore, this newfound knowledge advances our understanding. Our conceptual sense of leadership recognizes that it is inherently context-dependent. Effective leadership must adapt to and align with unique workplaces [26,38].

2.1.2. Social Exchange Theory

Social exchange theory offers a valuable outline for understanding the interpersonal relationships within organizations and the dynamics of reciprocity between individuals and their social environments [39]. Social exchange theory is a fundamental concept for understanding human reactions. Communication sequences give rise to responsibilities [40]. These interdependent communications rely on the actions of others. Such conversations can encompass various aspects, including exchanging actions, tangible or intangible resources, and financial or socioeconomic outcomes [41]. According to social exchange theory, social interactions operate based on principles of reciprocity and mutual gain. Individuals engage in social exchanges with others, whereby they invest resources such as time, effort, or support in exchange for rewards or benefits. Factors such as trust, perceived fairness, and the quality of affiliation influence these exchanges, which are based on the expectation of future reciprocity [41]. In the context of workplace relationships, social exchange theory helps us comprehend how organizations and managers play a role in generating employee responsibilities and fostering positive work environments. Essentially, it is like an ongoing conversation: an organization initiates positive actions toward its employees, expecting reciprocity in return [40]. Thus, employees are responsible for accepting this optimistic approach within a favorable work environment [42].

Safety leadership contributes to shaping employee safety behavior within organizations. However, other factors, such as perceived employer safety obligations, can influence this relationship. Employees develop beliefs about their workplace safety responsibilities based on societal and organizational influences [43,44]. When employees recognize their employer's authentic dedication to safety, they reciprocate by exhibiting constructive safety-related actions and attitudes [40]. If employees perceive that employers fall short in meeting safety obligations, they might exhibit reduced enthusiasm for safety-related behaviors or fulfilling their perceived safety responsibilities [42]. When perceived employer safety obligations are low, it weakens the otherwise positive link between safety leadership and safety behavior. Employers widely use social exchange theory to understand why employees engage in safety behavior, laying the groundwork for the concept of safety leadership.

2.1.3. Theory of Planned Behavior

The theory of planned behavior [44], which draws insights from reasoned action, endeavors to anticipate and illuminate human behaviors within particular contexts or situations. While the theory of planned behavior has been widely successful in predicting intentional behaviors across various scenarios, its application to work behavior has been relatively infrequent. In workplace social exchange theory, the theory of planned behavior has primarily found application in understanding non-production-related behaviors. Furthermore, human resource managers have selectively utilized it to anticipate organizational behaviors, including their intentions regarding the use of unstructured or structured interviews [45].

From the perspective of the present study, a critical question arises about how the theory of planned behavior effectively contributes to our understanding and prediction of perceived employer safety obligations. Intention, as a proximal cause of behavior, plays a crucial role. The concept of perceived behavioral control also influences intentions [46]. Furthermore, a strong link exists between individuals who perceive a deficiency in their ability or competence to participate in a specific behavior and intention; this directly impacts their intentions, and their intention to perform that behavior diminishes [44]. Intentions can significantly impact behavior only when the behavior is within volitional control and individuals possess the capability to successfully exert that control [47]. The link between safety knowledge and safety behavior depends significantly on perceived control. A strong understanding of safety protocols, hazards, and preventive measures strengthens employees' perceived employer safety obligations, leading to improved safety behavior [21].

Safety knowledge determines safety practices within organizations. Equipped with this understanding, employees make decisions and take actions that prioritize safety. The theory of planned behavior and safety knowledge emerge as pivotal determinants influencing individual behavior [48]. Effective safety leadership and positive safety behavior foster an environment conducive to knowledge acquisition. When leaders prioritize safety, they establish the organizational tone. Furthermore, employees' attitudes toward safety have a significant impact on their perceptions and willingness to actively participate in safe practices. The theory of planned behavior [44] suggests that employer safety obligations are important as when an individual perceives a deficiency in their ability or competence to undertake a particular behavior, it significantly impacts their intentions. However, scholarly discussions persist regarding the nature and clarity of this concept [49]. Within the field of construction safety, the effectiveness aspect of perceived employer safety obligations pivots, which is most aptly encapsulated by highlighting the safety knowledge construct. This approach revolves around the perceived physiological capability to execute desired safety behaviors. This provides a more nuanced comprehension of the significance of perceived employer safety obligations within the construction sector [21,50].

2.2. Safety Leadership

Safety leadership is a crucial aspect of organizational management that focuses on promoting and sustaining a safe work environment. It encompasses the behaviors, attitudes, and actions of leaders within an organization that influence employee safety culture and practices. In addition to implementing safety policies and procedures, effective safety leadership also fosters a supportive climate where everyone in the organization prioritizes and values safety [51]. Safety leadership engages the dynamic interface between influencers and followers to achieve managerial safety objectives [13]. Managers cultivate behaviors that significantly influence the safety behavior of group members, reflecting transformational leadership theory's significant influence [14].

The impact of general transformational leadership has been explored [26]. A leadership training program evaluation revealed statistically significant improvements in safety behavior, with intentions to promote safety and safety knowledge. This emphasizes the critical role of safety leadership training in enhancing workplace safety. Prior research has

emphasized that the context within which safety leadership operates significantly influences outcomes [37]. In high-accident environments, research specifically shows a close link between the management-by-exception (active) component of transformational leadership and contextual performance and safety participation, compared to lower-accident-probability situations [52].

One study explored the impact of transformational leadership on safety in Turkey. The findings revealed that safety-specific transformational leadership positively and significantly correlated with apprentices, underscoring the relevance of this leadership style in enhancing safety at construction sites [53]. Front-line construction supervisors have become a focal point of extensive research. Within the industry context, they grapple with formidable challenges, including intense production pressures, unfavorable safety attitudes among subcontractors [54] insufficiently skilled labor, and language barriers. All these factors can hinder supervisors' active participation in safety leadership [37].

Despite these challenges, prior studies have pinpointed specific leadership actions that contribute to enhancing construction safety. Research has demonstrated that regular leader-based verbal communication regarding safety significantly elevates safety levels [55]. Additionally, positive safety leadership behaviors in construction are reinforced by activities where leaders serve as role models. Given the impact of transformational leadership behaviors on positive safety performance in previous construction safety leadership research [51], we recommend further investigation into the application of transformational leadership within the construction industry. This study aims to build upon existing theoretical knowledge by practically examining how supervisors' safety-related leadership behaviors align with transformational leadership's theoretical components. Additionally, it investigates the degree to which supervisors' leadership approaches deviate from conventional models of ideal leadership behavior [26].

2.3. Safety Behavior

Safety behavior refers to the actions, decisions, and practices undertaken to ensure personal and others' safety in environments such as workplaces. It includes a variety of behaviors, like adhering to safety protocols, using PPE, reporting hazards, participating in safety training, and actively engaging in safety-related discussions and initiatives [56].

Recent research has emphasized the impact of safety behavior in various contexts, especially in high-risk industries like construction, manufacturing, and healthcare. A study by [57] highlighted the crucial role of safety behavior in reducing workplace accidents and injuries within the construction sector. The research showed that fostering a positive safety culture and encouraging proactive safety practices among employees led to a decrease in accident rates and improved overall safety effectiveness [58].

Additionally, recent studies have explored the factors influencing safety behavior and their effects on organizational performance. For example, ref. [59] examined the influence of leadership styles on safety behavior in healthcare settings [60]. The study found that transformational leadership, characterized by inspirational motivation and individualized consideration, was positively associated with employees' safety behavior, resulting in a safer work environment and better patient outcomes [53].

Additionally, advancements in technology have allowed for the development of innovative approaches to promoting safety behavior. The research by ref. [61] explored the use of wearable sensors to monitor and improve safety behavior among construction workers. The study demonstrated how real-time feedback provided by wearable devices could enhance workers' responsiveness to security hazards and persuade them to adopt safer work practices [62]. Safety behavior plays a crucial role in preventing accidents and injuries in various industries [57]. Recent research underscores the importance of nurturing a positive safety culture, effective leadership, and utilizing technological advancements to promote and sustain safe behaviors in the workplace.

2.4. Safety Leadership and Safety Behavior

Safety leadership and safety behavior represent essential components in upholding a secure work atmosphere, especially in industries prone to high risk, such as construction. Grasping the correlation between safety leadership and safety behavior is imperative for enhancing workplace safety results and diminishing the occurrence of accidents and injuries. Determining safety as an organizational output remains a contentious issue [51]. While various tools exist for measuring safety behavior, one of the most commonly employed measures is employee safety behavior [52].

Safety, operating at three distinct levels, yields positive behavioral outcomes that arise when organizations prioritize compliance or achieve a level of maturity where safety is cultivated through active participation and innovative practices [55]. One investigation introduced a model for safety performance that delineates two primary dimensions: adherence to safety protocols and engagement in safety measures [63]. Adhering to safety protocols involves essential tasks individuals must execute to preserve workplace safety, such as following standard operating procedures and utilizing personal protective gear. Conversely, participation in safety measures includes actions that indirectly influence individual safety while also contributing to cultivating an overall safer work environment. These actions comprise actively contributing to voluntary safety programs, aiding colleagues with safety-related issues, and attending safety briefings [53]. Safety leadership corresponds to the intermediary phase of safety expression, while safety behavior aligns with the proactive phase. The least favorable stage, reactive, involves responding to safety lapses, particularly during accidents and work-related illnesses [55,57].

Safety leadership then transitions into the proactive phase, aiming to institutionalize safety behavior within the system. Safety leadership is a pivotal factor influencing employees' safety behavior. Research suggests that transformational leadership in the safety context significantly enhances employees' adherence to safe behaviors [46]. Transformational leadership significantly influences the dimensions both of safety leadership and safety knowledge in employee safety behavior across different age groups, as well as participants in leadership behaviors and safety practices. Research has consistently demonstrated that workers who maintain a strong and positive relationship with their supervisors tend to express safety concerns more openly and exhibit heightened dedication to safety within the organization, resulting in a reduction in occupational accidents [64]. One study found that transformational leadership strengthens the relationship between safety knowledge and safety leadership. Specifically, under a high level of transformational leadership, employees with strong safety motivation tend to engage more actively in safety-related behaviors. Moreover, when motivated and backed by their team leader, employees display a greater propensity to aid others in establishing a secure work atmosphere. While earlier investigations have examined the impacts of different safety leadership behaviors on employees' safety conduct, this study concentrates specifically on safety leadership behavior [63,64]. Thus, we formulate the following hypothesis:

Hypothesis H1. *Safety leadership positively influences safety behavior.*

2.5. Safety Leadership and Safety Knowledge

Organizations recognize safety leadership as a crucial factor in promoting a culture of safety, which contributes to improved safety outcomes. Safety knowledge represents individuals' considerations of safety, protocols, and best practices [12]. Investigating the interplay between safety leadership and safety knowledge is essential for enhancing workplace safety and reducing incidents [65]. This research aims to explore the influence of safety leadership on safety knowledge, considering the theoretical underpinnings and empirical evidence.

Recent studies have provided empirical support for the positive relationship between safety leadership and safety knowledge. For example, the research by [66] in the manufacturing sector demonstrated that leadership behaviors emphasizing safety priorities

and communication were associated with increased safety knowledge among employees. Similarly, a study by ref. [67] on industry found that transformational leadership practices, such as providing training and resources, positively influenced employees. These results emphasize the role of leadership in influencing employees' understanding of safety principles and procedures.

The literature provides robust evidence supporting the idea that safety leadership significantly impacts employees' safety knowledge across various industries. Recent studies have particularly emphasized this relationship, shedding light on how different leadership behaviors influence employees' understanding of safety principles and procedures [68]. A group of authors perform a study in the manufacturing sector to investigate the impact of leadership behaviors on safety knowledge among employees. Their findings indicate that leadership behaviors that prioritize safety, such as safety priorities and effective communication regarding safety measures, are positively associated with increased safety knowledge among workers. This suggests that when leaders actively show an obligation to safety and effectively communicate safety expectations, employees are more likely to acquire and retain relevant safety knowledge.

Jones [67] investigated how transformational leadership practices affect safety knowledge among oil and gas industry employees. Transformational leadership provides support and resources and fosters a culture of continuous improvement. Their study revealed that transformational leadership behaviors, such as providing training opportunities and allocating resources for safety initiatives, positively impacted employees' safety knowledge [31]. This implies that when leaders invest in training programs, provide access to safety resources, and actively support employee development, they contribute to improving employees' understanding of safety principles and procedures. These studies highlight the critical role of leadership in shaping employees' safety knowledge [12].

They also demonstrate how different leadership behaviors influence safety knowledge acquisition and retention, offering valuable guidance to organizations aiming to improve safety outcomes. Effective safety leadership extends beyond merely establishing clear safety priorities. It also entails actively supporting and empowering employees in their safety endeavors and promoting learning and development in safety-related areas [58]. As such, organizations can benefit from investing in leadership training programs that emphasize the importance of safety and provide leaders with the skills and resources needed to promote a culture of safety within their teams. This hypothesis aligns with the principles of transformational leadership [31], which focus on leaders' capacity to inspire and motivate employees toward shared objectives. We expect transformational leaders to prioritize safety and provide guidance and resources to enhance employees' knowledge and skills in safety-related matters. Moreover, according to social exchange theory, supportive leadership behaviors foster a reciprocal exchange, motivating employees to engage in the organization by acquiring and applying safety knowledge [69].

Some authors hypothesize that safety leadership positively influences safety knowledge based on the established link between leadership behaviors and employee outcomes in the safety domain. Safety leaders who prioritize employee well-being, ensure transparent communication, and invest in training and resources play a pivotal role in enhancing employees' comprehension of safety principles and procedures. By fostering a safety-centric culture and championing constant learning, these leaders actively contribute to disseminating safety knowledge across the organization [58]. Based on the preceding discussion, the following hypothesis can be formulated:

Hypothesis H2. *Safety leadership positively influences safety knowledge.*

2.6. Safety Knowledge and Safety Behavior

Safety knowledge and safety behavior are critical components of maintaining a safe work environment. Safety knowledge refers to employees' understanding of safety procedures, regulations, and best practices, while safety behavior encompasses the actions

and decisions individuals undertake to ensure their safety in the workplace [56]. From one perspective, individuals acquire safety knowledge through learning. In this approach, individuals acquire safety knowledge at an individual level, gaining insights through their own experiences. This understanding of knowledge emphasizes the ability to transfer personal insights to meet organizational needs.

This research focuses primarily on individual employees' safety knowledge, with a specific emphasis on understanding how personal safety knowledge influences safety behavior [21]. Knowledge, from this perspective, involves both commitment and action [70]. The conceptual model for knowledge transfer underscores its dynamic nature, emphasizing that true acquisition of relevant knowledge occurs when workers apply knowledge to their daily organizational activities. This application is reflected in changes to personal cognition [53,56]

Within the construction industry, elevated rates of occupational injuries underscore a discrepancy between on-site safety knowledge and worker safety leadership and behaviors. The complicated nature of construction projects, coupled with organizational personnel fluctuations, adds further complexity to the challenge of effectively disseminating safety knowledge [58]. Workers who lack sufficient safety knowledge often struggle to comprehend safety procedures or identify security risks. Consequently, they find it challenging to exhibit appropriate safety behaviors when necessary. Insufficient safety knowledge can result in unsafe practices within the workplace [44].

Previous research has emphasized that knowledge serves as a prerequisite for effective action (behavior) [53]. In the context of safety, knowledge is fundamental to various job roles, enabling employees to carry out safe activities and behaviors during work. Studies consistently demonstrate that safety knowledge positively influences safety behavior throughout the entire causal chain [21]. In light of the aforementioned discussion, a hypothesis is proposed as follows:

Hypothesis H3. *Safety knowledge positively influences safety behavior.*

2.7. Safety Knowledge as a Mediator

Employees' safety knowledge, which represents their understanding of safety procedures and principles, also plays a critical role in influencing their safety behavior. Understanding the mechanisms through which safety leadership impacts safety behavior is essential for developing effective strategies to promote workplace safety [71]. Safety leadership is a critical determinant of safety behavior in the workplace. Employees' safety knowledge, representing their understanding of safety procedures and principles, also plays a vital role in influencing their safety behavior [51]. Understanding the mechanisms through which safety leadership impacts safety behavior is essential for developing effective strategies to promote workplace safety.

The purpose of this study is to investigate whether safety knowledge acts as a mediator in the connection between safety leadership and safety behavior among construction laborers, drawing upon pertinent theoretical frameworks and empirical findings [63]. Recent research has offered empirical backing for the mediating function of safety knowledge in the association between safety leadership and safety behavior. Investigations conducted in the construction sector revealed that safety knowledge partially mediates the correlation between safety leadership and perceived employer safety obligations among employees [39]. It was also demonstrated that safety knowledge mediates the relationship between safety leadership and safety behavior among construction workers. These findings underscore the importance of safety knowledge as a mechanism through which safety leadership influences safety behavior [7]. The literature presents accumulated empirical evidence supporting the idea that safety knowledge acts as a mediator in the relationship between safety leadership and safety behavior. Recent studies have particularly emphasized this mediating role, highlighting how safety knowledge serves as a mechanism through which safety leadership influences employees' safety behavior [72]. For instance, a manufacturing

industry study examined the relationship between safety leadership, safety knowledge, and safety behavior among employees. Their findings revealed that safety knowledge partially mediated the link between safety leadership and safety behavior [73].

This suggests that safety leadership behaviors that prioritize safety and support employees' safety-related learning contribute to increasing safety knowledge among employees. Subsequently, this enhanced safety knowledge leads to greater adherence to safety protocols and regulations, ultimately influencing employees' safety compliance behaviors. In the construction sector, the impact of safety leadership on safety behavior among construction workers was investigated, with a focus on safety knowledge's mediating role [74]. One study demonstrated that safety knowledge fully mediated the relationship between safety leadership and safety behavior. This implies that safety leadership behaviors, such as providing training, resources, and support for safety initiatives, contribute to the development of safety knowledge among construction workers [75]. Employees with higher levels of safety knowledge are better equipped to perform their tasks safely, leading to improved safety behavior outcomes. Collectively, these findings underscore the importance of safety knowledge as a mechanism through which safety leadership influences safety behavior among employees [74]. By investing in safety leadership practices that prioritize safety and support employees' safety-related learning and development, organizations can effectively enhance safety knowledge, leading to improved safety compliance and performance outcomes. Therefore, understanding and promoting safety knowledge as a mediator is essential for developing effective strategies to foster a culture of safety within organizations and reduce workplace accidents and injuries.

Social exchange theory [40,74] forms the basis of this hypothesis, suggesting that individuals engage in reciprocal exchanges with their leaders, whereby favorable leadership behaviors elicit positive responses. Safety leadership behaviors that prioritize safety and support employees' safety-related learning and development are likely to foster a reciprocal exchange, leading to increased safety knowledge among employees. Moreover, the theory of planned behavior suggests that safety knowledge serves as a form of perceived behavioral control, influencing employees' intentions and behaviors related to safety [44,47] and hypothesizes that safety knowledge mediates the link between safety leadership and safety behavior based on the theoretical frameworks and empirical evidence supporting this mechanism. Safety leadership behaviors that prioritize safety and support employees' safety-related learning are likely to enhance employees' safety knowledge [76]. In rotation, this increased safety knowledge empowers employees to make informed decisions and engage in safe work practices, ultimately influencing their safety behavior. Therefore, investigating safety knowledge as a mediator provides valuable insights into the processes through which safety leadership impacts safety behavior [74,77]. From the previous insights, the corresponding hypothesis is put forward:

Hypothesis H4. *The relationship between safety leadership and safety behavior is mediated by safety knowledge.*

2.8. Perceived Employer Safety Obligations as a Moderator

Perceived employer safety obligations represent an organization's commitment to safety, and can radically manipulate attitudes and behaviors regarding safety practices. Safety leadership shapes employees' safety-related attitudes and behaviors. It is important to look into how perceived employer safety obligations affect the relationship between safety leadership, safety knowledge, and safety behavior if we want to know how organizational factors affect how well safety leadership interventions work [46]. Ensuring workplace safety is heavily reliant on effective safety leadership within organizations is a critical factor that comes into play when examining employees' unsafe behavior and actions that put them at risk of accidents and occupational disorders. Research in the field of safety has consistently highlighted a positive correlation between employees' safety behavior and their perceptions of safety leadership [78]. Similarly, studies conducted on

Turkish companies focusing on occupational safety underscore a growing interest in the connection between safety leadership and safety knowledge. These findings emphasize that leadership behavior significantly contributes to enhancing workplace safety.

Ree and Wiig [79] research consistently demonstrates a strong link between safety leadership and effective management practices. These procedures include instructing employees on the proper use of personal protective equipment (PPE) and safety procedures, fostering a positive psychosocial workplace atmosphere, and ensuring routine maintenance and repairs to minimize hazards associated with malfunctioning machinery and equipment. However, it is worth noting that studies are scarcely specifically focused on safety leadership [78]. Research based on social exchange theory [40] safety behavior arises through the reciprocal influence of social interactions within organizations. Transformational leadership theory, which also builds upon social exchange theory, posits that positive safety behavior can result from both transactional and relational interactions within an organization [26]. Beliefs and perceptions regarding safety obligations are formed from employers to employees and vice versa. When employers fulfill safety-related duties and transactional responsibilities, such as offering safety training and upkeeping equipment, they communicate to employees a profound appreciation for their safety and welfare within the organization [80].

An organization's perceived emphasis on safety and authentic care for employee well-being can function as an implicit motivator, prompting employees to exhibit safe work practices in return [46]. The outcomes of one study revealed a positive correlation between construction safety initiatives—such as enhancing employee safety knowledge, promoting safety leadership, and emphasizing perceived employer safety obligations—and employee safety behavior. This finding supports the idea that safety knowledge contributes to enhancing perceived employer safety obligations, ultimately leading to improved safety behavior. The above arguments lead to the following hypotheses:

Hypothesis H5. *Positively perceived employer safety obligations strengthen the positive relationship between safety leadership and safety knowledge.*

Hypothesis H6. *Poorly perceived employer safety obligations diminish the positive relationship between safety leadership and safety behavior.*

Hypothesis H7. *Positively perceived employer safety obligations strengthen the indirect relationship between safety leadership and safety behavior positively via safety knowledge.*

The research framework for this research draws upon three key theoretical perspectives: transformational leadership theory, social exchange theory, and the theory of planned behavior. Transformational leadership posits that effective leaders inspire and motivate their followers towards shared goals, which, in the context of safety leadership, would entail promoting safe behaviors among workers. Social exchange theory suggests that workers engage in safety behavior based on perceived rewards or benefits from their organization or leaders. The theory of planned behavior asserts that attitude, social norms, and perceived behavioral control influence individuals' behavior. The conceptual model integrates these theories, with safety leadership as the independent variable, safety behavior as the dependent variable, safety knowledge as a mediator, and perceived employer safety obligations as a moderator. The hypotheses propose specific relationships between these variables, such as the positive influence of safety leadership on safety behavior and safety knowledge, as well as the moderating effect of perceived employer safety obligations. This framework provides a structured approach to understanding the dynamics of safety leadership and behavior within the Turkish construction sector, offering insights into both theory and practice. Figure 1 shows the conceptual research framework for this research.

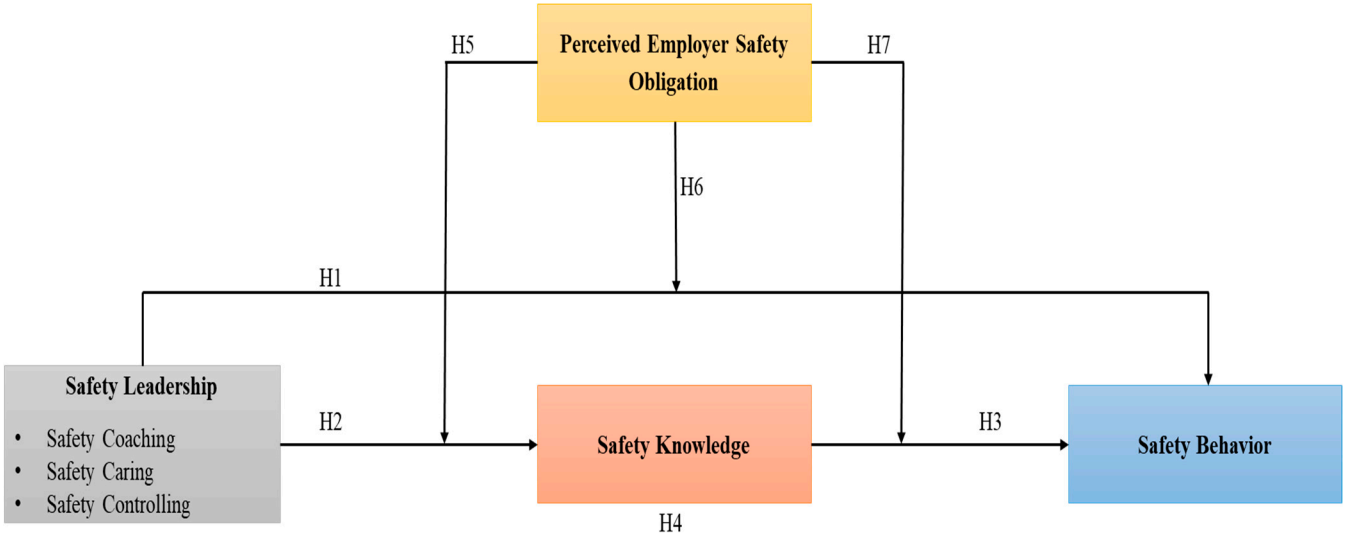


Figure 1. Conceptual research framework.

3. Research Methods

3.1. Participants and Procedure

The population and sample selection for this study were carefully designed to ensure relevance and representativeness within the context of the Turkish construction sector, specifically focusing on the bustling environment of Istanbul. Given Istanbul's status as the hub of large tertiary constructions within the country [81], it serves as an ideal locale for investigating the dynamics of safety leadership and workers' safety behaviors. This choice is supported by research indicating Istanbul's dominance in hosting major construction projects, compared to other Turkish states with relatively smaller-scale constructions [82,83].

With a total employment rate of 5.52% and a significant contribution of 6% to the total GDP, the Turkish construction sector emerges as a pivotal economic and social force in the country [84]. Moreover, the sector's substantial growth rate, averaging 10%, underscores its strategic importance in driving social and environmental development, particularly in enhancing infrastructure and quality of life [85,86].

To ensure the study's rigor and validity, the researchers targeted professionals within the construction sector, specifically civil engineers and architects, who represent key stakeholders shaping safety practices and behaviors within the industry [84,85]. This strategic focus aligns with the premise that understanding the behavior of major divisions within the construction industry is paramount for comprehensively assessing safety dynamics [82].

The data collection process employed a systematic approach, utilizing random sampling techniques to gather responses from a diverse group of construction professionals. According to the Union of Chamber of Turkish Engineers and Architects (https://www.tmmob.org.tr, accessed on 10 January 2024), Turkey has approximately 157,252 active professionals, including 106,262 civil engineers and 50,990 architects. From this pool, we randomly distributed 1000 invitations via email to members of a Building Information Centre's network, ensuring a comprehensive representation of the target population.

A robust response rate of 38% (380 respondents) was achieved, demonstrating a notable level of engagement within the professional community. Upon scrutiny, 21 responses were deemed incomplete and subsequently excluded from the analysis, resulting in a final sample size of 359 respondents. This sample size surpasses the average rate for online surveys, thus enhancing the study's statistical power and reliability [87]. Through meticulous sampling and data collection procedures, we endeavor to capture nuanced insights into the interplay between safety leadership, safety knowledge, perceived employer safety obligations, and construction workers' safety behaviors within the Turkish construction sector.

3.2. Sample Profile

The sample for this study comprised 359 participants, with the majority being male (63.8%, n = 229) and the remaining 36.2% female (n = 130). Most respondents were between 20 and 40 years old (84.2%, n = 302), reflecting a young and active workforce. In terms of educational background, 72.4% (n = 260) held either a diploma or an undergraduate degree, indicating a well-educated sample. Work experience was predominantly under five years, with 73.5% (n = 264) falling into this category. The professional composition was evenly split between civil engineers (54%, n = 194) and architects (46%, n = 165), offering diverse insights from both key roles in the construction sector.

3.3. Instrument Development

In developing the instrument for data collection, meticulous attention was devoted to crafting a comprehensive questionnaire that effectively captured the multifaceted dimensions of safety leadership, safety knowledge, perceived employer safety obligations, and safety behavior within the Turkish construction sector. The questionnaire comprised two distinct sections, with the first section housing scales designed to assess key constructs integral to the study's objectives (see Appendix A, Table A1).

In order to facilitate clarity and comprehension among respondents, the English scales were meticulously translated into Turkish by an expert committee [88], ensuring linguistic accuracy and semantic equivalence across languages [89]. A 7-point response scale ranging from "strongly disagree" to "strongly agree" was employed for items related to safety leadership, safety knowledge, and safety behavior. Conversely, items assessing perceived employer safety obligations were rated on a 7-point scale, spanning from "not at all fulfilled" to "completely fulfilled" [23].

The measurement of safety leadership drew upon established frameworks and scales within the literature, with 18 items adapted from the study by ref. [76] utilized to assess safety coaching, safety caring, and safety controlling. These constructs were validated by previous studies [90], ensuring robustness and validity in measuring safety leadership within the construction context. Safety knowledge measures were adapted from ref. [91], incorporating six statements designed to gauge respondents' understanding and awareness of safety protocols and practices within the construction domain. Furthermore, perceived employer safety obligations were assessed using 11 items developed based on ref. [92], reflecting the perceived fulfillment of safety-related responsibilities by employers within the construction sector. Finally, safety behavior, comprising dimensions of safety compliance and participation, was evaluated through a combination of four items and three items, respectively, drawn from seminal works [91,92].

3.4. Common Method Bias

To address non-response and common method bias (CMB), we implemented multiple robust checks, ensuring the data reliability critical for construction-related research. Non-response bias, which can compromise representativeness, was tested by comparing early and late survey responses based on employee and firm age using a t-test. The results indicated no significant differences (all t-statistics < 1.65, $p > 0.1$), confirming that non-response bias was not a concern in this study. Regarding CMB, a potential issue when collecting independent and dependent variable data from a single source, we adopted several preventive measures [93]. First, we collected data from highly knowledgeable construction professionals—civil engineers and architects—who possess detailed insights into safety practices within their organizations, thereby enhancing the credibility of the responses. Following ref. [94] recommendations, we conducted Harman's single-factor test, which showed that a single factor explained only 33.6% of the variance, well below the threshold of 50% for CMB concerns. Additional confirmatory tests, including the common latent factor test, were performed, further affirming the absence of significant CMB in the dataset [95]. Lastly, exploratory and confirmatory factor analyses confirmed that each item loaded onto its intended factor without substantial cross-loadings [96].

4. Data Analysis and Findings

The data analysis method employed in this study centers on PLS-SEM, a robust methodological approach that facilitates the examination of intricate links between latent variables [92,97,98]. PLS-SEM offers distinct advantages that make it well suited for this study. Primarily, it enables the analysis of complex models with multiple constructs—in this case, 7 constructs with 42 items—making it particularly valuable in handling intricate models with mediating and moderating variables [99,100]. Unlike covariance-based SEM, which requires larger sample sizes, PLS-SEM can provide reliable results with smaller samples, which enhances its applicability in data-limited contexts [101]. Moreover, PLS-SEM is robust against normality violations, a common issue in real-world data, allowing analysis without data transformation, and thus preserving data integrity [102].

Despite these strengths, PLS-SEM is less suitable for theory confirmation, as it emphasizes prediction over hypothesis testing and lacks a global goodness-of-fit metric, which limits its utility in confirming well-established theoretical models [99]. Additionally, PLS-SEM may be more susceptible to measurement error since it does not fully account for it, as covariance-based SEM does [103]. Nonetheless, its strengths in exploratory research, particularly with complex models, smaller samples, and non-normal data, align well with this study's objectives of examining the relationships between safety leadership, perceived employer safety obligations, and safety behavior in Turkey's construction sector.

4.1. Measurement Validation

In evaluating the validity and reliability of our theoretical model, we relied on the PLS-SEM 4 program as our analytical framework [104]. This methodological choice enabled us to comprehensively evaluate the robustness of our measurement constructs and the relationships between them within the context of the Turkish construction sector. To ensure the reliability of our measures, we employed established metrics such as Cronbach's α, composite reliability, and AVE [105]. Consistent with prior research recommendations, reliability values exceeding the threshold of 0.70 signify acceptable internal consistency [106]. Importantly, our analysis revealed Cronbach's α and composite reliability values exceeding this threshold across all constructs, providing strong evidence of internal consistency and reliability, as depicted in Table 1.

Table 1. Scale measurement validation.

Factors	Indicators	Outer Loadings	Cronbach's Alpha Values	Rho A	CR	AVE
Safety Knowledge			0.764	0.786	0.831	0.553
	safety knowledge 1	0.713				
	safety knowledge 2	0. 628				
	safety knowledge 3	0.634				
	safety knowledge 4	0.793				
	safety knowledge 5	0.683				
	safety knowledge 6	-				
Safety Behavior			0.913	0.916	0.931	0.659
Safety Participation	SP1	0.837	0.841	0.849	0.904	0.758
	SP2	0.916				
	SP3	0.857				
Safety Compliance	SC1	0.873	0.881	0.884	0.918	0.737
	SC2	0.857				

Table 1. *Cont.*

Factors	Indicators	Outer Loadings	Cronbach's Alpha Values	Rho A	CR	AVE
	SC3	0.823				
	SC4	0.880				
Perceived Employer Safety Obligations	Perceived Employer Safety obligations 1	0.709	0.891	0.892	0.912	0.539
	perceived employer safety obligations 2	0.792				
	perceived employer safety obligations 3	0.749				
	perceived employer safety obligations 4	0.727				
	perceived employer safety obligations 5	0.736				
	perceived employer safety obligations 6	0.719				
	perceived employer safety obligations 7	0.754				
	perceived employer safety obligations 8	0.726				
	perceived employer safety obligations 9 *	-				
	perceived employer safety obligations 10 *	-				
	perceived employer safety obligations 11	0.616				
Safety Leadership			0.931	0.934	0.939	0.565
Safety Coaching	SCA1	0.874	0.932	0.933	0.947	0.747
	SCA2	0.853				
	SCA3	0.858				
	SCA4	0.897				
	SCA5	0.885				
	SCA6	0.818				
Safety Caring	SCN1	0.850	0.890	0.895	0.915	0.644
	SCN2	0.822				
	SCN3	0.803				
	SCN4	0.788				
	SCN5	0.763				
	SCN6	0.785				
Safety Controlling	SCO1	0.776	0.895	0.900	0.920	0.658
	SCO2	0.745				
	SCO3	0.762				
	SCO4	0.867				
	SCO5	0.857				
	SCO6	0.851				

Note: * items deleted due to low factor loading.

Furthermore, we scrutinized the psychometric properties of each construct within the SEM by calculating AVE and assessing Discriminant Validity, as recommended by ref. [107]. Our findings, as presented in Table 1, demonstrated that individual factor loadings surpassed the recommended threshold of 0.5, indicating satisfactory convergent validity [107,108] Additionally, all AVE coefficients exceeded 0.5, further bolstering confidence [107]. The assessment of Discriminant Validity, depicted in Table 2, indicated HTMT values below 0.850, suggesting minimal concerns regarding multicollinearity among constructs [109].

Table 2. HTMT correlation values.

Factors	1	2	3	4	5	6	7
1. Safety Caring	0						
2. Perceived Employer Safety Obligations	0.489	0					
3. Safety Compliance	0.543	0.528	0				
4. Safety Coaching	0.633	0.449	0.682	0			
5. Safety Controlling	0.648	0.596	0.491	0.433	0		
6. Safety Knowledge	0.412	0.420	0.560	0.584	0.365	0	
7. Safety Participation	0.521	0.437	0.817	0.588	0.432	0.541	0

4.2. Hypothesis Testing

In this subsection, we present the results of hypothesis testing through the PLS-SEM 4 software version 4.1.0.1. We document every path coefficient and their associated *p*-values in Table 3, furnishing a thorough outline of the scrutinized relationships.

Table 3. Hypotheses testing results of direct, indirect, and interaction effects.

Path	Hypothesis	Standardized Path Coefficients	*t*-Values	Confidence Intervals		Decision
				Lower 2.5%	Upper 97.5%	
Step 1 (model one): Direct effects						
Safety leadership →safety behavior	H1	0.411 ***	6.447	0.279	0.529	Supported
Safety leadership → safety knowledge	H2	0.383 ***	5.072	0.241	0.535	Supported
Safety knowledge → safety behavior	H3	0.191 ***	3.614	0.091	0.299	Supported
Step 2 (model two): Indirect effect of safety knowledge						
Safety leadership → (safety knowledge) → safety behavior	H4	0.073 **	2.836	0.031	0.132	Supported
Step 3 (model three): Moderating effects of perceived employer safety obligations						
safety leadership_x_perceived employer safety obligations→ safety knowledge	H5	0.043	0.993	−0.066	0.101	Not supported
safety leadership_x_perceived employer safety obligations → safety behavior	H6	−0.318 **	3.136	−0.477	−0.071	Supported

Note: asterisks represent significance levels: **—significant at $p < 0.01$; ***—significant at $p < 0.001$.

4.3. The Direct and Indirect Results of the Structural Model Testing

In our analysis of hypothesis testing, depicted in Figure 2, the direct effects revealed significant findings that support several key relationships. Firstly, Hypothesis H1 was supported ($\beta = 0.411$; $p = 0.000$), indicating that safety leadership positively influences safety behavior. Moreover, our results corroborate the significance of Hypothesis H2 ($\beta = 0.383$; $p = 0.000$), illustrating the substantial impact of safety leadership on safety knowledge.

This underscores the pivotal role of leadership behaviors in fostering a culture of safety consciousness and awareness among employees. Additionally, Hypothesis H3 garnered support (β = 0.191; p = 0.000), elucidating the positive link between safety knowledge and behavior. Furthermore, Hypothesis H4 was supported (β = 0.073; p = 0.005), highlighting the mediating effect of safety knowledge on the relationship between safety leadership and safety behavior. This underscores the indirect influence of leadership behaviors on safety outcomes, mediated through employees' understanding and application of safety protocols.

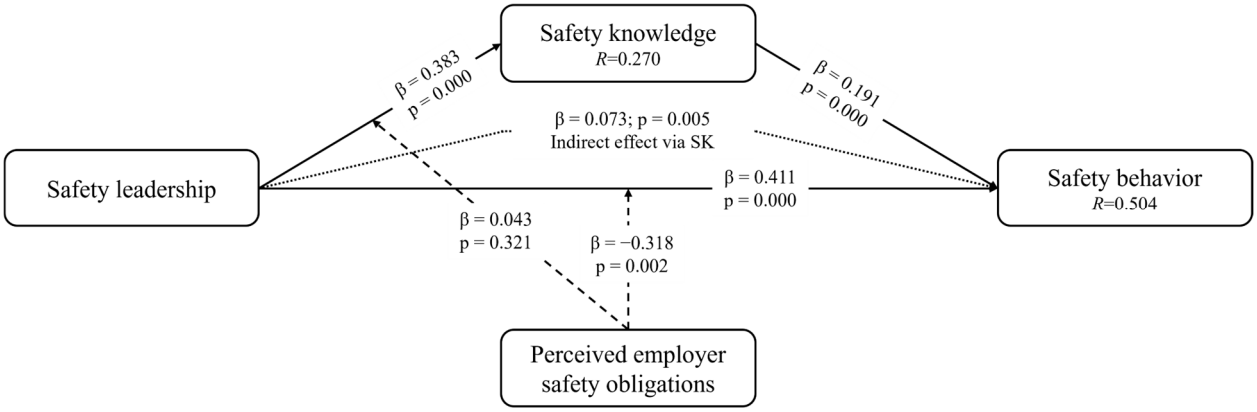


Figure 2. Structural model testing results.

4.4. Results of Moderating Effect of Perceived Employer Safety Obligations

In pursuing the secondary aim of our study, we delved into investigating the moderating effects of perceived employer safety obligations on the intricate link between safety leadership, safety knowledge, and safety behavior. Leveraging SmartPLS 4, we generated interaction terms between safety leadership and perceived employer safety obligations and conducted bootstrapping to scrutinize the statistical significance of these moderating effects [110]. Our findings reveal nuanced insights into the moderating dynamics within the Turkish construction sector (see Table 3). Specifically, the interaction term for the relationship between safety leadership and safety knowledge did not exhibit statistical significance (β = 0.043; p = 0.321), failing to provide support for Hypothesis H5. Conversely, the interaction between safety leadership and safety behavior yielded significant results (β = −0.318, p =0.002), bolstering support for Hypothesis H6. This underscores the nuanced influence of perceived employer safety obligations in shaping the relationship between safety leadership and safety behavior, emphasizing the need for a multifaceted understanding of organizational dynamics in promoting safety cultures.

4.5. Moderated Mediation Results

In delving deeper into the moderating effect of perceived employer safety obligations on the positive indirect relationship between safety leadership and safety behavior via safety knowledge, we conducted a moderated mediation analysis. To scrutinize Hypothesis H7, model 14 in the process macro was employed [111], allowing us to assess the nuanced interplay between organizational factors and individual competencies in fostering safety compliance and proactive behaviors among employees. Our analysis revealed that the interaction term between perceived employer safety obligations and safety knowledge significantly impacted safety behavior (β = 0.190, t-value = 2.759, p = 0.006), underscoring the intertwined nature of organizational dynamics and individual competencies in shaping safety outcomes within the Turkish construction sector.

The index results displayed in Table 4 unveiled a major moderated mediation mechanism of perceived employer safety obligations in the conditional indirect relationship between safety leadership and safety behavior via safety knowledge, as the 95% CI didn't include zero, both for Turkish construction employees exhibiting a low level (β = 0.040, SE = 0.015, [LLCI = 0.010, ULCI = 0.071]) and a high level (β = 0.084, SE = 0.017, [LLCI = 0.052,

ULCI = 0.118]) of PSO. Furthermore, the conditional indirect effect index also did not include zero (LLCI = 0.007, ULCI = 0.128), further affirming the significance of the mediated moderation mechanism. These findings robustly support Hypothesis H7 and investigate the intricate interplay between organizational factors, leadership behaviors, and safety knowledge in shaping safety behavior within the Turkish construction sector.

Table 4. Moderated mediation effect.

Step 4 (Model Four) Moderated Mediation Effect				
Independent Variable: Safety Leadership	**Mediator**	**Path to: Safety Behavior**	**Confidence Interval 95%**	
			Lower Bound	**Upper Bound**
Low perceived employer safety obligations (−0.331)	Safety knowledge	0.040	0.010	0.071
Mean perceived employer safety obligations (0.000)		0.062	0.040	0.088
High perceived employer safety obligations (0.331)		0.084	0.052	0.118

Note: To scrutinize Hypothesis H7, related to the conditional indirect effect of perceived employer safety obligations (perceived employer safety obligations) on the positive indirect link between safety leadership and safety behavior via safety knowledge, Model 14 in the PROCESS macro was employed [111].

5. Discussion

The main goal of this study was to identify key factors that enhance perceived employer safety obligations, which in turn improve safety behaviors. Using the theory of planned behavior as a framework, the study finds that subjective norms, attitudes toward safety practices, and perceived employer safety obligations significantly influence individuals' intentions to practice safety [78]. Safety leadership is crucial in motivating team members and reducing accident and injury rates. Safety behaviors include actions and behaviors aimed at promoting health and safety in the workplace, such as following safety protocols, participating in safety initiatives, and maintaining a safety-conscious attitude.

Various leadership styles significantly impact safety leadership, safety behavior, and safety knowledge across different contexts. The study findings validate Hypothesis H1, showing that effective safety leadership, where leaders prioritize the safety and well-being of their employees, leads to safe behavior among employees. This finding is consistent with the existing literature, which highlights the positive impact of safety leadership on safety behavior [42,63,112]. Additionally, regular reminders from on-site supervisors to prioritize safety and address unsafe behaviors promptly reinforce safety leadership, thereby supporting Hypothesis H2. On-site supervisors' involvement enhances safety training. Moreover, highlighting accident prevention measures and facilitating safety knowledge communication improve safety awareness. Implementing safety knowledge within the on-site construction setting as a component of the organization's health and safety management strategy fosters self-directed learning. In addition to safety leadership, on-site supervisors play a pivotal role in safety training and knowledge dissemination [58].

This analysis supports our hypothesis, showing that safety significantly improves employees' safety knowledge, with a p of 0.383. Additionally, our research highlights the positive impact of safety knowledge on safety behavior, indicated by a p of 0.191, underscoring the essential role of safety knowledge in promoting safety behavior. Hypothesis H4 confirms that safety knowledge mediates the link between safety leadership and safety behavior, with a p of 0.073 for the indirect effect, emphasizing safety knowledge's significant mediating role. The validation of Hypothesis H5 highlights the moderating role of perceived employer safety obligations in this study, suggesting that influential factors affect safety behavior, such as the impact of safety leadership and various dimensions of safety knowledge. Understanding how these factors contribute to employees' perceived employer safety obligations is crucial [21]. Interestingly, statistical insignificance was observed in the moderating impact of perceived employer safety obligations on the link between safety leadership and safety knowledge. This finding indicates that employees' perceived employer safety obligations do not significantly alter the impact of safety leadership on safety

knowledge. Hypothesis H6 finds support, revealing a significant negative interaction term. This suggests that when employer safety obligations are perceived to be lower, the positive impact of safety leadership on safety behavior weakens. Moving on to Hypothesis H7, different groups of researchers are looking into how safety knowledge acts as a mediator and how perceived control affects the relationship between safety knowledge and safety leadership. By examining these factors and their interactions, researchers obtain deeper insights into safety behavior and its outcomes at the individual level among construction workers. Our study emphasizes the significance of safety knowledge on safety behavior among construction workers.

Additionally, we present innovative evidence concerning the moderating result of perceived employer safety obligations on the link between safety knowledge and safety behavior [56]. Our analysis revealed that the interaction term between perceived employer safety obligations and safety knowledge significantly influenced safety behavior ($\beta = 0.190$, t-value = 2.759, $p = 0.006$); in particular, this relationship is more conspicuous among construction workers exhibiting higher levels of perceived employer safety obligations in contrast to those with lower perceived control. Specifically, the interaction term for the relationship between safety leadership and safety knowledge did not exhibit statistical significance ($\beta = 0.043$; $p = 0.321$), failing to provide support for Hypothesis H5. Conversely, the interaction between safety leadership and safety behavior yielded significant results ($\beta = -0.318$, $p = 0.002$), bolstering support for Hypothesis H6. This underscores the nuanced influence of perceived employer safety obligations in shaping the link between safety leadership and safety behavior, emphasizing the need for a multifaceted understanding of organizational dynamics in promoting safety cultures. Our investigation implies that diverse factors, such as improvements in workplace safety, play a role in the alterations in perceived employer safety obligations among construction workers. The results of our moderated mediation analysis show that higher perceived employer safety obligations [46] strengthen the indirect positive link between safety leadership and safety behavior through safety knowledge. Also, the study outcomes revealed a positive link between construction safety initiatives—such as enhancing employee safety knowledge and promoting safety leadership—and perceived employer safety obligations and employee safety behavior. This finding supports the idea that safety knowledge contributes to enhancing perceived employer safety obligations, ultimately leading to improved safety behavior.

6. Conclusions

6.1. Theoretical Contribution

The theoretical contribution of this work combines insights from transformational leadership [44] social exchange theory [40] and the theory of planned behavior to provide a complete understanding of the machinery behind safety leadership and safety behavior. Safety leadership is crucial for ensuring safety. This research explores the intricate relationship between safety leadership and safety behavior [51]. Previous studies have examined the mediating role of safety knowledge in the impact of various safety leadership styles on safety behavior indicators, considering multiple variables. This empirical study aligns construction safety leadership behaviors with theoretical concepts, particularly emphasizing the enhancement of the theory of planned behavior of safety behavior. Moreover, safety knowledge communication is vital in developing responsibilities within the context of social exchange theory [63].

Our research particularly analyzed and established links between different dimensions of the safety-enhancing comprehension of perceived employer safety obligations and employee behavior. Furthermore, this study investigates the methods through which safety is affected. Previous studies have highlighted the importance of considering intervening circumstances and possible procedural factors that influence the link between safety leadership and perceived employer safety obligations. Positively perceived employer safety obligations strengthen the positive association between safety leadership and safety

knowledge, while diminished perceived employer safety obligations weaken the positive link between safety leadership and safety behavior.

Conversely, heightened stress reinforces the indirect link between safety leadership and safety behavior, mediated by safety knowledge. This empirical study offers convincing evidence in light of the proposed model. This research constitutes an important contribution to the existing literature by applying transformational leadership theory, the theory of planned behavior, and social exchange theory. The combination of transformational leadership theory, social exchange theory, and the theory of planned behavior offers a solid foundation for comprehending and improving safety leadership and safety behavior in the construction industry. As explained by ref. [44] the theory of planned behavior states that attitudes and behavioral control are important factors in predicting safety behavior. This emphasizes the need for effective leadership and clear communication to align workers' attitudes with safety protocols [46].

According to ref. [40] the social exchange theory model proposes that reciprocal relationships in the workplace have a significant effect on safety outcomes. Positive safety leadership practices promote a shared dedication to safety, which in turn fosters a culture of complying with safety regulations and actively engaging in safety measures. Furthermore, transformational leadership theory emphasizes the impact of leadership on both an organization's culture and employee performance. Leaders who motivate and intellectually engage their teams not only cultivate a favorable safety environment, but also improve overall safety performance by exemplifying behaviors that highlight the significance of safety [16,30]. Recent empirical studies, such as those conducted by refs. [51,63] provide evidence for these theories. They demonstrate that safety knowledge acts as a mediator between transformational safety leadership and safety behavior, thereby emphasizing the importance of spreading knowledge and providing safety training.

By utilizing these interconnected theories, this research enhances our perception of the dynamic link between leadership, behavior, and organizational safety culture in the construction industry. It offers practical insights for enhancing safety management practices and minimizing workplace accidents.

6.2. Practical Implications

The findings of this research are highly pertinent for managers and safety professionals focused on accident prevention within the context of perceived employer safety obligations. This study underscores the vital role of effective safety leadership in cultivating a safety-oriented culture within construction firms. Employers can leverage these insights to create and implement leadership training programs that highlight transformational leadership qualities and role modeling of safety practices. By investing in the development of safety leadership skills among managers and supervisors, organizations can create a safer work environment and reduce workplace accidents.

This study also emphasizes the importance of safety knowledge in shaping the safety practices of construction personnel. By continuously investing in safety education and training, organizations can empower their workforce to make informed decisions and proactively prevent accidents on construction sites.

Furthermore, this research indicates that safety responsibilities can influence the response to safety leadership initiatives. Employers can enhance these perceptions by implementing transparent safety protocols and procedures, providing adequate resources and support for safety efforts, and actively involving employees in safety-related decision-making processes. Addressing concerns related to perceived employer safety obligations can help organizations foster a stronger commitment to safety among their employees.

This study's focus on the Turkish construction industry highlights the importance of considering cultural, organizational, and regulatory factors in designing and implementing safety interventions. Employers, safety professionals, and policymakers should recognize the unique challenges and dynamics present within the Turkish construction sector and modify interventions accordingly. This may involve collaborating with local stakeholders,

leveraging existing cultural norms and practices, and adapting international best practices to suit the specific needs and context of the Turkish construction industry.

6.3. Limitations and Future Directions

The limitations of this study lie in its cross-sectional design, which limits the ability to infer causal links between safety leadership, safety knowledge, and safety behavior. Future research would benefit from longitudinal studies to better capture the dynamic interplay between these variables over time. Future research employing more objective safety performance measures could enhance the reliability of future findings. The research is geographically limited to the Turkish construction industry, which limits the results' generalizability. Future studies from other regions or industries could provide broader insights and validate the model in diverse settings. Furthermore, while the study focuses on perceived employer safety obligations, it does not fully explore the broader organizational context, such as company size or safety culture, which may also impact safety behaviors. Future research should explore the role of these factors in greater depth and consider the use of mixed methods to enrich understanding. Finally, investigating the influence of emerging technologies could open new avenues for enhancing safety leadership and safety behavior in construction and other high-risk industries.

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Informed Consent Statement: All participants in this study provided their informed consent.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A Survey Measure

Table A1. Measurement items.

Safety Leadership
Safety Coaching
1. My supervisor handles safety cases honestly.
2. My supervisor sets an example by obeying safety regulations.
3. My supervisor helps employees recognize the importance of safety.
4. My supervisor explains the concept of safety clearly.
5. My supervisor involves personnel in safety decision-making.
6. My supervisor draws a picture to describe a safety vision.
Safety Caring
1. My supervisor creates a harmonious group climate.
2. My supervisor allocates safety resources fairly.
3. My supervisor accepts employees' advice to improve safety.

Table A1. *Cont.*

4. My supervisor is confident of the employee's safety performance.
5. My supervisor makes an effort to meet employees' need for safety.
6. My supervisor recognizes employees' safety achievements.
Safety Controlling
1. My supervisor orders employees to accomplish safety goals firmly.
2. My supervisor effectively assesses and rewards staff safety performance.
3. My supervisor supports to establish regulations of safety management.
4. My supervisor consistently requests employees to obey regulations of safety management.
5. My supervisor requests employees to improve safety defects continuously.
6. My supervisor regularly audits employees' safety performance.
Safety Knowledge
1. I know how to perform my job safely.
2. I know how to use safety equipment and standard work procedures.
3. I know how to maintain or improve workplace health and safety.
4. I know how to reduce the risk of accidents and incidents in the workplace.
5. I know what hazards are associated with my job and the necessary precautions to be taken while doing my job.
6. I don't know what to do and whom to report if a potential hazard is noticed in my workplace. *
Perceived Employer Safety Obligation
1. Provided me with safety training.
2. Showed me how to prevent accidents.
3. Pointed out aspects of the job that could potentially harm me.
4. Taught me how to respond to emergencies.
5. Prevented me from carrying out potentially dangerous work.
6. Prevented me from performing a task that I have not been properly trained to do.
7. Taught me how to properly use equipment and machinery.
8. Ensured that my co-workers were properly trained before performing a job.
9. Monitored the safety behavior of my co-workers to ensure they did not injure someone. *
10. Implemented safety policies and practices. *
11. Ensured the equipment is maintained and properly functioning.
Safety Behavior
Safety Compliance
1. I carry out work in a safe manner.
2. I use all necessary safety equipment to do my job.
3. I use the correct safety procedures for carrying out my job.
4. I ensure the highest level of safety when I carry out my job.
Safety Participation
1. I put in extra effort to improve the safety of my workplace.
2. I help my co-workers when they are working under hazardous conditions.
3. I voluntarily carry out tasks or activities that help improve workplace safety.

Note: * Item deleted.

References

1. Ozyuksel, S.; Bacak, Y. Impact of engineering insurances on the growth of Turkish construction sector. *Int. J. Econ. Financ.* **2020**, *12*, 1–28. [CrossRef]
2. Buniya, M.K.; Othman, I.; Sunindijo, R.Y.; Kineber, A.F.; Mussi, E.; Ahmad, H. Barriers to safety program implementation in the construction industry. *Ain Shams Eng. J.* **2021**, *12*, 65–72. [CrossRef]
3. Xia, N.; Tang, Y.; Li, D.; Pan, A. Safety behavior among construction workers: Influences of personality and leadership. *J. Constr. Eng. Manag.* **2021**, *147*, 04021019. [CrossRef]
4. Heinrich, H.W.; Petersen, D.; Roos, N. *Industrial Accident Prevention*; McGraw-Hill: New York, NY, USA, 1941.
5. Clarke, S.; Robertson, I. An examination of the role of personality in work accidents using meta-analysis. *Appl. Psychol.* **2008**, *57*, 94–108. [CrossRef]
6. Lawton, R.; Parker, D. Individual differences in accident liability: A review and integrative approach. *Hum. Factors* **1998**, *40*, 655–671. [CrossRef]
7. Tam, C.M.; Zeng, S.X.; Deng, Z.M. Identifying elements of poor construction safety management in China. *Saf. Sci.* **2004**, *42*, 569–586. [CrossRef]
8. Othman, I.; Shafiq, N.; Nuruddin, M.F. Effective safety management in construction projects. *IOP Conf. Ser. Mater. Sci. Eng.* **2017**, *291*, 012018. [CrossRef]
9. Clarke, S. Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviors. *J. Occup. Organ. Psychol.* **2013**, *86*, 22–49. [CrossRef]
10. Asad, M.; Kashif, M.; Sheikh, U.A.; Asif, M.U.; George, S.; Khan, G.U.H. Synergistic effect of safety culture and safety climate on safety performance in SMEs: Does transformational leadership have a moderating role? *Int. J. Occup. Saf. Ergon.* **2022**, *28*, 1858–1864. [CrossRef]
11. Zhao, L.; Yang, D.; Liu, S.; Nkrumah, E.N.K. The effect of safety leadership on safety participation of employees: A meta-analysis. *Front. Psychol.* **2022**, *13*, 827694. [CrossRef]
12. Chen, W.T.; Tsai, I.-C.; Merrett, H.C.; Lu, S.T.; Lee, Y.-I.; You, J.-K.; Mortis, L. Construction safety success factors: A Taiwanese case study. *Sustainability* **2020**, *12*, 6326. [CrossRef]
13. Martin, H.; Lewis, T.M. Pinpointing safety leadership factors for safe construction sites in Trinidad and Tobago. *J. Constr. Eng. Manag.* **2014**, *140*, 04013046. [CrossRef]
14. Tyssen, A.K.; Wald, A.; Spieth, P. The challenge of transactional and transformational leadership in projects. *Int. J. Proj. Manag.* **2014**, *32*, 365–375. [CrossRef]
15. Wu, C.; Fang, D.; Li, N. Roles of owners' leadership in construction safety: The case of high-speed railway construction projects in China. *Int. J. Proj. Manag.* **2015**, *33*, 1665–1679. [CrossRef]
16. Chemers, M.M. *An Integrative Theory of Leadership*; Lawrence Erlbaum Associates, Inc.: Mahwah, NJ, USA, 2014.
17. Wu, C.; Song, X.; Wang, T.; Fang, D. Core dimensions of the construction safety climate for a standardized safety-climate measurement. *J. Constr. Eng. Manag.* **2015**, *141*, 04015018. [CrossRef]
18. Zhang-Liao, Z.L.; Chen, H.C.; Li, H.X.; Wu, X.G.; Skibniewski, M.J. Perceiving interactions and dynamics of safety leadership in construction projects. *Saf. Sci.* **2018**, *106*, 66–78. [CrossRef]
19. Zhou, L.; Fu, G.; Liu, X. Statistics and analysis of chemical accidents based on behavioral safety theory. *Sci. Technol. Safe Prod. China* **2016**, *12*, 148–153.
20. Hofmann, D.A.; Jacobs, R.; Landy, F. High-reliability process industries: Individual, micro, and macro-organizational influences on safety performance. *J. Saf. Res.* **1995**, *26*, 131–149. [CrossRef]
21. Duryan, M.; Smyth, H.; Roberts, A.; Rowlinson, S.; Sherratt, F. Knowledge transfer for occupational health and safety: Cultivating health and safety learning culture in construction firms. *Accid. Anal. Prev.* **2020**, *139*, 105496. [CrossRef]
22. Walker, A.; Hutton, D.M. The application of the psychological contract to workplace safety. *J. Saf. Res.* **2006**, *37*, 433–441. [CrossRef]
23. Mullen, J.; Kelloway, E.K.; Teed, M. Employer safety obligations, transformational leadership, and their interactive effects on employee safety performance. *Saf. Sci.* **2017**, *91*, 405–412. [CrossRef]
24. Shen, Y.; Koh, T.Y.; Rowlinson, S.; Bridge, A.J. Empirical investigation of factors contributing to the psychological safety climate on construction sites. *J. Constr. Eng. Manag.* **2015**, *141*, 04015038. [CrossRef]
25. Xu, S.; Zou, P.X.; Luo, H. Impact of attitudinal ambivalence on safety behavior in construction. *Adv. Civ. Eng.* **2018**, *2018*, 7138930. [CrossRef]
26. Oswald, D.; Lingard, H.; Zhang, R.P. How transactional and transformational safety leadership behaviors are demonstrated within the construction industry. *Constr. Manag. Econ.* **2020**, *40*, 374–390. [CrossRef]
27. Ahmad, R.; Nawaz, M.R.; Ishaq, M.I.; Khan, M.M.; Ashraf, H.A. Social exchange theory: Systematic review and future directions. *Front. Psychol.* **2023**, *13*, 1015921. [CrossRef]
28. Yu, X.; Mehmood, K.; Paulsen, N.; Ma, Z.; Kwan, H.K. Why safety knowledge cannot be transferred directly to expected safety outcomes in construction workers: The moderating effect of physiological perceived control and the mediating effect of safety behavior. *J. Constr. Eng. Manag.* **2021**, *147*, 04020152. [CrossRef]
29. Martinez, S.A.; Leija, N. Distinguishing servant leadership from transactional and transformational leadership. *Adv. Dev. Hum. Resour.* **2023**, *25*, 141–188. [CrossRef]

30. He, C.; McCabe, B.; Jia, G.; Sun, J. Effects of safety climate and safety behavior on safety outcomes between supervisors and construction workers. *J. Constr. Eng. Manag.* **2020**, *146*, 04019092. [CrossRef]
31. Siangchokyoo, N.; Klinger, R.L.; Campion, E.D. Follower transformation as the linchpin of transformational leadership theory: A systematic review and future research agenda. *Leadersh. Q.* **2020**, *31*, 101341. [CrossRef]
32. Pham, H.T.; Pham, T.; Quang, H.T.; Dang, C.N. Impact of transformational leadership on green learning and green innovation in construction supply chains. *Eng. Constr. Archit. Manag.* **2023**, *30*, 1883–1901. [CrossRef]
33. Baskoro, B.D.; Sudarmadji, S.; Suherman, S.; Yani, A.; Simanjuntak, R. Transformational leadership, knowledge management, work motivation, and employee performance among construction employees in Jakarta. *Int. J. Multicult. Multirelig. Underst.* **2021**, *8*, 214–230. [CrossRef]
34. Ali, H.; Chuanmin, S.; Ahmed, M.; Mahmood, A.; Khayyam, M.; Tikhomirova, A. Transformational leadership and project success: Serial mediation of team-building and teamwork. *Front. Psychol.* **2021**, *12*, 689311. [CrossRef] [PubMed]
35. Kozcu, G.Y.; Özmen, Ö. Effects of transformational leadership on organizational change management and organizational ambidexterity. *Glob. J. Econ. Bus. Stud.* **2021**, *10*, 15–25.
36. Zaman, U. Examining the effect of xenophobia on "transnational" megaconstruction project (MCP) success: Moderating role of transformational leadership and high-performance work practices. *Eng. Constr. Archit. Manag.* **2020**, *27*, 1119–1143. [CrossRef]
37. Al-Subaie, A.A.; Faisal, M.N.; Aouni, B.; Talib, F. A strategic framework for transformational leadership development in megaprojects. *Sustainability* **2021**, *13*, 3480. [CrossRef]
38. Mahfouz, S.A.; Awang, Z.; Muda, H.; Bahkia, A.S. The mediating role of employee commitment in the relationship between transformational leadership style and employee performance. *Humanit. Soc. Sci. Rev.* **2020**, *8*, 624–637. [CrossRef]
39. Reader, T.W.; Mearns, K.; Lopes, C.; Kuha, J. Organizational support for the workforce and employee safety citizenship behaviors: A social exchange relationship. *Hum. Relat.* **2017**, *70*, 362–385. [CrossRef]
40. Thomas, A.; Gupta, V. Social capital theory, social exchange theory, social cognitive theory, financial literacy, and the role of knowledge sharing as a moderator in enhancing financial well-being: From bibliometric analysis to a conceptual framework model. *Front. Psychol.* **2021**, *12*, 664638. [CrossRef] [PubMed]
41. Cao, E.; Jiang, J.; Duan, Y.; Peng, H. A data-driven expectation prediction framework based on social exchange theory. *Front. Psychol.* **2022**, *12*, 783116. [CrossRef]
42. Shen, Y.; Ju, C.; Koh, T.Y.; Rowlinson, S.; Bridge, A.J. The impact of transformational leadership on safety climate and individual safety behavior on construction sites. *Int. J. Environ. Res. Public Health* **2017**, *14*, 45. [CrossRef]
43. Henseler, J.; Dijkstra, T.K.; Sarstedt, M.; Ringle, C.M.; Diamantopoulos, A.; Straub, D.W.; Ketchen, D.J.; Hair, J.F.; Hult, G.T.M.; Calantone, R.J. Common beliefs and reality about PLS: Comments on Rönkkö and Evermann. *Organ. Res. Methods* **2014**, *17*, 182–209. [CrossRef]
44. Ajzen, I. The theory of planned behavior: Frequently asked questions. *Hum. Behav. Emerg. Technol.* **2020**, *2*, 314–324. [CrossRef]
45. Ahmed, N.; Li, C.; Khan, A.; Qalati, S.A.; Naz, S.; Rana, F. Purchase intention toward organic food among young consumers using the theory of planned behavior: Role of environmental concerns and environmental awareness. *J. Environ. Plan. Manag.* **2021**, *64*, 796–822. [CrossRef]
46. Liu, S.; Yang, X.; Mei, Q. The effect of perceived organizational support for safety and organizational commitment on employee safety behavior: A meta-analysis. *Int. J. Occup. Saf. Ergon.* **2021**, *27*, 1154–1165. [CrossRef]
47. Nickell, G.S.; Hinsz, V.B. Applying the Theory of Planned Behavior to understand workers' production of safe food. *Rev. Psicol. Trab. Organ.* **2023**, *39*, 89–100. [CrossRef]
48. Pillai, S.G.; Kim, W.G.; Haldorai, K.; Kim, H.-S. Online food delivery services and consumers' purchase intention: Integration of the theory of planned behavior, theory of perceived risk, and the elaboration likelihood model. *Int. J. Hosp. Manag.* **2022**, *105*, 103275. [CrossRef]
49. Qi, X.; Ploeger, A. Explaining Chinese consumers' green food purchase intentions during the COVID-19 pandemic: An extended Theory of Planned Behavior. *Foods* **2021**, *10*, 1200. [CrossRef] [PubMed]
50. Han, H.; Al-Ansi, A.; Chua, B.-L.; Tariq, B.; Radic, A.; Park, S.-H. The post-coronavirus world in the international tourism industry: Application of the theory of planned behavior to safer destination choices in the case of US outbound tourism. *Int. J. Environ. Res. Public Health* **2020**, *17*, 6485. [CrossRef]
51. Zhang, J.; Xie, C.; Wang, J.; Morrison, A.M.; Coca-Stefaniak, J.A. Responding to a major global crisis: The effects of hotel safety leadership on employee safety behavior during COVID-19. *Int. J. Contemp. Hosp. Manag.* **2020**, *32*, 3365–3389. [CrossRef]
52. Lyu-bykh, Z.; Gulseren, D.; Turner, N.; Barling, J.; Seifert, M. Shared transformational leadership and safety behaviors of employees, leaders, and teams: A multilevel investigation. *J. Occup. Organ. Psychol.* **2022**, *95*, 431–458. [CrossRef]
53. Gao, Y.; González, V.A.; Yiu, T.W. Exploring the relationship between construction workers' personality traits and safety behavior. *J. Constr. Eng. Manag.* **2020**, *146*, 04019111. [CrossRef]
54. Çınar, S. Construction labour, subcontracting, and masculinity: Construction is a man's job. *Constr. Manag. Econ.* **2020**, *38*, 275–290. [CrossRef]
55. Grill, M.; Nielsen, K. Promoting and impeding safety—A qualitative study into direct and indirect safety leadership practices of construction site managers. *Saf. Sci.* **2019**, *114*, 148–159. [CrossRef]

56. Adami, P.; Rodrigues, P.B.; Woods, P.J.; Becerik-Gerber, B.; Soibelman, L.; Copur-Gencturk, Y.; Lucas, G. Effectiveness of VR-based training on improving construction workers' knowledge, skills, and safety behavior in robotic teleoperation. *Adv. Eng. Inform.* **2021**, *50*, 101431. [CrossRef]
57. Binshakir, O.; AlGhanim, L.; Fathaq, A.; AlHarith, A.M.; Ahmed, S.; El-Sayegh, S. Factors affecting the bidding decision in sustainable construction. *Sustainability* **2023**, *15*, 14225. [CrossRef]
58. Huang, Y.-H.; Yang, T.-R. Exploring on-site safety knowledge transfer in the construction industry. *Sustainability* **2019**, *11*, 6426. [CrossRef]
59. Tadesse, S.; Asgedom, T.; Taddese, A. Leadership behavior association with human resource management practice in selected Ethiopian sport federations. *Res. Sport Educ. Sci.* **2024**, *26*, 9–15.
60. Neal, A.; Griffin, M.A. A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *J. Appl. Psychol.* **2006**, *91*, 946–953. [CrossRef]
61. Seong, S.; Park, S.; Ahn, Y.H.; Kim, H. Development of an integrated fatigue measurement system for construction workers: A feasibility study. *BMC Public Health* **2022**, *22*, 1593. [CrossRef]
62. Çelik, G.; Oral, E. Mediating effect of job satisfaction on the organizational commitment of civil engineers and architects. *Int. J. Constr. Manag.* **2021**, *21*, 969–986. [CrossRef]
63. Draghici, A.; Dursun, S.; Başol, O.; Boatcă, M.E.; Gaureanu, A. The mediating role of safety climate in the relationship between transformational safety leadership and safe behavior—The case of two companies in Turkey and Romania. *Sustainability* **2022**, *14*, 8464. [CrossRef]
64. Jiang, L.; Probst, T.M. Transformational and passive leadership as cross-level moderators of the relationships between safety knowledge, safety motivation, and safety participation. *J. Saf. Res.* **2016**, *57*, 27–32. [CrossRef] [PubMed]
65. Li, R.Y.M.; Chau, K.W.; Lu, W.; Ho, D.C.W.; Shoaib, M.; Meng, L. Construction hazard awareness and construction safety knowledge sharing epistemology. In Proceedings of the International Conference on Smart Infrastructure and Construction 2019 (ICSIC): Driving Data-Informed Decision-Making, Cambridge, UK, 8–10 July 2019; pp. 283–290.
66. Bin-Zulkifly, S.S.; Bin Hasan, N.H.; Bin Baharudin, M.R. Role of safety leadership in fostering safety behavior in Malaysia's small and medium manufacturers: Determining the effect of safety knowledge and attitudes. *Res. Mil.* **2022**, *12*, 1154–1166.
67. Jones, K. The Influence of Transformational Leadership Style of Real Estate Managing Brokers, Perceptions of Group Dynamics, and the Influence of These Perceptions on Job Satisfaction. Ph.D. Thesis, Capella University, Minneapolis, MN, USA, 2022.
68. Buchan, S.A.; Smith, P.M.; Warren, C.; Murti, M.; Mustard, C.; Kim, J.H.; Menon, S.; Brown, K.; Van Ingen, T.; Smith, B.T. Incidence of outbreak-associated COVID-19 cases by industry in Ontario, Canada, 1 April 2020–31 March 2021. *Occup. Environ. Med.* **2022**, *79*, 403–411. [CrossRef] [PubMed]
69. Basahel, A.M. Safety leadership, safety attitudes, safety knowledge, and motivation toward safety-related behaviors in electrical substation construction projects. *Int. J. Environ. Res. Public Health* **2021**, *18*, 4196. [CrossRef]
70. Bowen, P.; Edwards, P.; Lingard, H.; Cattell, K. Workplace stress, stress effects, and coping mechanisms in the construction industry. *J. Constr. Eng. Manag.* **2014**, *140*, 04013059. [CrossRef]
71. Yin, J.; Ma, Z.; Yu, H.; Jia, M.; Liao, G. Transformational leadership and employee knowledge sharing: Explore the mediating roles of psychological safety and team efficacy. *J. Knowl. Manag.* **2020**, *24*, 150–171. [CrossRef]
72. Ni, G.; Zhu, Y.; Zhang, Z.; Qiao, Y.; Li, H.; Xu, N.; Deng, Y.; Yuan, Z.; Wang, W. Influencing mechanism of job satisfaction on safety behavior of the new generation of construction workers based on Chinese context: The mediating roles of work engagement and safety knowledge sharing. *Int. J. Environ. Res. Public Health* **2020**, *17*, 8361. [CrossRef]
73. Fikri, M.A.A.; Pramono, T.; Nugroho, Y.A.; Novitasari, D.; Asbari, M. Leadership model in pesantren: Managing knowledge sharing through psychological climate. *Int. J. Soc. Manag. Stud.* **2021**, *2*, 149–160.
74. Nagaraj, S. Role of consumer health consciousness, food safety attitude on organic food purchase in an emerging market: A serial mediation model. *J. Retail. Consum. Serv.* **2021**, *59*, 102423. [CrossRef]
75. Dwivedi, P.; Chaturvedi, V.; Vashist, J.K. Transformational leadership and employee efficiency: Knowledge sharing as mediator. *Benchmarking Int. J.* **2020**, *27*, 1571–1590. [CrossRef]
76. Wu, T.-C.; Chen, C.-H.; Li, C.-C. A correlation among safety leadership, safety climate, and safety performance. *J. Loss Prev. Process Ind.* **2008**, *21*, 307–318. [CrossRef]
77. Liu, S.; Nkrumah, E.N.K.; Akoto, L.S.; Gyabeng, E.; Nkrumah, E. The state of occupational health and safety management frameworks (OHSMF) and occupational injuries and accidents in the Ghanaian oil and gas industry: Assessing the mediating role of safety knowledge. *BioMed Res. Int.* **2020**, *2020*, 6354895. [CrossRef] [PubMed]
78. Koo, K.E.; Nurulazam, M.A.; Rohaida, M.S.; Teo, T.G.; Salleh, Z. Examining the potential of safety knowledge as an extension construct for the theory of planned behavior: Explaining safety practices of young adults at engineering laboratories and workshops. *Procedia-Soc. Behav. Sci.* **2014**, *116*, 1513–1518.
79. Ree, E.; Wiig, S. Linking transformational leadership, patient safety culture, and work engagement in home care services. *Nurs. Open* **2020**, *7*, 256–264. [CrossRef] [PubMed]
80. Wahyuni, N.P.D.; Purwandari, D.A.; Syah, T.Y.R. Transactional leadership, motivation, and employee performance. *J. Multidiscip. Acad.* **2020**, *3*, 156–161.
81. Yıldırım, N.; Gultekin, D.; Tilkici, D.; Ay, D. An institutional system proposal for advanced occupational safety and labor standards in the Turkish construction industry. *Int. J. Environ. Res. Public Health* **2022**, *19*, 15113. [CrossRef]

82. Akiner, I.; Tijhuis, W. Work goal orientation of construction professionals in Turkey: Comparison of architects and civil engineers. *Constr. Manag. Econ.* **2007**, *25*, 1165–1175. [CrossRef]
83. Yilmaz, F. Analysis of occupational accidents in the construction sector in Turkey. *J. Multidiscip. Eng. Sci. Technol.* **2014**, *1*, 421–428.
84. Qabaja, M.; Tenekeci, G. Nexus between the construction sector and economic indicators for Turkey and the European Union evidenced by panel data analysis. *Eng. Constr. Archit. Manag.* **2022**, *30*, 1978–2007. [CrossRef]
85. Ayalp, G.G.; Çivici, T. Factors affecting the performance of the construction industry during the COVID-19 pandemic: A case study in Turkey. *Eng. Constr. Archit. Manag.* **2022**, *30*, 3160–3202. [CrossRef]
86. Gurcanli, G.E.; Bilir Mahcicek, S.; Serpel, E.; Attia, S. Factors affecting productivity of technical personnel in the Turkish construction industry: A field study. *Arab. J. Sci. Eng.* **2021**, *46*, 11339–11353. [CrossRef]
87. Nulty, D.D. The adequacy of response rates to online and paper surveys: What can be done? *Assess. Eval. High. Educ.* **2008**, *33*, 301–314. [CrossRef]
88. Aljuhmani, H.Y.; Emeagwali, O.L.; Ababneh, B. The relationships between CEOs' psychological attributes, top management team behavioral integration, and firm performance. *Int. J. Organ. Theory Behav.* **2021**, *24*, 126–145. [CrossRef]
89. Babbie, E.R. *The Practice of Social Research*, 15th ed.; Cengage Learning: Boston, MA, USA, 2020.
90. Subramaniam, C.; Johari, J.; Mashi, M.S.; Mohamad, R. The influence of safety leadership on nurses' safety behavior: The mediating role of safety knowledge and motivation. *J. Saf. Res.* **2023**, *84*, 117–128. [CrossRef]
91. Vinodkumar, M.; Bhasi, M. Safety management practices and safety behavior: Assessing the mediating role of safety knowledge and motivation. *Accid. Anal. Prev.* **2010**, *42*, 2082–2093. [CrossRef] [PubMed]
92. Walker, A. The development and validation of a psychological contract of safety scale. *J. Saf. Res.* **2010**, *41*, 315–321. [CrossRef]
93. Nasr, E.; Emeagwali, O.L.; Aljuhmani, H.Y.; Al-Geitany, S. Destination social responsibility and residents' environmentally responsible behavior: Assessing the mediating role of community attachment and involvement. *Sustainability* **2022**, *14*, 14153. [CrossRef]
94. Podsakoff, P.M.; MacKenzie, S.B.; Lee, J.-Y.; Podsakoff, N.P. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* **2003**, *88*, 879–903. [CrossRef]
95. Lindell, M.K.; Whitney, D.J. Accounting for common method variance in cross-sectional research designs. *J. Appl. Psychol.* **2001**, *86*, 114–121. [CrossRef]
96. Costello, A.B.; Osborne, J. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Pract. Assess. Res. Eval.* **2005**, *10*, 7.
97. Al-Tera, A.; Alzubi, A.; Iyiola, K. Supply chain digitalization and performance: A moderated mediation of supply chain visibility and supply chain survivability. *Heliyon* **2024**, *10*, e25584. [CrossRef] [PubMed]
98. Neiroukh, S.; Emeagwali, O.L.; Aljuhmani, H.Y. Artificial intelligence capability and organizational performance: Unraveling the mediating mechanisms of decision-making processes. *Manag. Decis.* 2024; *ahead-of-print*. [CrossRef]
99. Hair, J.F.; Risher, J.J.; Sarstedt, M.; Ringle, C.M. When to use and how to report the results of PLS-SEM. *Eur. Bus. Rev.* **2019**, *31*, 2–24. [CrossRef]
100. Akter, S.; Fosso Wamba, S.; Dewan, S. Why PLS-SEM is suitable for complex modeling? An empirical illustration in big data analytics quality. *Prod. Plan. Control.* **2017**, *28*, 1011–1021. [CrossRef]
101. Al'Ararah, K.; Çağlar, D.; Aljuhmani, H.Y. Mitigating job burnout in Jordanian public healthcare: The interplay between ethical leadership, organizational climate, and role overload. *Behav. Sci.* **2024**, *14*, 490. [CrossRef] [PubMed]
102. Alsafadi, Y.; Aljuhmani, H.Y. The influence of entrepreneurial innovations in building competitive advantage: The mediating role of entrepreneurial thinking. *Kybernetes* **2023**, *9*, 100082. [CrossRef]
103. Lowry, P.B.; Gaskin, J. Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Trans. Prof. Commun.* **2014**, *57*, 123–146. [CrossRef]
104. Ringle, C.M.; Wende, S.; Becker, J.-M. *SmartPLS, Version 4*; SmartPLS GmbH: Oststeinbek, Germany, 2022; Available online: https://www.smartpls.com (accessed on 10 January 2024).
105. Salamah, E.; Alzubi, A.; Yinal, A. Unveiling the impact of digitalization on supply chain performance in the post-COVID-19 era: The mediating role of supply chain integration and efficiency. *Sustainability* **2024**, *16*, 304. [CrossRef]
106. Awwad, R.I.; Aljuhmani, H.Y.; Hamdan, S. Examining the relationships between frontline bank employees' job demands and job satisfaction: A mediated moderation model. *SAGE Open* **2022**, *12*, 215824402210798. [CrossRef]
107. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
108. Hair, J.F.; Hult, G.T.M.; Ringle, C.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equations Modeling (PLS-SEM)*, 2nd ed.; SAGE: Thousand Oaks, CA, USA, 2017.
109. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* **2015**, *43*, 115–135. [CrossRef]
110. Al-Geitany, S.; Aljuhmani, H.Y.; Emeagwali, O.L.; Nasr, E. Consumer behavior in the post-COVID-19 era: The impact of perceived interactivity on behavioral intention in the context of virtual conferences. *Sustainability* **2023**, *15*, 8600. [CrossRef]

111. Hayes, A.F. Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Commun. Monogr.* **2009**, *76*, 408–420. [CrossRef]
112. Barling, J.; Loughlin, C.; Kelloway, E.K. Development and test of a model linking safety-specific transformational leadership and occupational safety. *J. Appl. Psychol.* **2002**, *87*, 488. [CrossRef] [PubMed]

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