

Improving the Safety Culture and Climate of Smaller Construction Firms: A Necessary Addition to the OSH Intervention Model

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Abstract: The unsatisfactory safety performance of smaller construction firms has been identified as a challenge that requires further investigation and intervention. There are few studies, if any, that investigate the safety culture and climate of smaller construction firms. This study represents a much needed attempt to clarify the obstacles that prevent smaller construction firms from creating a satisfactory level of safety culture and climate. The study aims to propose a framework that is better suited for smaller construction firms based on literature. To validate the proposed framework, a questionnaire was designed and administered. The findings support the proposed framework and deliver an objective defining criterion that classifies smaller construction firms into small firms and micro firms. Among other factors, the findings suggest that smaller construction firms often lack systematic safety operations due to the absence of safety personnel. Accordingly, a revised occupational safety and health (OSH) model for smaller construction firms has been developed based on the model previously developed by the National Institute of Occupational Safety and Health (NIOSH). It is expected that this study will improve safety intervention programs for smaller construction firms and the safety performance of the construction industry.

Keywords: Small construction firms; Construction safety culture; Construction safety climate; Safety and health intervention.

1. Introduction

The majority of US construction firms are small to medium-sized [1,2]. In the United States, the proportion of construction firms that hired fewer than 20 employees was roughly 90% between 2010 and 2019, see Table 1. These firms hired approximately 58.7% of the construction workforce; thus, creating more jobs than larger construction firms and playing a vital role in the construction industry and the US economy. A similar trend has also been reported globally. For example, 98% of all construction firms have fewer than 50 employees in Denmark [3]. The importance of small firms to the economy and employment growth is significant [3,4].

Smaller construction firms lack the resources required to control work hazards [1,4]. The non-compliance with safety training and procedures are a great factor for occupational injuries [5]. Specifically, the safety management practices and policies of small construction firms differ from those of larger [5, 6, 7]. In fact, Page [8] suggests that workers are safer in large firms than small ones due to the availability of more safety resources. Cunningham [2] reported that the average incident rate per 100 full-time workers for construction firms with 11–49 employees is 2.8 times higher than that of firms that employ 100 or more workers. Similarly, Al-Bayati [4] found that construction firms that employ more than 250 employees often have fewer cases of days away from work, days of restricted work activity, and job transfer cases [days away, restricted or transferred (DART) cases] on average than construction firms that employ 51-250 employees. Accordingly, the safety performance of smaller construction firms is a serious challenge that needs immediate attention through training and education. Reaching smaller firms with OSH interventions across multiple disciplines is challenging [9, 10]. The number of small firms is beyond the capacity of most government OSH programs [3]. The NIOSH educates smaller firms through online materials or direct mailing [11]; however, these methods have a limited effect on transferring OSH information to small businesses [12].

2. Literature review

Sinclair et al. [13] proposed an extended model for small businesses to diffuse OSH resources and incident prevention through utilizing intermediary organizations such as insurance firms, suppliers, trade associations,

chambers of commerce and vocational training institutions. The proposed model assumes that there is a relationship between smaller firms and these intermediaries [13]. Furthermore, the model was built on the social exchange theory, which presumes that a relationship will not survive if the costs of said relationship outweighs its benefits [13]. This means all parties (e.g., NIOSH, intermediary firms, and smaller firms) should benefit from the extended model. The social exchange with the extended model should be carefully addressed for the intermediary firms since the OSH public agencies do not fund them. As a result, they are driven by their interest. In this case, intermediary organizations' social exchange could be a higher value to their members/clients/network. For example, if a chamber of commerce offers OSH programming to its members, and the members like it, they are more likely to continue their membership, and the chamber might use this as a selling point to attract new members.

Table 1. Number and Percentage of Employees of the US Construction Industry

Year	Firm size	Number of firms	Fewer than 50 (%)
2019	All	745,207	89.7
	Fewer than 20	669,144	
2018	All	733,689	89.9
	Fewer than 20	659,360	
2017	All	715,641	89.9
	Fewer than 20	643,500	
2016	All	696,733	90.0
	Fewer than 20	626,963	
2015	All	682,390	90.3
	Fewer than 20	615,911	
2014	All	667,099	90.6
	Fewer than 20	604,066	
2013	All	658,483	90.9
	Fewer than 20	598,242	
2012	All	652,902	91.1
	Fewer than 20	594,988	
2011	All	657,738	91.2
	Fewer than 20	599,849	
2010	All	682,684	91.4
	Fewer than 20	624,080	

Safety researchers and practitioners have identified and developed safety culture and safety climate frameworks to improve overall safety performance in the construction industry [14, 6, 15, 16]. According to Zou and Tafazzoli [17], three dimensions of safety culture exist:

- 1) Corporate safety culture which consists of an organization's official policies, systems, procedures, and workflow
- 2) Psychological safety culture which refers to mental thoughts and feelings about safety
- 3) Behavioral safety culture which includes employee activities, behaviors, and actions related to workplace safety.

It must be noted that the focus of this study is corporate safety culture. Most of the studies that have examined safety culture and climate in the construction industry have adopted measures that were developed for other industries [19]. Accordingly, Al-Bayati et al. [15] proposed a new safety culture and climate framework, as well as definitions that seek to satisfy the characteristics of the construction industry [20]. Table 2 provides the definitions of construction safety culture and climate and the stakeholders who are responsible for achieving them. This framework focuses on the actions of construction project stakeholders, instead of stakeholders' values and beliefs regarding safety.

Construction safety culture, which represents overall safety management policies, can be measured by assessing the safety-related actions of upper management and safety personnel. On the other hand, construction safety climate, which represents the firm's safety performance in the construction field, can be measured by assessing the actions of workers and frontline supervisors. Therefore, construction safety culture is responsible for the initiation and maintenance of construction safety climate, see Figure 1, and these factors collectively contribute to overall safety performance. This framework distinguishes between safety performance at the management level and the field level. This distinction is critically important because of the centralized policies and decentralized operations of construction firms. Furthermore, by focusing on the actions of main players, this framework differs from other models that focus on the attitudes, beliefs, and behaviors of individuals. There is a statistically significant positive correlation between firm size and construction safety culture, meaning smaller construction firms often have a lower level of safety culture [4]. The lower level of safety culture indicates the need for safety policies and safety

training that support adequate safety performance [4]. However, Al-Bayati’s safety culture model, like other safety culture and climate models, fits large construction firms, not smaller firms. Most of the current safety culture and climate frameworks were built based on larger firms’ needs and structures [6]. Therefore, the framework presented in Figure 1 cannot be effectively utilized for smaller construction firms since their safety management practices differ from large construction firms.

There are few, if any, studies that have genuinely examined the operational framework of safety culture and climate within smaller construction firms. To assess the safety culture and climate of small construction firms, a clear definition of "small" is needed [19]. Currently, there is no agreement on the definition of small construction firms. For example, Kvorning et al. [21] suggested that the threshold for small construction firms to be fewer than 9 employees, while Schwatka et al. [1] used a threshold of 75 employees. The safety-related actions and behaviors of main players undoubtedly differs between firms that hire fewer than 9 employees and those that hire fewer than 75 employees. Clearly, utilizing the current literature to adopt an objective definition is a challenge that must be addressed in a systemic and objective manner. Thus, this study does not adopt any of these thresholds and tries to deliver an object threshold. For now, the term "smaller construction firms" will be used instead of "small firms" because no objective definition exists.

Table 2. Construction Safety Culture and Safety Climate Definitions [15]

Aspect	Definition	Responsible Party
Safety Culture	The core values of a company or business that are indicative of the underlying beliefs and principles that guide safety decision-making.	Upper Management & Safety Personnel
Safety Climate	The manifestation of beliefs and principles in the form of practices and behaviors in the workplace.	Supervisors & Workers

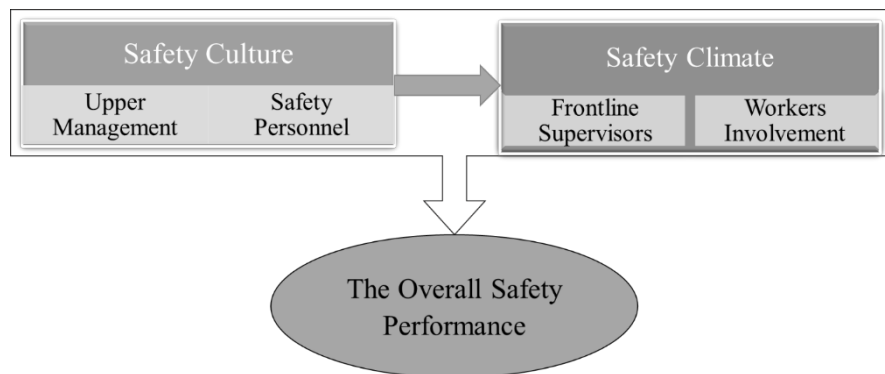


Fig. 1. The Construction Safety Culture and Climate – Larger Construction Firms

3. Safety culture and climate framework of smaller construction firms

The safety behavior of workers and field personnel is often shaped by the organizational safety standards of higher-level staff (i.e., upper managers and safety personnel) [20, 6]. Smaller firms are less capable of investing time and financial resources in occupational safety than large firms [22]. The owners are typically the main managers of these smaller firms and have a dominant influence on safety performance [3, 23, 24]. As a result, a lack of full-time safety personnel could be used as a defining criterion for smaller firms based on their safety management structure. The presence of safety personnel has a significant influence on the presence and quality of written safety programs and safety committees, which impacts overall safety performance [25]. Accordingly, the owner of a smaller firm has a dominant influence on the firm's safety performance [3]. The owners of smaller firms are also the managers of their firms [23, 25]. This study proposes that the construction safety culture and climate framework shown in Figure 2 depicts a typical operational safety management system within smaller construction firms. The proposed framework suggests that owner-manager represents the safety culture due to the anticipated lack of safety personnel. Moreover, the model also hypothesizes that the safety climate is characterized by frontline supervisors and workers, resulting from the owner's safety management style. It is hypothesized that Figure 2 represents the construction safety culture and climate of smaller construction firms. Accordingly, this study aims to identify when the structure of the construction safety culture and climate shifts from Figure 1 to Figure 2.

This study aims to validate the proposed corporate safety culture and climate framework for smaller construction firms presented in Figure 2. However, it is vital to identify an objective threshold that identifies smaller construction firms (i.e., definition of smaller construction firms). In addition, the study aims to improve

the extended OSH intervention model, that was suggested by Sinclair et al. [13], to ensure its resilience and effectiveness.

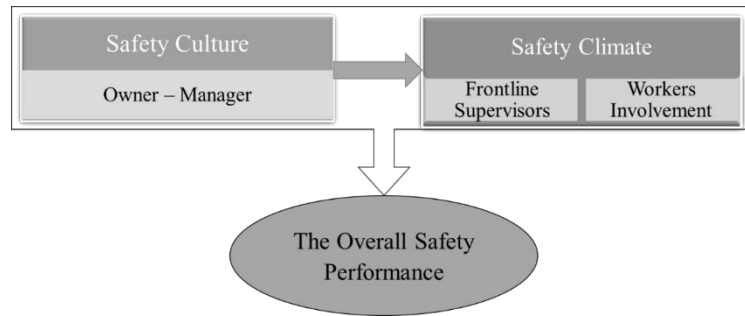


Fig. 2. The Construction Safety Culture and Climate – Smaller Construction Firms

4. Methodology

To achieve the study findings, an online survey was designed and administered to a convenience sample of construction firms in the United States. The survey was submitted to the Human Subject Institutional Review Board (HSIRB) at Western Michigan University for review and approval after it was pre-tested by construction practitioners. Appendix A shows the survey questions analyzed in this study. Before launching the survey, the research team worked with an online survey specialist from Qualtrics XM, a leading firm in online surveys, to ensure that the survey items are clear and arranged professionally. Accordingly, the invitations to participate were sent to construction firms between April and June 2020, and 125 responses were received. However, only 109 were deemed valid after removing responses that contained straight-lined or gibberish answers. The study sample is a convenience sample, which is a widespread research methodology in construction research due to the infeasibility of other sampling plans. Respondents were given a participant information and consent form at the beginning of the survey, which led them to the questionnaire only if they freely agreed to participate. Furthermore, participants were free to withdraw from the study at any time.

5. Findings

The collected data underwent descriptive and inferential statistical analysis. The following are areas of specialization of the respondents' firms: 28 (25.7%) were single-family residential contractors, 20 (18.3%) were residential apartment complex contractors, 27 (19.3%) were commercial building contractors, 21 (19.3%) were special trade contractors, and 13 (11.9%) were civil and heavy construction firms. The sizes of respondents' firms were as follows: 19 (17.4%) had fewer than 10 employees, 32 (29.4%) had 10–50 employees, 35 (32.1%) had 51–100 employees, 20 (18.3%) had 101–250 employees, and only three (2.8%) had more than 250 employees. The annual revenues of the respondents' firms were as follows: 16 (14.7%) earned less than \$100,000, 26 (23.9%) earned \$100,000–\$500,000, 32 (29.4%) earned \$500,000–\$1 million, 24 (22%) earned between \$1 million and \$10 million, and 11 (10.1%) earned more than \$10 million.

Most of the respondents were general contractors 85 (78%), and the rest were subcontractors 24 (22%). The participants' job descriptions were as follows: 27 (24.8%) workers, 34 (31.2%) supervisors, 42 (38.5%) management, and six (5.5%) safety personnel. The participants' levels of experience were as follows: seven (6.4%) had less than one year of experience, 35 (32.1%) had 1–5 years, 25 (22.9%) had 6–10 years, and 42 (38.5%) had more than 10 years. Overall, the respondent pool seems to be representative and purposive. As a result, the patterns of collected data are likely to be reliable and can represent the key themes of the study sample [26].

5.1 The defining criterion

One objective of this study is to provide a robust definition of smaller construction firms based on safety management structure to overcome the current inconsistency in industry definitions. The presence of a full-time safety manager is proposed as a distinguishing characteristic between smaller and larger firms due to the financial constraints that smaller firms often face, as discussed previously. Table 3 shows the respondents' answers to a question about the presence of a full-time safety manager within their respective firms. The table suggests that only three out of 19 firms that employed fewer than 10 employees had a full-time safety manager, whereas 33 out of 35 firms that employed between 51 and 100 employees had a full-time safety manager. Based on this finding, a new coding system was created to assess the statistical significance of the differences between the following firm size groups: less than 10, 10–50, and more than 50 employees.

Table 3. Safety Manager Presence by Firm Size

Firm Size groups	Yes (%)	No (%)
Less than 10	3 (15.8)	16 (84.1)
10–50	20 (63)	12 (37)
51–100	33 (94.3)	2 (5.7)
101–250	17 (85)	3 (15)
More than 250	3 (100)	0 (0)

To assess the statistical significance of the differences between these three groups, a chi-square test for homogeneity was conducted at an alpha level of 0.05. The null hypothesis was that the frequencies were alike. The chi-square test indicated that the frequencies of safety manager presence among the three groups were different to a statistically significant degree [$\chi^2 = 41.544$, $df = 2$, $p < 0.001$], suggesting that the presence of a full-time safety manager was influenced by firm size to a statistically significant degree and that the null hypothesis should be rejected. The results indicate that there is a 0.001 chance that the differences in terms of full-time safety manager presence between the three groups are coincidental. This finding suggests that the majority of smaller construction firms are less likely to have a full-time safety manager.

Furthermore, a binomial logistic regression analysis was performed to determine the proportion of safety personnel presence that is explained by the firm size. The logistic regression model revealed a statistically significant relationship [$\chi^2 (1) = 40.59$, $p < 0.001$]. Furthermore, the model explained 44% (Nagelkerke R²) of the variance in the presence of safety personnel and correctly classified 81.7% of the cases. As a result, this study objectively classifies the smaller construction firms into two groups:

- 1) Micro firms (fewer than 10 employees) and
- 2) Small firms (11–50 employees).

This study classifies firms that hire more than 50 employees as larger construction firms. Larger construction firms could be classified as medium size (50–250 employees) and large size (more than 250 employees), as suggested by Targoutzidis et al. [27]. However, classifying larger firms is beyond the scope of this study. This classification answers question one of this study by delivering the following: (1) providing an evidence-based threshold to categorize smaller construction firms that reduces the current discrepancy in definitions, and (2) providing a better understanding of the construction safety management of smaller construction firms (i.e., safety culture and climate structure).

5.2 General safety performance indicators

To validate the proposed safety culture framework, several critical safety-related activities and patterns are discussed based on the new classification of construction firms. Written safety programs and safety and health committees are essential to developing a systematic approach for managing safety and health on construction sites [25]. The presence of safety and health programs was the least common among micro firms when compared to small and larger firms, see Table 4. Additionally, the presence of safety and health committees was less common at both small and micro firms than at larger construction firms. The lack of written safety programs and safety and health committees is a direct result of the lack of full-time safety managers in micro firms [25]. Thus, this finding supports the proposed corporate safety culture framework for smaller construction firms which suggests the absence of full safety personnel, see Figure 2.

As for the sources of safety training, high proportion of micro firms (52.6%) utilize in-house sources seems alarming. The validity and reliability of the training source is questionable due to the lack of full-time safety personnel among these firms. On the other hand, trade associations seemed to be a source of training for only small portion of smaller construction firms (i.e., micro, and small firms). This finding limits the impact of the NIOSH's efforts to use trade associations as intermediary organizations to transfer OSH knowledge to smaller firms.

The role of upper managers within construction firms was also assessed. The proportion of upper managers who conducted field activities was higher among smaller construction firms than larger ones, suggesting that the owner-managers of smaller firms have a higher influence on the overall construction safety culture as well as safety climate, see Figure 2.

Again, this finding supports the proposed corporate safety culture for smaller construction firms. Finally, large proportion of micro firms (47.4) were subcontractors. Within the study sample, 50% of subcontractors had full-time safety personnel, whereas 75.3% of general contractors had full-time safety personnel.

5.3 General contractors role in improving site safety

The extended model for small business OSH intervention discussed earlier in this paper has great potential. Knowing that a higher proportion of smaller construction firms, especially micro firms, are subcontractors, general contractors should be targeted as intermediary organizations. General contractors have financial and operational interest in improving the overall safety performance of their subcontractors because poor safety performance could

impact project schedules and their reputations. Having an unsafe subcontractor would not only negatively influence the unsafe subcontractors' workers, but also everyone else working in the field [28]. This means that the overall safety climate of a construction site will be negatively impacted. Therefore, it is to the general contractor's benefit to act as an intermediary organization, satisfying the social exchange theory. Thus, it is strongly recommended to focus on general contractors as intermediary organizations. This shifting in focus must be realized by OSH organizations (i.e., initiators) to positively influence the safety performance of smaller construction firms. Utilizing general contractors as intermediary organizations is necessary because OSH interventions are better conveyed by face-to-face communications and the number of smaller construction firms is beyond the capacity of government OSH organizations. On other hand, this study shows that having trade associations as intermediary organizations may limit the impact of the NIOSH's extended OSH model since only small proportion of smaller construction firms depend on trade associations for their safety training.

Table 4. Differences in Safety-Related Activities by Firm Size

	Construction Firm Type		
	Micro	Small	Larger
Written Safety Program	n (%)	n (%)	n (%)
Yes	10 (52.6)	29 (90.6)	50 (86.2)
No	9 (47.4)	3 (9.4)	8 (13.8)
Safety and Health Committee			
Yes	3 (15.8)	20 (62.5)	53 (91.4)
No	16 (84.2)	12 (37.5)	5 (8.6)
Source of Safety Training Information			
In House	10 (52.6)	5 (15.6)	5 (8.6)
Online Search	2 (10.6)	1 (3.1)	9 (15.5)
OSHA Website	0	4 (12.5)	5 (8.6)
Third Party	0	7 (21.8)	8 (13.8)
Trade Associations	3 (15.7)	3 (9.3)	0
Other or More than Two of Above	4 (21.1)	12 (37.7)	31(53.5)
Upper Management Activities Including			
Frontline Supervisor Activities	7 (36.8)	19 (59.3)	39 (67.3)
Worker Activities	8 (42.1)	10 (31.3)	12 (20.6)
Both (Frontline Supervisors + Workers)	4 (21.1)	3 (9.4)	7 (12.1)
Establishment Role			
General Contractor	10 (52.6)	26 (81.3)	49 (84.5)
Subcontractor	9 (47.4)	6 (18.7)	9 (15.5)

6. Discussion

It is crucial to improve the safety performance of smaller construction firms, which represent the majority of the industry. In general, smaller firms have higher rates of occupational injuries and illnesses and fewer safety resources to control occupational hazards [13, 29, 4]. However, current literature provides no objective definition nor understanding of the safety management structures of smaller firms. This study overcomes these shortcomings by providing an evidence-based safety-related definition for smaller construction firms, which will help construction safety practitioners and scholars improve the overall safety performance of smaller construction firms. Smaller construction firms (i.e., small, and micro firms) lack the financial resources to hire full-time safety personnel, which significantly influences their capacity to manage safety. Al-Bayati et al. [15] suggested a few actions safety personnel must take to ensure a stronger construction safety culture. In smaller firms, these actions must be carried out by the owner-manager instead of safety personnel to create and maintain an acceptable construction safety culture. This fact shapes the construction safety culture and climate of smaller construction firms, as presented in Table 2. Cunningham et al. [2] reported that orientation training is lacking among smaller firms, suggesting the absence of relevant policies. However, based on the findings of this study, it seems that the lack of site orientation policy is not the main safety challenge among smaller construction firms. The absence of necessary policies and safety personnel due to financial constraints represent a major challenge.

The policies of smaller construction firms vary depending on the leadership style of the owner-manager [2]. Hasle and Limborg [3] suggest that the owner-managers of smaller firms are dominant actors in any changes made, and their values and priorities determine the culture of the firm. As a result, safety policies and practices are often shaped by the owner-managers of smaller construction firms based on their experience and subjective opinions. This explains the lower proportion of smaller firms that have a written safety program, as can be seen in Table 4. This also explains why the proportion of micro firms that utilize in-house materials is higher than smaller and

larger firms, see Table 4. Safety management systems can be categorized into two levels: (1) managing safety by focusing on OSHA requirements (basic level), and (2) managing safety by focusing on safety behaviors (advanced level) [30]. As for smaller firms, the focus should be transferring safety management techniques to the owner-managers of smaller construction firms. Empowering the owner-managers of smaller construction firms to better manage safety is crucial.

Cunningham and Sinclair [12] discuss a construction case study that aims to test the NIOSH's extended OSH intervention model. The construction case study was a half-day training on trenching safety provided by a national construction trade association and trenching equipment supplier. The training did not target the owner-managers of smaller construction firms. Similarly, the Foundations for Safety Leadership (FSL) training program, created to improve field communication, seems more effective in improving the safety leadership skills of frontline supervisors working for smaller construction firms [1]. Accordingly, it appears that the current interventions for smaller firms do not focus on the owner-managers which is a vital shortcoming.

7. Recommendations

Current interventions that aim to improve the safety performance of smaller construction firms must consider the findings reported in this study and revisit the training materials for smaller construction firms to ensure that they provide the most needed knowledge, not just general safety training topics. Training should focus on safety management techniques, including how to create and maintain written safety programs and OSH resources. In addition, training efforts should target the owner-managers of smaller construction firms. This shift in training materials and focus will empower the owner-managers to be safety leaders in their firms and establish a more robust safety culture among smaller construction firms, therefore, improving safety climate.

The owner-managers of smaller firms often consider safety activities as a financial burden that is too heavy and unrealistic since incidents, in general, are rare. However, this will not be the case if their hiring firms (i.e., general contractors) require and help them create and maintain better safety policies and practices. It is imperative that OSH organizations acknowledge and prioritize the critical function of general contractors and provide them with the needed resources to act as effective intermediaries. This model utilizes a mechanism to ensure the implementation of the OSH program through a safety education and training program of general contractors. As a result, this implied mechanism overcomes the lack of implementation the intermediary organizations deliver, as suggested by Olsen and Hasle [7].

Construction sites often have a fragmented safety climate due to the fact that subcontractors (i.e., smaller construction firms) have lower and various safety culture than general contractors. [4,31]. As a result, general contractors have a mutual benefit in improving the safety performance of their subcontracts by acting as intermediary organizations. Furthermore, empowering general contractors to be effective intermediary organizations is compatible with the nature of construction workplaces where the workplace is often controlled by the general contractor, who, as a result, plays an important role in improving overall site safety [15, 17]. Finally, targeting the owners of smaller firms will provide a sustainable means of improving safety training in construction firms because workers in the construction industry, especially those employed by micro construction firms, are generally temporary workers due to the seasonal nature of the industry [31, 18].

General contractors must act as intermediaries in order to improve smaller construction firms (i.e., subcontractor) safety performance. The general contractor should invest in improving their subcontractors' safety performance in all possible ways, including education and funding to effectively implement safety programs and policies. Safety is critical because of its impact on the wellbeing and lives of workers and their families. In addition, there are a few critical benefits from investing in site safety that should be considered by general contractors. Among other benefits, investing in site safety will lead to fewer interruptions to work production, lower worker's compensation, maintain a good business reputation, and lower workers' absenteeism [17]. Safety performance could be defined as the overall performance of a firm during safe operation (4). Therefore, it is often difficult to quantify the benefits of safety investment since a higher level of safety performance means no incident (i.e., no losses). However, it is anticipated that investing in safety will lead to a lower probability of an accident occurring [17].

8. Concluding remark

Based on this study, smaller construction firms could be classified into micro firms (i.e., employ fewer than 10 employees) and small firms (i.e., employ between 10 and 50 employees). The owner-managers of smaller construction firms are solely responsible for the firm construction safety culture due to the absence of safety personnel. This unique characteristic of smaller construction firms should be carefully addressed by current and future intervention programs aiming to improve overall safety performance. Specifically, the interventions of OSH organizations should prioritize enhancing small business owners' safety management skills.

On the other hand, OSH organizations can help improve the safety climate levels of small and micro construction firms by involving general contractors who have a financial and operational interest in achieving a higher level of construction safety climate. A recent study suggested that project general contractors should include a safety plan in the contract selection criteria and allocate a budget for needed safety programs and equipment when hiring small and micro construction firms [33]. The crucial role of general contractors should be carefully examined and utilized by OSH organization. As a result, it is highly recommended to empower general contractors to act as effective intermediaries. Recognizing the significance of this crucial component for the OSH intervention diffusion model to be effective is vital.

It is crucial for OSH government organizations to implement the proposed recommendations outlined in this paper. Doing so will effectively equip owner-managers of smaller construction firms with the necessary tools to improve their safety management practices and capabilities. As a result, small and micro construction firms will undoubtedly witness a significant decrease in both fatal and non-fatal injuries. Therefore, this article significantly contributes to the body of knowledge with critical practical and theoretical recommendations.

One limitation of this study is that it does not consider the workforce characteristics of smaller construction firms, which are different from larger firms [24]. Smaller US firms are more likely to hire Hispanic workers, who face higher rates of fatal and non-fatal workplace injuries. Thus, the Hispanic construction workforce has unique characteristics that should be carefully addressed through the firm's safety management program [34]. Another limitation is related to the study methodology, which only relies on a survey instrument. However, smaller firms do not necessarily prefer written information as opposed to personal contacts [3]. Thus, it is recommended to use a friendly method such as focus group studies to validate the findings of this study and better understand working conditions of smaller construction firms.

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Appendix A – Survey Questions Discussed in this Article

What of the following match your position/title? check all that apply

- Upper Management (e.g., Human Resources Manager, Owner, a person who manages several construction worksites)
- Field Supervisor (Superintended, Forman)
- Safety Personnel
- Worker

Other – Specify

How many people are employed by your company?

- Less than 10
 10-50
 51-100
 101-250
 More than 250

How much annual revenue does your firm make?

- Less than \$100,000k
 \$100K - \$500K
 \$500K - \$1 million
 \$1 million - \$10 million
 More than \$10 million

Does your establishment have a safety manager/coordinator whose only job is managing and providing oversight of the safety and health program?

- Yes No

Does your firm have a safety and health committee?

- Yes No

Does your firm have a written safety program?

- Yes No

Do upper management do any of the following duties?

- Frontline Supervisor Activities
 Worker Activities
 Both (Frontline Supervisors + Workers)

Where is the source of your safety training material? Choose all that apply.

- In house
 Online Search
 OSHA Website
 Third Party
 Trade Associations
 Other or More than Two of Above

How many years have you been in construction?

Which of the following industries most closely matches your establishment work?

- Residential - Single-family
 Residential - Apartment Complex
 Commercial (buildings, shopping centers)
 Special Trades Contract
 Civil and Heavy (Street or Road Construction)

Which of the following roles most closely matches your establishment work?

- General Contractor
 Sub-Contractor



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