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Complex Cause-Effect Relationships of Social Capital, Leader-Member Exchange, and Safety Behavior of Workers in Small-Medium Construction Firms and the Moderating Role of Age

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Abstract: Due to workers’ vulnerability in construction sites, workplace safety has become of particular interest, and the current literature offers myriad approaches to dealing with it. From a social and organizational lens, this study explores an empirical model that integrates the dimensions of social capital theory (SCT) and leader-member exchange (LMX) in modelling the safety behavior of construction workers, particularly relevant in small-medium construction firms. The data were collected from 232 construction workers in the central Philippines. The responses were analyzed using partial least squares—structural equation modeling to investigate five hypothesized paths, including the influence of SCT dimensions (e.g., structural, relational, and cognitive) on LMX and LMX on safety behaviors (i.e., compliance and participation). We also tested whether the relationship of LMX to safety behaviors is moderated by age. The results indicate that the three dimensions of SCT have a significant and direct influence on LMX. In addition, LMX directly affects safety participation but does not significantly affect safety compliance. Particularly in small and medium construction firms with relatively flat organizational structures and supervisors displaying diverse roles, these findings suggest that the social relationships of workers tend to promote their trust and professional respect for supervisors who can leverage their position to encourage them participate in safety initiatives. On the other hand, age negatively influences the relationship of LMX to safety participation, indicating that younger workers tend to better translate high quality LMX into initiatives that promote overall workplace safety. Our findings offer the first evidence of the positive relationship between SCT and LMX in advancing the safety participation of construction workers. From these insights, practical inputs to the design of relevant measures and future research works are outlined.

Keywords: social capital; leader-member exchange; safety behavior; construction workers; small-medium enterprises

1. Introduction

The construction sector plays a vital role in the economy by building establishments, healthcare facilities, educational premises, railways, airports, roadways, and bridges that drive development [1]. In fact, in 2020, the global construction output was estimated at 10.7 trillion US dollars and is expected to grow continuously by 42% for the next ten years [2]. In developing economies such as the Philippines, the construction sector helps
improve the country’s socio-economic development as it comprises 16.6% of the gross domestic product [3]. The United Nations Sustainable Development Goals highlight the need to promote safe and secure working environments for all workers, embedded in achieving decent work and economic growth (Goal 8). However, construction is considered one of the most dangerous industries globally for workers, especially in developing economies where work is less automated yet more labor intensive [4]. When measured against international standards, construction workers in developing economies rarely observe the strict implementation of safety practices, i.e., often performing most tasks manually, making them more exposed to hazards and vulnerable to severe injuries when accidents occur [5]. Due to the increased exposure and vulnerability of workers in the construction industry, a collective effort to address relevant pressing issues must be at the forefront of scholarly and policy discussions to contribute to achieving sustainability Goal 8 by 2030.

In the Philippines, for instance, occupational injuries and accidents are more prevalent since workers are highly at risk due to poor working conditions and occupational hazards [6]. The Occupational Safety and Health Center of the Department of Labor and Employment, the country’s government arm in labor-related concerns, addressed these problems by providing safety and health training to the safety officers of construction firms [7]. Moreover, in 2018, an improved measure that strengthens occupational safety and health initiatives was enacted as the overall guideline for construction firms, among others [8]. Despite these efforts, the number of construction accidents is still relatively high. In fact, construction work in the country incurs an estimated 1986 to 3032 cases of occupational injuries, most of which are musculoskeletal due to the nature of the work and burns caused by contact with overhead electrical power lines [6]. These observations are also prevalent in other developing economies [9–11]. In addition, the rarity of practicing safety measures is even more observed in construction small and medium enterprises (SMEs) [12]. In contrast with large firms, they are more financially constrained and have less market share and profit margin, thus making them less likely to invest in augmenting safety [13,14]. Consequently, fatal accidents in construction SMEs are reportedly eight times more likely than in large firms [15]. This issue becomes more significant since SMEs dominate the construction industry [16].

A considerable volume of studies in the literature has been dedicated to managing the root causes of occupational accidents, particularly from the agenda of construction technologies (e.g., [17,18]), management (e.g., [19,20]), and behavioral and social perspectives (e.g., [21,22]), with emphasis mostly attributed to cutting-edge technologies [14,23,24]. Specifically, the investigation of the unsafe behavior of workers, its causes and effects have gained considerable attention to promote workplace safety in recent years [23,25,26]. Accordingly, for decades, one of the many factors that contribute to accidents in construction has been the unsafe behavior of construction workers [27–29]. The non-adherence and non-compliance of construction workers to the safety and health guidelines have been directly associated with their safety negligence, as prescribed by previous studies (e.g., [30,31]). However, eliminating workers’ disorderly conduct is an oversimplification of the accident causation process; this can often be viewed as a “blame culture” [32]. This traditional way of thinking insinuates that when accidents happen, workers are primarily blamed for being the cause—attributed to their laziness, incompetence, and inattentiveness when doing their work [25]. However, this concept has been debunked in the literature, wherein the social nature of construction workers and their network relationships have been associated with safety and health, reducing occupational accidents [33,34]. This perspective suggests that human error is due to systemic failures and that safety behavior is highly dependent on the roles played by organizational factors [25,35]. In this regard, more emphasis should be given to improving the safety behavior of construction workers in the context of organizational and social structures.

Individual and organizational factors are widely accepted variables that directly influence workers’ safety behavior. All the underlying relationships of these factors have been studied extensively to improve the safety behavior of construction workers. Guo et al. [25]
developed and tested an integrative model of construction workers’ safety behavior to understand better how safety climate factors and individual factors influence workers’ safety behavior. Previous studies verified that safety climate or culture positively affects safety behavior \[25,36,37\]. Furthermore, investigations of safety training and management conditions to safety have been examined to positively influence safety behavior \[25,38\]. In summary, most studies mainly focused on these perspectives: (1) workers’ individual characteristics or cognition, (2) safety management or management commitment to safety, and (3) safety culture or climate of group environments. While these approaches are proven effective at promoting workers’ safety behavior, incremental improvements may still be advanced by concentrating on the dynamic relationships of their social interactions.

Consequently, the integration of social capital theory (SCT) has gained traction in managing construction project safety over the last few years. Nahapiet and Ghoshal \[39\] developed the distinction between structural (connections among actors), relational (trust between actors), and cognitive (shared goals and values among actors) social capital. Social capital involves the complex interrelations between these three dimensions, giving conceptual distinctions for analytic convenience \[40\]. Previous studies have verified the positive effects of social capital on safety and health \[23,29,33\]. This is particularly relevant since construction work is essentially a social process \[41\], and the people and their interactions play significant roles in the process. In the construction industry, workers rely heavily on their supervisors for assigned tasks due to the complex and dynamic nature of construction work \[42\]. Thus, an in-depth understanding of these social interactions (i.e., worker-to-worker, supervisor-to-worker, worker-to-supervisor) could offer meaningful insights into managing construction safety. In the context of construction SMEs, the dependence of workers on the supervisor is more amplified due to the small number of social groups wherein greater control is observed on their safety behavior with better efficiency \[13\]. The social interaction between the supervisor (leader) and subordinates (member) is one of the most critical interactions among groups that influence how subordinates perceive safety \[36,43,44\]. The influence of leader-member exchange (LMX) to predict worker behavior varies on the quality of relationships in social groups \[45\]. A high quality LMX relationship is found to predict a worker’s positive work performance (e.g., safety participation) \[46\]. By contrast, low quality LMX relationship may lead to unsafe behavior \[45\]. However, despite being widely studied, the current literature on SCT in view of construction safety found a positive association with workers’ safety behavior but cautioned the intricacies of the complex relationships between workers, particularly in small social groups. For instance, workers’ social interactions with their supervisors (i.e., structural dimensions) are more formalized in large groups but may be viewed in contrast with more informal structures such as in small organizations. In small groups with supervisors performing multiple roles (i.e., site engineer, safety engineer, liaison officer, counselor, and human resource officer), the concept of social exchange that brings forth affect and loyalty is more emphasized within the social interaction between supervisors and workers. This brings the relevance of LMX in better capturing such a concept. Notably, being separately studied, current studies achieve no consensus on the impact of LMX on certain aspects of safety behavior (e.g., \[47\]). Thus, reinforcing each other, an integration of SCT and LMX may be explored better to facilitate the impact of social interactions on construction safety.

The main departure of this work is to offer an integration of SCT and LMX by directly focusing on the role of LMX in explaining workers’ safety behavior. This integration is particularly of significant interest to construction SMEs where social interactions between supervisors and workers are more pronounced. In addition, as described in the literature \[48\], the integrative model investigates the role of age as a reinforcing variable in the LMX process. Various methods have been employed in the literature to explore relationships between variables in a specific agenda. The most notable method is the partial least squares-based structural equation modeling (PLS-SEM). PLS-SEM is a robust statistical technique for estimating structural models in complex conditions \[49\]. PLS-SEM has been
applied to various fields such as in education (e.g., [50,51]), social networks (e.g., [52]), agriculture (e.g., [53]), and information technology (e.g., [54]). There has been an increase in the use of the PLS-SEM technique in construction management research in the past decades. Thus, Zeng et al. [55] provided a critical review of the current application of PLS-SEM in construction management, highlighting its critical issues and recommendations for future use. Exploring the safety behavior in construction firms using PLS-SEM has been particularly prominent in the literature, as demonstrated in the works of Shanmugapriya and Subramanian [56], Li et al. [57], Yiu et al. [58], Buniya et al. [59], Ashraf et al. [51], among others. Accordingly, this study advances the integration of SCT and LMX by using PLS-SEM in modelling the causal relationships of these constructs within the context of the safety behavior of construction workers. A case in a developing economy (i.e., the Philippines) is reported in this work, where construction SMEs are popular, and workers’ safety behavior is of interest. The insights of the proposed integrative model offer inputs to the design of initiatives in managing workplace safety in construction sites, particularly relevant to construction SMEs.

The remaining sections of this study are arranged as follows. Section 2 provides the literature review and hypotheses development, while Section 3 details the PLS-SEM methodology and its results. Section 4 discusses the findings and their insights. Finally, Section 5 concludes the study and presents its limitations for future research agenda.

2. Literature Review and Hypotheses Development

This section presents the related literature regarding workers’ safety behavior in construction workplaces, the relevance of SCT and LMX, and the hypothesized relationships among the identified constructs.

2.1. Safety Behavior

Safety behavior has been notably considered a leading indicator of safety performance [60]. It is widely used in various environments, such as in hospitals (e.g., [61]), aviation industry (e.g., [62]), agricultural settings (e.g., [63]), manufacturing (e.g., [64]), among others. Safety behavior implies the individual’s measures to promote safety in conducting work, such as wearing personal protective equipment (PPE) and following safety regulations to prevent safety accidents to oneself or others [65]. As a multi-dimensional construct, it can be predicted or estimated by other indicators [25]. Neal et al. [65] developed the safety behavior scale consisting of two dimensions: safety compliance and safety participation. Safety compliance is used to describe worker’s adherence to standard work procedures to maintain workplace safety, while safety participation is used to describe a series of behaviors in which workers participate in voluntary safety activities, help co-workers with safety-related issues, improve safety precautions, and demonstrate initiative that supports safe workplace [25,29]. These two dimensions of safety behavior have been widely accepted in many academic circles (e.g., [23,25,44]). We adopted this two-dimensional structure of safety behavior. In particular, safety behavior in construction sites has been a prominent topic in the literature. A search query with the keywords “safety behavior” AND “construction” AND “organizational” OR “social” produces a list of recent (i.e., 2016 onwards) safety behavior-related studies (see Table A1) to identify various relevant constructs.

From a total of 21 recently published literature on social and organizational constructs of safety behavior in the construction industry, Figure 1 shows the frequency or times each construct is integrated into their respective empirical models. Expectedly, on top is safety behavior, where above 61% (13 papers) tackled the topic. Next in queue are safety participation with about 52% (11 out of 21), safety climate and safety compliance, each with more than 42% (9 out of 21), and safety commitment, safety knowledge, and safety motivation, each with not less than 19% (4 out of 21) of papers have addressed the constructs, respectively. The constructs comprising attitude, communication, perceived management norms, and risk perception are each discussed by 14% (3 over 21) of the
papers. Other organizational constructs with a frequency under three instances are skipped in the analysis.

![Organizational Constructs](image)

**Figure 1.** Frequency of the inclusion of social and organizational constructs in recent models.

2.2. Social Capital Theory

Introduced as a new sociology notion to study the behaviors of relational networks, social capital theory (SCT) has long been discussed among researchers for a couple of decades. Bourdieu and Richardson [66] started defining the main idea of SCT as interpersonal links that act as valuable resources in social affairs—the sum of real or potential resources between individuals for improvement. These links serve as vital elements to support the development of individual behaviors toward organizational success [67]. Nahapiet and Ghostal [39] first formally introduced SCT to be composed of three dimensions: structural, relational, and cognitive, embedded in a network of relationships possessed by involved parties.

Firstly, the structural dimension discusses the interactions between employees [68], with interactions mainly referring to the mode and network of connections among members, and the characteristics, strengths, and other attributes of these connections [69]. Moreover, the applications of the relational dimension in social capital focus on the quality of relationships, i.e., specific types of personal relationships established among group members through social interactions—and are dependent in terms of identification, trust, cooperation, obligation, and reciprocity norms [70–72]. Lastly, the cognitive dimension elevates interpersonal cooperation through shared attitudes, dispositions, and participation [73].

In the construction sector, SCT has been empirically significant in promoting workplace safety, having been applied in different specified areas of concentration. Li et al. [23] incorporated social capital in construction and established the role of supervisors’ safety competency in formulating management methods to help improve safety conditions. Consequently, primarily based on interpersonal relationships, SCT helped provide a theoretical foundation for enhancing practices to improve construction workers’ safety behaviors [29]. From a two-fold view between project managers and members, Wu et al. [74] incorporated SCT on mega construction projects and facilitated the sustainable accomplishment of exten-
sive goals. With these reviews, SCT proves to enforce construction safety norms effectively by regulating safety behaviors.

2.3. Leader-Member Exchange

The relationship between the leader and followers has been a significant topic in the domain literature since the influential work of Weber’s model of charismatic leadership [75]. Accordingly, the most prominent theory that describes leader-follower interactions is the leader-member exchange (LMX) developed in 1975, also referred to as the vertical dyad linkage theory [76]. LMX can be viewed as a reciprocal exchange or a continuous process of role-making which is highly dependent on the dyadic relationship formed by the leader and followers over time [76,77]. It is a systematic theory that involves the followers in the leadership process and emphasizes the significance of followers’ perception of the dyadic relationship [76]. This positive perception shapes the respect and trust of the followers to the management and, consequently, molds the followers’ urge to feel obligated to reciprocate, put in effort, and follow orders [47]. Thus, LMX has become an inherent factor that determines and enhances work performance [78], organizational citizenship behavior [79], work participation [78], satisfaction [23,80], commitment [23], self-efficacy [81], and safety behavior [22].

In particular, safety behavior is a trait that requires a strong drive of followers to reciprocate to their leader or supervisor in a workplace [47]. Various studies (e.g., [82]) have emphasized that employees often ignore safety rules and regulations due to the perception that being mindful of safety would make them less efficient and decrease their productivity. Moreover, safety violations rarely lead to immediate punishment or consequence, and sometimes, even the management finds it a burden to implement strict safety regulations due to market competition, and the pressure of choosing productivity is of higher priority than choosing safety in practice [47,83]. Thus, safety practices in the workplace have been neglected despite the perceived contradiction of safety practices and productivity being debunked in the literature (e.g., [82,84]). The defiance in properly implementing safety practices and enhancing safety perception and behavior in the workplace are the agenda that LMX can address. Thus, various studies have explored the link between LMX and safety behavior within various working environments and industries such as in maritime (e.g., [85]), energy (e.g., [47]), airline (e.g., [86]), railway (e.g., [87]), and construction industry (e.g., [22]). Among these industries, safety is particularly relevant in construction sites due to the nature of work prevalent in these workplaces [88]. However, despite the relevance of safety behavior within construction sites, safety remains overlooked by construction workers [89] and is rarely explored and analyzed from the lens of LMX [44]. Thus, this study investigates the impact of LMX on safety behavior in the context of construction sites.

2.4. Hypothesis Development

The hypotheses developed according to the relationships identified in the domain literature are detailed below.

2.4.1. Structural Social Capital

Structural dimension, as one of the dimensions of SCT, refers to the overall interaction and connection among a network of people [39]. It encompasses the structure and pattern of individual relations, particularly the network ties and configuration, as well as the roles, rules, precedents, and procedures that make up an organization’s structure [90]. Early studies (e.g., [91]) have highlighted that the hierarchical structure of an organization influences the dyadic relationship between the leader and follower. Later studies (e.g., [92]) further implied that the resources a leader can exchange toward their followers or subordinates within a workplace are conditioned on the leader’s structural position. This dyadic relationship is particularly observed in construction SMEs wherein the followers’ dependence on the leader in performing specific tasks is emphasized more. The structural dimensions of
an organization would legitimize the leader’s authority to provide information, resources, and execute rules and regulations [93]. Thus, they enforce the workplace interaction between two parties to abide by the regulations, particularly in using safe procedures while completing tasks [94,95]. In line with this, we propose that:

**Hypothesis 1 (H1). Structural dimension directly impacts leader-member exchange.**

2.4.2. Relational Social Capital

The relational dimension of SCT describes individuals’ interpersonal connections through social interactions and trust with other group members [39]. The key aspects involved in the relational dimensions are trust, norms, sanctions, obligations, identity, and identification that encourage normative behavior based on reciprocity and expectations [90]. This normative behavior describes the reliable leader-member relationship within an organization, especially in a small working environment such as in SMEs. Accordingly, the positive relationship between leaders (e.g., supervisors, managers) and subordinates encourages them to consider the interests of others when making decisions, which promotes more cooperative behavior, especially in the context of developing a safe working environment [29]. Therefore, we hypothesize that:

**Hypothesis 2 (H2). Relational dimension directly impacts leader-member exchange.**

2.4.3. Cognitive Social Capital

Resources that facilitate common meaning systems, interpretations and representations among parties are referred to as the cognitive dimension of social capital [39]. It depicts the shared language and vision of the individual and other employees in the organization [96]. When leaders and members share the same language, interpretation of information, and visions in an organization, their interactions are more impactful and more aligned to achieving organizational goals [29], which is particularly relevant in construction SMEs where most workers share a common dialect. Accordingly, positive experiences that enforce positive behavior (e.g., safety practices) within a workplace oscillate based on the quality of the continuous exchange of information [97]. Thus, the communicative exchanges between an organization’s leaders and members ultimately result in the development of varied LMX associations [98]. In line with this, Li et al. [29] suggest that industries must gather individuals who speak the same language and share similar interests to improve their psychological environment and interpersonal climate. Such an environment increases leaders’ ability to influence employees’ safety behavior. Thus, this study hypothesizes that:

**Hypothesis 3 (H3). The cognitive dimension directly impacts the leader-member exchange.**

2.4.4. Leader-Member Exchange

LMX suggests that when leaders and followers can build mature relationships and effective resource exchange, then successful leadership processes take place [76]. Accordingly, this mature relationship would induce reciprocity between the leader and followers within the workplace [99]. This reciprocity and the impact of leaders on their members or subordinates is crucial in enhancing workplace behavior and mitigating safety incidents [36]. However, in construction SMEs, there is a lack of full-time safety personnel that facilitates the implementation of safety practices and the responsibility to enforce safety is often given to the supervisor, mostly preoccupied with multiple roles (e.g., site engineer, human resource personnel). As a result, safety practices are often overlooked. Accordingly, when a supervisor has the required interpersonal leadership skills, observes safety practices, and treats their subordinates properly and with due respect, subordinates will acknowledge them by working efficiently and safely [100]. Moreover, employees are more likely to engage in voluntary safety improvement efforts such as safety compliance and participate in the implementation of safety practices as reciprocal if leaders appreciate workplace safety and care about the wellness of their workforce [101,102]. Therefore, this study hypothesizes that:
Hypothesis 4 (H4). Leader-member exchange directly affects safety compliance.

Hypothesis 5 (H5). Leader-member exchange directly affects safety participation.

2.4.5. Safety Compliance

Safety compliance refers to employees engaging in fundamental safety practices to ensure workplace safety, such as wearing PPEs and abiding to safety regulations [103–105]. To comply with safety requirements, workers should carry out construction projects consistent with safety regulations, such as adhering to company policies, rules, and operating procedures [29].

2.4.6. Safety Participation

Apart from seminars, safety participation includes optional attitudes that support workplace safety, e.g., regular attendance at safety meetings, the creation of safety near-miss reports, and the substitution of co-workers for unsafe conditions, which are generally regarded as indirect variables [105,106]. Although actions associated with safety participation do not immediately cause personal protection of each person, they significantly contribute to creating a secure atmosphere [104].

2.4.7. Age as a Moderating Variable

Age has been identified as one of the most critical factors affecting construction injuries [48] and is a key factor that leads to workers’ unsafe behaviors [107]. Several studies show how age affects workers in the construction industry (e.g., [108,109]). According to Peng and Chan [110] and López et al. [111], older construction employees are more susceptible to severe injuries, and younger workers are more vulnerable to accidents in the workplace [108,112]. On the contrary, Meng et al. [113] reported uncertainty about the impact of age on construction workers’ safety. For example, Shacklock and Brunetto [114] claimed that older workers tend to comply less in the labor force. In light of the construction industry in general, where tasks are highly associated with hard skills (e.g., masonry, carpentry, civil works, electrical works), younger workers tend to be submissive to their supervisors as they accumulate experience in these skills. As age advances and experience may supersede those with supervisors, older workers tend to work more independently and rely mostly on their experience and previous knowledge. In addition, they may not be too receptive to additional inputs from their supervisors, including insights associated with safety, especially on tasks they have been most familiar with for years. This view may be consistent with those of Peng and Chan [110] and López et al. [111]. Thus, the following hypothesis is proposed:

Hypothesis 6 (H6). Age negatively moderates the relationship between leader-member exchange and safety compliance.

Hypothesis 7 (H7). Age negatively moderates the relationship between leader-member exchange and safety participation.

Given these hypotheses, the proposed structural model is shown in Figure 2.
be too receptive to additional inputs from their supervisors, including insights associated with safety, especially on tasks they have been most familiar with for years. This view may be consistent with those of Peng and Chan [110] and López et al. [111].

Thus, the following hypotheses are proposed:

**Hypothesis 6 (H6).** Age negatively moderates the relationship between leader-member exchange and safety compliance.

**Hypothesis 7 (H7).** Age negatively moderates the relationship between leader-member exchange and safety participation.

Given these hypotheses, the proposed structural model is shown in Figure 2.

### 3. Methods

This section details the sampling used in this study, data collection, the participants’ profile, and the results of the analysis using the PLS-SEM method.

#### 3.1. Sampling

The measurement items for each construct in this study were adopted from measures validated in previous works, as summarized in Table A2. The constructs utilized SCT dimensions, with the structural dimension having five measurement items, relational dimension having eight measurement items, and cognitive dimension having five measurement items. In addition, the LMX construct has ten measurement items, safety compliance has six measurement items, and safety participation has six measurement items. All these scale items were evaluated using a 7-point Likert scale. Measurement items of all constructs range from “strongly disagree” to “strongly agree”. Moreover, it was polished by academic experts, and the phrasings were revised in the context of safety behavior. It was translated to the native dialect of the participants (i.e., Visayan) to avoid language misunderstanding.

#### 3.2. Data Collection

The on-site survey was conducted with the selected construction workers of construction SMEs in central Philippines. The most commonly used minimum sample size estimation approach in PLS-SEM is the ‘10-times rule’ method [115,116]. In determining the minimum sample size for PLS-SEM, the rule of thumb should be ten times the maximum number of arrows pointing to the latent variable in the PLS path model [117]. In this work, the minimum sample size is set at 70. Although increasing the coverage of participants to other regions of the country is desired, most of the construction workers are being moved from one project location to another as specific project demands. Thus, rather than emphasizing location, worker’s cumulative experience in the construction industry reflects their perception of the identified constructs of the study. In this regard, the distinction between their perception on their current work location and previous work locations becomes blurred, such that their responses to the items in the questionnaire are a reflection of their cumulative work experience. In addition, participants were given privacy by their supervisors in answering the survey questionnaire. This would suggest
that possible biases associated with the presence of supervisors are limited. The data collection utilized convenience sampling. The data was gathered solely through face-to-face questionnaire completion from 8 August 2022 to 26 August 2022. Out of 300 survey instruments distributed, there were 243 responses collected. In this case, 11 incomplete responses were removed. Thus, out of the 243, only 232 were considered valid and were used for the final analysis.

3.3. Profile of the Participants

The majority of the participants were between 35–44 years old (30%) who have educational background of generally high school level (57%). With regards to the physical danger associated with their line of work, the participants had not experienced any physical danger (97%). The summary of their profile is shown in Table 1.

Table 1. Profile of the participants.

| Category                                | n  | %  |
|-----------------------------------------|----|----|
| Age                                     |    |    |
| 18–24 years old                         | 29 | 12.5|
| 25–34 years old                         | 58 | 25.0|
| 35–44 years old                         | 71 | 30.6|
| 45–54 years old                         | 60 | 25.9|
| 55–64 years old                         | 13 | 5.6 |
| 65 years old and above                  | 1  | 0.4 |
| Highest Educational Attainment          |    |    |
| Elementary level                        | 12 | 5.2 |
| Elementary graduate                     | 19 | 8.2 |
| High school level                       | 133| 57.3|
| High school graduate                    | 60 | 25.9|
| College level                           | 8  | 3.4 |
| Experience Physical Danger              |    |    |
| Yes                                     | 7  | 3.0 |
| No                                      | 225| 97.0|

3.4. Data Analysis

This study utilized PLS-SEM to model the direct relationships between the independent and dependent constructs. In addition, the moderating effect of age was tested. The PLS-based SEM is suitable for providing a more robust and comprehensive statistical technique for determining the structural models in high-complex domains [118]. Furthermore, aside from complex models, it is most suitable for studies with small sample sizes, non-normally distributed data, and predictive and exploratory analyses [119]. The SmartPLS software developed by Dr. Jan-Michael Becker from Norway, version 4.0.7.8, was used in this study.

3.5. Measurement Model Assessment

PLS-SEM analysis permits the parallel testing of the outer measurement model and the inner structural model in a consecutive manner and the occurrence of both reflective and formative latent variables [120]. The proposed model has reflective measures; thus, in assessing the model, the first criterion is to examine the reliability and validity of the measures [119]. The measurement model assessment results indicate that all indicators were convergent and reliable, as summarized in Table 2. The factor loading estimates should be between 0.5 and 0.7 [121]. In this study, the acceptable factor loading for each item is set at 0.60. Outer loading above 0.60 is regarded as acceptable, and the factor with a loading value of less than 0.60 was removed. In this case, 16 item indicators were removed after a series of calculations through the SmartPLS algorithm until all the item indicators reached the threshold value of 0.60. The item indicators removed were LMX1, LMX3, LMX5, LMX6, LMX7, LMX9, SC5, SC2, SC6, SP6, SP5, SSC1, SSC2, SSC4, SSC5,
and SSC7. There were 40 measurement indicators considered for the final analysis. The convergent validity of the measurement model was assessed by examining the average variance extracted (AVE) value. The AVE threshold value of 0.40 is acceptable following the condition that if the AVE value is less than 0.50, but composite reliability is higher than 0.60, the convergent validity of the construct is acceptable [122]. All constructs have the appropriate convergent validity ranging from 0.459 to 0.593.

Table 2. Measurement model assessment results.

| Convergent Validity | Construct Reliability | Convergent Validity | Construct Reliability |
|---------------------|-----------------------|---------------------|-----------------------|
| Loadings            | AVE                   | α                   | CR                    | Loadings            | AVE                   | α                   | CR                    |
| CSC1                | 0.722                 | 0.551               | 0.793                 | 0.816               | SSC3                 | 0.741                | 0.526                | 0.561                 | 0.559                |
| CSC2                | 0.588                 |                      |                       |                      | SSC6                 | 0.74                 |                      |                       |                      |
| CSC3                | 0.83                  |                      |                       |                      | SSC8                 | 0.693                |                      |                       |                      |
| CSC4                | 0.82                  |                      |                       |                      | LMX10                | 0.738                | 0.459                | 0.607                 | 0.611                |
| CSC5                | 0.725                 |                      |                       |                      | LMX2                 | 0.648                |                      |                       |                      |
| RSC1                | 0.635                 | 0.459               | 0.833                 | 0.84                | LMX4                 | 0.629                |                      |                       |                      |
| RSC2                | 0.68                  |                      |                       |                      | LMX8                 | 0.69                 |                      |                       |                      |
| RSC3                | 0.655                 |                      |                       |                      | SC1                  | 0.579                | 0.593                | 0.73                  | 0.626                |
| RSC4                | 0.641                 |                      |                       |                      | SC3                  | 0.846                |                      |                       |                      |
| RSC5                | 0.699                 |                      |                       |                      | SC4                  | 0.853                |                      |                       |                      |
| RSC6                | 0.681                 |                      |                       |                      | SP1                  | 0.611                | 0.501                | 0.681                 | 0.795                |
| RSC7                | 0.672                 |                      |                       |                      | SP2                  | 0.851                |                      |                       |                      |
| RSC8                | 0.751                 |                      |                       |                      | SP3                  | 0.617                |                      |                       |                      |
|                     |                       |                      |                       |                      | SP4                  | 0.724                |                      |                       |                      |

Note: α = Cronbach’s alpha; CR = composite reliability; AVE = average variance extracted; CSC = cognitive dimension; RSC = relational dimension; SSC = structural dimension; LMX = leader-member-exchange; SC = safety compliance; SP = safety participation.

Aside from the traditional Cronbach’s alpha, the composite reliability was utilized to assess the internal consistency reliability of the construct measures. In this study, Cronbach’s alpha (α) ranges from 0.606 to 0.854. Thus, the measurement items were all reliable, with all the constructs obtaining above Cronbach’s alpha (α) threshold value of 0.60, which is considered reliable and an acceptable index [123,124]. On the other hand, the composite reliability (CR) values range from 0.714 to 0.887. These results indicate high-reliability values. The CR threshold value of 0.70 [119] is met.

In this study, the discriminant validity was measured through the Fornell and Larcker criterion and the Heterotrait-Monotrait (HTMT) criterion. The AVE of the constructs that supported discriminant validity was higher than the squared correlation of each latent variable [120]. In Table 3, the square roots of the AVE are bolded, while non-bolded values represent the intercorrelation value between constructs. All off-diagonal values are less than the square roots of AVE, which show that the Fornell and Larker’s condition was met. In addition, the SmartPLS algorithm function generates the HTMT criterion output. HTMT is the ratio of the between-trait correlations to the within-trait correlations [118]. Table 4 shows the valid HTMT value for each construct, which is less than 0.85. The HTMT values range between 0.223 and 0.729. Overall, the reliability and validity tests of the measurement model were met. Thus, all the items used to measure constructs in this study were valid and fit to estimate parameters in the structural model.
Table 3. Fornell and Larcker criterion results.

|     | CSC    | LMX   | RSC   | SC    | SP    | SSC   |
|-----|--------|-------|-------|-------|-------|-------|
| CSC | 0.742  |       |       |       |       |       |
| LMX | 0.518  | 0.677 |       |       |       |       |
| RSC | 0.430  | 0.481 | 0.678 |       |       |       |
| SC  | 0.203  | 0.208 | 0.378 | 0.77  |       |       |
| SP  | 0.434  | 0.400 | 0.503 | 0.56  | 0.708 |       |
| SSC | 0.273  | 0.378 | 0.301 | 0.199 | 0.268 | 0.725 |

Note: square root of AVE is shown on the diagonal of the matrix in bold; inter-construct correlation is shown off the diagonal.

Table 4. Heterotrait-Monotrait criterion results.

|     | CSC    | LMX   | RSC   | SC    | SP    | SSC   |
|-----|--------|-------|-------|-------|-------|-------|
| CSC |        | 0.729 |       |       |       |       |
| LMX | 0.517  | 0.642 |       |       |       |       |
| RSC | 0.223  | 0.260 | 0.442 |       |       |       |
| SC  | 0.547  | 0.549 | 0.653 | 0.839 |       |       |
| SP  | 0.419  | 0.632 | 0.418 | 0.288 | 0.477 |       |

3.6. Structural Model

The structural model was evaluated using the coefficient of determination (R²) and path coefficients in PLS. The first principle is to assess each endogenous latent variable’s R², which measures the relationship of a latent variable’s explained variance to the overall variance [125]. The acceptable R² of 0.75, 0.50, and 0.25 correspond, respectively, to substantial, moderate, and modest levels of prediction accuracy [49,115]. In this study, the R² of the structural model is shown in Figure 3. LMX is explained as the highest variance with an R² value of 0.377 (38%). Furthermore, SP has a modest prediction accuracy of 0.221 (22%), and SC has a negligible prediction accuracy of 0.109 (11%). The second principle is to examine the path coefficient value that predicts the strength of the two latent variables’ relationship by evaluating the path coefficients, algebraic sign, magnitude, and significance. In this study, most hypotheses (H1, H2, H3, H5) were supported, and only one was not supported (H4). These are summarized in Table 5 (Figure 3). In addition, LMX has a complex cause-effect relationship between the social capital dimensions (i.e., SSC, RSC, and CSC) towards SP, as depicted in Figure 2.

Table 5. Path coefficient results.

|     | β      | T Value | p Values | Decision   |
|-----|--------|---------|----------|------------|
| H1: SSC → LMX | 0.195  | 2.351   | 0.019 ** | Supported  |
| H2: RSC → LMX | 0.274  | 3.974   | 0.000 ***| Supported  |
| H3: CSC → LMX | 0.347  | 4.475   | 0.000 ***| Supported  |
| H4: LMX → SC | 0.207  | 1.402   | 0.161 ns | Not supported |
| H5: LMX → SP | 0.401  | 4.575   | 0.000 ***| Supported  |

Note: *** p < 0.000; ** p < 0.001; ns not significant.

Furthermore, the PLS algorithm was used to derive the effect size (f²) values and estimated 0.02 (minor), 0.15 (medium), and 0.35 (substantial) effects on the relationship between independent and dependent variables [119]. In addition, a value less than 0.02 points to no effect of independent constructs on a dependent construct. The f² results show that CSC has a medium effect on LMX (f² = 0.155). On the other hand, LMX has a medium effect on SP (f² = 0.191) while having a minor effect on SC (f² = 0.045). The effect of RSC and SSC on LMX is also considered minor, with f² = 0.094 and f² = 0.058, respectively. These results are aligned with the other findings of the study.
Table 5. Path coefficient results.

|                | β     | t Value | p Value | Decision |
|----------------|-------|---------|---------|----------|
| H1: SSC → LMX  | 0.195 | 2.351   | 0.019   | **        |
| H2: RSC → LMX  | 0.274 | 3.974   | 0.000   | **        |
| H3: CSC → LMX  | 0.347 | 4.475   | 0.000   | **        |
| H4: LMX → SC  | 0.207 | 1.402   | 0.16    | ns        |
| H5: LMX → SP  | 0.401 | 4.575   | 0.000   | **        |

Note: *** p < 0.000; ** p < 0.001; ns not significant.

3.7. Moderating Effect

Table 6 and Figure 3 show the details of the moderating relationships examined in the study. As a moderating variable, age yields negatively but no significant effect on the relationship between LMX and SC (β = −0.129; p-value = 0.318); thus, H6 was not supported. Meanwhile, age negatively and significantly moderates the relationship between LMX and SP (β = −0.231; p-value = 0.004). Hence, H7 was supported.

Table 6. Moderating effect results.

|                | β     | t Value | p Value | Decision |
|----------------|-------|---------|---------|----------|
| H6: Age × LMX → SC | −0.129 | 1       | 0.318   | Not supported |
| H7: Age × LMX → SP | −0.231 | 2.89    | 0.004   | Supported  |

4. Discussion and Insights

As the LMX theory suggests, effective resource sharing and mature relationships between leaders and followers are prerequisites for successful leadership processes [76]. As a result, in the workplace, this mature connection would encourage reciprocity between the leader and followers [99]. The LMX philosophy generally asserts that leaders should not treat all of their subordinates in the same way; instead, they should create special ties or exchanges with one another [76,126]. Additionally, given high-quality LMX, if leaders value workplace safety and are concerned with the well-being of their workforce, employees are more likely to participate in volunteer safety improvement activities and demonstrate safe behaviors [101,102]. This study subscribes to this view by proposing the role of LMX to directly impact workers’ safety behavior. In addition, due to the social relationships of workers, SCT is proposed to impact LMX positively. This integration offers a novel empirical model in the literature.

The study highlights the relationships between the dimensions of SCT (i.e., SSC, RSC, CSC), LMX, and the safety behavior of workers (SC, SP), particularly in construction SMEs with limited insights in the literature. Five hypotheses were proposed and a structural...
model incorporating social capital (structural, relational, and cognitive social capital), LMX, and safety behaviors of compliance and participation were formulated. Our empirical results show that all dimensions of social capital positively impact LMX. First, the configuration of the roles of supervisors and workers affords supervisors the leverage for providing information and resources to implement and encourage safety behaviors, as Hazy and Uhl-Bien [93] suggest. With those kinds of support and the authority defined by owners of construction SMEs, it promotes trust and professional respect of workers to their supervisors, thus, strengthening LMX. This finding is strongly relevant in construction SMEs having a generally flat organizational structure and supervisors demonstrating diverse roles. Secondly, the interpersonal relations between supervisors and workers (i.e., relational social capital) promote cooperative behavior [29] and thus enhance LMX. In construction sites, strong relational capital between supervisors and members leads to a positive work environment where the welfare of workers is more considered in supervisors’ safety-related decisions, such as investing in PPEs and fool-proofing mechanisms. Consequently, workers reciprocate in the process, and it builds more trust in their supervisors by adhering to safety measures in the workplace. This environment strengthens the LMX relationship. Lastly, the positive effect of cognitive social capital on LMX implies that supervisors and workers sharing common goals and interests promote high-quality LMX. This finding may be straightforward as it suggests that workers who share similar safety goals with their supervisors tend to be more supportive of achieving those goals.

The results also show that LMX positively affects safety participation but does not significantly affect safety compliance. It implies that while LMX encourages workers to promote a safe workplace, it does not necessarily result in actual safety compliance. This insight is interesting and adds value to the current discussion of construction safety. LMX may have contributed to an increased participation of construction workers in safety training, observance of safety protocols, and dissemination of safety awareness. However, actual observance of those safety measures depends on the workers’ response behaviors. This finding radiates well with the observations of Zhou and Jiang [47], and we subscribe to their conjecture. They argue that high-quality LMX provides no direction on the reciprocal behaviors that workers pay to their supervisors. They suggest that the reciprocal obligation that workers perceive in high-quality LMX may lead to various behaviors that members believe are beneficial to their supervisors’ interests. For instance, when supervisors encourage workers to always wear hard hats while inside the construction site, the workers may help in disseminating the wearing of hard hats, but it may not necessarily result in the actual adherence to the wearing of hard hats, especially without the physical presence of supervisors on site. Another example is when workers participate in safety training and seminars, but only a few put them into practice. These behaviors may be associated with the productivity-safety tradeoff that workers think about when adhering to certain safety protocols. This observation is particularly relevant in construction SMEs where productivity is at a premium, and they would think that an additional step involving compliance with safety requirements may negatively affect their productivity. Similarly, the moderating effect of age works significantly in safety participation but not in safety compliance. Even with the presence of age, high-quality LMX may not result in high safety compliance, and the same argument we emphasized earlier holds. However, the moderating effect of age on safety participation offers interesting insights. It supports the hypothesis that older workers may reciprocate less with high quality LMX, which would affect their participation in making the workplace safe. Older workers tend to skip safety training and display resistance to some new safety measures as they would rely on their previous experience. This contrasts with younger workers who tend to show high reciprocity with the benefits they receive from high-quality LMX.

The findings of this study may offer insights into the design of management interventions in promoting a culture that highly regards workplace safety. They can also help design measurement systems that enable an organization to support safety participation improvements focusing on individual and organizational factors. Following the role of
LMX in safety participation and social capital in LMX, owners of construction SMEs must encourage initiatives that would enhance the dimensions of social capital. Some of these insights are outlined as follows. First, owners must properly define the roles and responsibilities of the supervisors to establish authority (i.e., structural capital) and create awareness among workers on these roles. Properly defined roles enable the workers to realize the necessary support and information regarding safety protocols they would expect from their supervisors, consequently promoting LMX. Secondly, owners must provide the necessary resources to supervisors in the implementation of safety requirements. The provision of PPEs and fool-proofing technologies may build trust among workers that their welfare is of high priority, and this increases reciprocity to their supervisors. Third, incentive schemes associated with achieving target safety goals may be appropriately designed to encourage the workers to reciprocate in LMX. Such incentive programs must be designed to promote teamwork and participation among workers. Monitoring systems may be in place on construction sites to track desired goals. Fourth, recreational programs that stimulate social bonds among workers and supervisors would positively impact the affect that is linked to high-quality LMX. These would include leisure activities, family days, and night outs that would intend to build bonds among workers. Finally, owners must invest in initiatives that would enhance the communication of safety goals of the organization. Participation of workers must be encouraged for them to build a sense of ownership and enhance cognitive capital. Regular communication on safety issues and targets between the management (or owners), supervisors, and the workforce is an effective initiative to establish a shared perspective regarding workplace safety on construction sites.

5. Conclusions and Future Work

This work proposes and validates an empirical model that examines how the social capital theory (SCT) explains safety behavior via leader-member exchange (LMX) in the context of construction workers among construction small and medium enterprises (SMEs). Through on-site data gathering, 232 valid responses were analyzed using PLS-SEM. The model proposes five hypothesized paths, and the empirical case supports four of them. Furthermore, the moderating effect of age is investigated in view of a hypothesis that more experienced construction workers may have a different level of appreciation of safety protocols than the younger ones.

Three essential contributions are put forward in the study. First, all the hypothesized paths from SCT to LMX theory revealed significant positive relationships explaining about 31% of its part and overall variations. Social capital’s relational, structural, and cognitive dimensions are identified as crucial factors that could develop a more profound social exchange between supervisors and workers on construction sites. With a primarily flat organizational structure, supervisors find leverage to offer information and necessary resources to highlight desired safety behaviors. In addition, when workers become aware that their welfare is considered a priority, they tend to reciprocate by displaying behaviors favorable to the safety-related interests of supervisors. Supervisors and workers sharing common safety goals arguably promote high quality LMX. Secondly, the path from LMX to safety participation is directly supported, explaining about 16% of the total variations. However, high quality LMX does not necessarily result in safety compliance. The study adopts previous insights indicating that the reciprocal behaviors workers would display from high-quality LMX may be diverse as LMX does not provide direction on these behaviors. Thus, workers may perceive other responses which they think are more beneficial to the supervisors. The third contribution is on the supported moderation effect of age on the path from LMX to safety participation among construction workers. This moderation is negative, which means that as the construction workers’ age increases, the effects of the path from LMX to safety participation dampens. In the case of construction SMEs, especially in developing countries such as the Philippines, the workers’ relative length of experience is associated with the skills needed for the site, which may result in low reciprocity among older workers with the LMX.
Similar to other existing studies in this field, this work has limitations. The most potential constraint is the participants’ limited organizational affiliation since the model validation is made among construction SMEs in a developing economy. Thus, generalization and inference through the lens of this paper must be made with caution. Another possible restriction of the results is attributable to the inability to venture into the specific dimensions of LMX, investigating more hypothetical links to safety behavior. Given this, the overall theoretical significance of the study leads to specific insights for future works. Among those, we suggest three compelling topics. First, a closer look at emerging constructs of SCT, LMX, and safety behavior by analyzing the mediating effects on larger population groups, including more prominent construction companies, is recommended.

The main idea is to compare and contrast the intricacies of the complex structures, in the context of safety behavior, between leaders and members when there are more well-defined communication lines in the organizational structure. Secondly, a deeper investigation of the loyalty, affect, contribution, and professional respect as dimensions of the LMX with a higher order construct of safety behavior may be explored in future work. Finally, the moderating effects of other demographic variables, such as years of experience and civil status, may be an interesting future work. As this study suggests, the assumption of age correlated with years of experience may not be reflective in all cases.

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Appendix A

Table A1. Recent literature on the construction industry’s social and organizational constructs of safety behavior.

| Year | Title                                                                 | Constructs                                                                 | References         |
|------|----------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|
| 2021 | Relationships between social support, social status perception, social identity, work stress, and safety behavior of construction site management personnel | Social status perception, professional identity, social support, family support, friend support, work stress, safety behavior. | Huang et al. [95] |
| 2021 | Exploring the relationship between safety climate and worker safety behavior on building construction sites in Taiwan    | Safety commitment, risk decision making, safety attributes and communication, safety training, safety participation, safety operation | Chen et al. [127] |
| Year | Title | Constructs | References |
|------|-------|------------|------------|
| 2021 | Impact of construction safety culture and construction safety climate on safety behavior and safety motivation | Construction safety climate, safety culture, safety behavior, safety motivation | Al-Bayati [21] |
| 2021 | Effect of leader-member exchange on construction worker safety behavior: safety climate and psychological capital as the mediators | Leader-member exchange, safety climate, psychological capital, safety compliance, safety participation | He et al. [100] |
| 2021 | Relationship between leader–member exchange and construction worker safety behavior: the mediating role of communication competence | Leader-member exchange, communication competence, safety compliance, safety participation | He et al. [44] |
| 2020 | Effects of safety climate and safety behavior on safety outcomes between supervisors and construction workers | Safety climate, safety compliance, safety participation, safety outcomes | He et al. [128] |
| 2020 | Relationship between social capital, safety competency, and safety behaviors of construction workers | Structural dimension, relational dimension, cognitive dimension, safety competency, safety compliance, safety participation | Li et al. [29] |
| 2020 | Safety doesn’t happen by accident: A longitudinal investigation on the antecedents of safety behavior. | Age, safety climate, risk perception, safety knowledge, safety behavior | Mazzetti et al. [129] |
| 2020 | A dual perspective on risk perception and its effect on safety behavior: A moderated mediation model of safety motivation, and supervisors and co-workers’ safety climate | Risk perception, safety behavior, job demands, safety motivation, safety climate, safety compliance, safety participation | Xia et al. [130] |
| 2019 | Exerting explanatory accounts of safety behavior of older construction workers within the theory of planned behavior | Management commitment, safety knowledge, aging expectation, health conditions, attitude towards safety behavior, subjective norms, perceived behavioral control, work pressure, safety participation, safety compliance | Peng and Chan [110] |
| 2019 | Perceived risk, safety climate and safety behavior on Moroccan construction sites | Safety climate, risk perception, safety behavior, risk severity, and occurrence probability | Elmoujaddidi and Bachir [131] |
| 2018 | Effect of social capital between construction supervisors and workers on workers’ safety behavior | Structural dimension, relational dimension, cognitive dimension, safety competency, safety compliance, safety participation | Li et al. [21] |
| 2018 | Relations between safety climate, awareness, and behavior in the Chinese construction industry: A hierarchical linear investigation | Safety climate, safety awareness, safety behavior | Wang et al. [132] |
| 2018 | Relationships among Safety Climate, Safety Behavior, and Safety Outcomes for Ethnic Minority Construction Workers | Safety climate, safety behaviors, safety compliance, safety outcomes | Lyu et al. [133] |
| 2018 | The influence of social capitalism on construction safety behaviors: An exploratory megaproject case study | Social capital and social capitalism, safety behavior | Wu et al. [74] |
| 2017 | Role of social norms and social identifications in safety behavior of construction workers: Group analyses for the effects of cultural backgrounds and organizational structures on social influence process | Perceived management norms, perceived workgroup norm, worker’s own opinion, project identity, workgroup identity, attitude, safety behavior | Choi and Lee [134] |
| 2017 | Construction workers’ group norms and personal standards regarding safety behavior: Social identity theory perspective | Perceived group norms, personal standards, management norms, social identification, safety behavior | Choi et al. [135] |
### Table A1. Cont.

| Year | Title                                                                 | Constructs                                                                                                           | References                        |
|------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 2017 | Role of organizational factors affecting worker safety behavior      | Safety culture, communication, empowerment, management commitment, leadership, organizational learning, reward system, subjective norm, intention, behavioral control, participation, attitude, safety work, behavioral inaction | Hadikusumo et al. [92]            |
| 2017 | The impact of transformational leadership on safety climate and individual safety behavior on construction sites | Transformational leadership, safety-specific LMX, safety climate, safety knowledge, safety motivation, safety compliance, safety participation | Shen et al. [136]                |
| 2016 | Predicting safety behavior in the construction industry: Development and test of an integrative model | Management safety commitment, social support, production pressure, safety knowledge, safety motivation, safety participation, safety compliance | Guo et al. [25]                  |
| 2016 | A Bayesian Belief Network model of organizational factors for improving safe work behaviors in Thai construction industry | Organizational factors, safe work behavior, construction project                                                    | Jitwasinkul et al. [137]          |

### Table A2. Measurement indicators.

| Constructs                  | Code | Items                                                                 | References                                      |
|-----------------------------|------|----------------------------------------------------------------------|-------------------------------------------------|
| Relational Social Capital   | RSC1 | There is a norm of teamwork in our workplace relating to safety.     | Robert et al. [138], Li et al. [23].             |
|                             | RSC2 | I find it easy to identify myself with this workplace.               |                                                 |
|                             | RSC3 | Given my workmate’s previous performance about workplace safety, I see no reason to doubt their competence and preparation for another work task. | Li et al. [25].                               |
|                             | RSC4 | I can cooperate truthfully with supervisors most especially when relating to workplace safety. |                                                 |
|                             | RSC5 | Mutual support about workplace safety exists between my supervisors and me. |                                                 |
|                             | RSC6 | The mutual trust about workplace safety exists between my supervisors and me. |                                                 |
|                             | RSC7 | I do not take advantage of others even when the opportunity arises in my workplace. |                                                 |
|                             | RSC8 | I know that my workmates will help me regarding workplace safety, so it’s only fair to help them. |                                                 |
| Structural Social Capital   | SSC1 | In my workplace, I know my supervisors in my project department.     | Sun et al. [139], Li et al. [25].               |
|                             | SSC2 | In my workplace, I maintain close relationships with my supervisors. |                                                 |
|                             | SSC3 | I seek my supervisors’ support to maintain safety in my workplace.   |                                                 |
|                             | SSC4 | I exchange ideas and information with my supervisors regarding workplace safety |                                                 |
|                             | SSC5 | Employees in my department maintain close social relationships with each other. |                                                 |
|                             | SSC6 | Employees in my department know some employees at a personal level particularly about their perceptions in workplace safety. |                                                 |
|                             | SSC7 | Employees in my department have frequent communication with each other regarding workplace safety. |                                                 |
|                             | SSC8 | Employees in my department spend a lot of time interacting with each other about workplace safety. |                                                 |
| Constructs                        | Code | Items                                                                 | References                                                                 |
|----------------------------------|------|----------------------------------------------------------------------|---------------------------------------------------------------------------|
| Cognitive Social Capital         | CSC1 | I have shared language with supervisors and can communicate effectively in the workplace, especially about safety. | Karahanna and Preston [140], Li et al. [23].                             |
|                                 | CSC2 | I use common terms with supervisors at the workplace.                 |                                                                           |
|                                 | CSC3 | I use understandable language to communicate with supervisors regarding workplace safety. |                                                                           |
|                                 | CSC4 | Workmates have a shared vision of safety goals in the workplace      |                                                                           |
|                                 | CSC5 | My ideas for improving safety are similar to those of my supervisor in the workplace |                                                                           |
| Leader-Member Exchange           | LMX1 | I respect my supervisor’s knowledge of safety and competence about safety in the workplace. | Liden and Maslyn [141], Eisenberger et al. [142], Atwater and Carmeli [143]. |
|                                 | LMX2 | My supervisor is the kind of person one would like to have as a friend in the workplace. |                                                                           |
|                                 | LMX3 | My supervisor defends my safety actions to a superior, even without complete knowledge of the issue in question in the workplace |                                                                           |
|                                 | LMX4 | I am willing to apply extra efforts, beyond those normally required, to further the interests about safety of my work group. |                                                                           |
|                                 | LMX5 | I am willing to apply extra efforts, beyond those normally required, to further the interests about safety of my work group |                                                                           |
|                                 | LMX6 | In the workplace, I do work for my supervisor that goes beyond what is specified in my job description, particularly about workplace safety. |                                                                           |
|                                 | LMX7 | In the workplace, I am impressed with my supervisor’s knowledge about safety of his/her job. |                                                                           |
|                                 | LMX8 | My supervisor is a lot of fun to work with.                           |                                                                           |
|                                 | LMX9 | I do not mind working my hardest for my supervisor particularly relating to workplace safety. |                                                                           |
|                                 | LMX10| I admire my supervisor’s professional skills relating to workplace safety. |                                                                           |
| Social Compliance                | SC1  | I follow all safety procedures for the tasks that I perform in the workplace. | Vinodkumar and Bhasi [38], Li et al. [23].                                 |
|                                 | SC2  | I use all necessary safety equipment to do my tasks in the workplace. |                                                                           |
|                                 | SC3  | I can practice the risk reduction techniques that I learned during safety orientation. |                                                                           |
|                                 | SC4  | I can obey safety rules in the workplace.                             |                                                                           |
|                                 | SC5  | I aim to ensure the highest levels of safety when I carry out my tasks in the workplace. |                                                                           |
|                                 | SC6  | I carry out my work in a safe manner.                                 |                                                                           |
| Safety Participation             | SP1  | I voluntarily carry out tasks or activities that help to improve workplace safety. | Vinodkumar and Bhasi [38], Li et al. [23].                                 |
|                                 | SP2  | I put in extra effort to improve the safety of the workplace          |                                                                           |
|                                 | SP3  | I speak up and encourage others to get involved in safety issues      |                                                                           |
|                                 | SP4  | I speak up and encourage others to get involved in safety issues      |                                                                           |
|                                 | SP5  | I take action to prevent safety violations in order to protect the well-being of other co-workers |                                                                           |
|                                 | SP6S | I encourage my co-workers to work safely.                             |                                                                           |
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