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Implementation of Safety Culture Among Workers of Selected Construction Companies

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ABSTRACT

Safety performance improvements in the construction industry increase its resistance to and lower the risk of accidents. The study assessed the firm's effectiveness in promoting safety culture in a construction project on-site and examined the safety culture of construction employees working at a construction project in Cagayan de Oro City. The study used a descriptive-correlational design and utilized a survey questionnaire in gathering the primary data from the 218 respondents. Findings depicted that more respondents were in the age range from 31 to 35 years old; the majority were males and had served less than 5 years of experience. The overall mean description of the accident determinants of safety culture usually experienced by the workers in a construction project resulted in a "great extent", and the same was true for the construction workers' assessment of the extent of implementation of safety culture. The accident determinants of the construction workers' safety were all significantly correlated with all the indicators of safety culture. Results showed no "significant difference" in the implementation of construction regulations factors in terms of age and civil status. Further, there was a significant relationship between the safety culture and the firm's performance on safety culture. The action plan was developed to ensure the safety culture of the construction workers, which includes the six areas of concern, such as influence of unsafe behavior, technical guidance, enforcement of safety regulations, shortage of equipment, lack of safety training, and wearing personal protective equipment. The study concluded that firm's performance on safety culture in terms of increase in productivity, cost reduction, quality improvement, and organizational commitment is greatly affected by the lack of safety training, influence of the unsafe behavior, shortage of equipment, enforcement of safety regulation, technical guidance and wearing of personal protective equipment. Thus, the action plan is recommended for the safety culture of construction workers.

Keywords: *Safety culture, construction project, project manager, construction regulations, Philippines*

INTRODUCTION

The construction industry plays a significant role in the economy, and the activities of the industry are also important to the achievement of national socio-economic development aims of providing shelter, infrastructure, and employment. The construction industry also employs a large number of people in order to operate. The workers in this industry need to be physically fit because the work involves standing for long hours, bending, and slouching in small spaces. The construction industry and workplaces are known as one of the most adventurous and dangerous industries in the world, incurring more occupational fatalities than any other sector (Alipouri et al, 2021).

Fang et al. (2020) stressed that the safety of the workers must be the topmost priority in every project. Major accidents in the workplace due to poor safety protocols may cause delays or halt productivity and could escalate to huge financial losses due to costs incurred in dealing with the accident. Poor safety culture is one of the most significant factors affecting employees' workplace safety behavior, which may lead to injuries and accidents, and strengthening such culture can improve workers' safety performance or the quality of safety-related work (Ehiaguina & Moda, 2020). Safety performance improvements in construction can increase its resistance and lower the risk of accidents. According to Trivedi and Yadav (2020), a safety culture attempts to create a self-sustaining environment based on a full awareness of the causes of various workplace security executions by anticipating a common security threat that happens frequently enough to elicit a standard reaction.

Furthermore, Kale (2020) mentioned that one of Turkey's significant issues is occupational accidents in the building industry. From 1992 to 2015, the industry alone was responsible for 32.0 percent of all fatal industrial accidents. A project's success is enhanced by maintaining project safety throughout the building process. Keeping workers safe during construction helps a project's success (Nguyen, 2020). The development trend includes four stages: the impact of corporate safety culture on behavior, the impact of safety cognition and occupational risk assessment on construction safety, and the use of computer technology (Fu, 2020). A resilient safety culture has been proposed to manage emergent and unforeseen safety concerns in order to achieve consistently good safety performance. Although this influence may not be significant for a high level of resilient safety culture (Trinh & Feng, 2020).

The construction sector is a major employment generator and a boon for the effective growth of developing countries like India (Sambandan & Kala, 2020). The Department of Labor and Employment is the main OSH institution in the Philippines, responsible for the prevention of diseases and accidents in construction work, law enforcement, rehabilitation, and compensation. This regulation provides guidance and enforcement for workplaces involving training of personnel for health and safety, safety and health committees, and illness and accident records of construction work (Indrayana, 2020). Due to the sophisticated and dynamic nature of construction work, workers rely heavily on their supervisors for job assignments, ongoing monitoring, and support. Results of the study of Chih et al. (2017) revealed that a high-quality working relationship between workers and their supervisors can facilitate workers' positive emotions, leading to enhanced job embeddedness and superior performance, based on data collected from the Philippines' construction industry using a time-lagged research design.

Further, Typhoon Washi (or Sendong) wreaked immense devastation in Cagayan de Oro City, prompting a large-scale migration program and house construction. Cagayan de Oro is known as the "City of Golden Friendship". It is the provincial capital of the province of Misamis Oriental and the "Gateway of Northern Mindanao," lying along the northern coastline of Mindanao Island in the southern part of the Philippines. The local authorities outlawed these structures, claiming that residents could be forced to reproduce dangerous and unstable pre-disaster living circumstances. These assertions conflict with those of scholars who believe that community development and empowerment can be aided by resident-led housing additions (Carrasco et al., 2016).

MATERIALS & METHODS

This study used the descriptive-correlational research design. This study was carried out in the city of Cagayan de Oro as part of a construction project. The study used a simple random sampling method. The study was based on a population of 500 workers taken from the list of construction companies. The 218 respondents were subdivided into the contractors (5), area managers (5), project engineers (7), safety officers (7), and construction workers (194), a mixture of skilled and semi-skilled construction workers on the construction projects (like roads, bridges, and buildings). The instrument used in the study was a researcher-made questionnaire, which has two parts. The first part of the questionnaire was the demographic profile of the respondents, which includes age, sex, civil status, educational attainment, job description, and years of experience. The second part of the questionnaire was adapted from Mahmoud (2020), which assessed the safety culture of construction workers at a construction project in the city and referenced articles on the firm’s performance on safety culture.

RESULTS AND DISCUSSION

The study assessed the firm's effectiveness in promoting safety culture in a construction project on-site and examined the safety culture of construction employees working at a construction project in Cagayan de Oro.

Respondents' Demographic Profile

The data revealed that the highest frequency was from 31 to 35 years old; it had 84 or 38.50 percent, and the lowest frequency was from 40 years old and above with 1 or 0.50 percent.

This implied that the age bracket 31-35 years old is commonly hired as construction workers, and the age bracket when men started to have families, thus need to work in order to provide the economic needs of their families.

The distribution of respondents according to sex revealed that there were 186 males, or 85.30 percent, and 32, or 14.70 percent, for females. This indicates that there were more male respondents than female respondents in this study. This is because construction work requires strength that men are more capable of than women. This finding is supported by Norberg and Johansson (2021), who stressed that the construction industry is a typical example of a work site heavily dominated by one gender, which is male. The percentage of construction work held by women is extremely low, between 9-13%, and has remained more or less at the same level over the years, although in some countries.

The distribution of respondents according to civil status revealed that the highest frequency was married, with 50 percent, and the lowest frequency was widowed and separated, both had 1.40 percent. This result entails that more of the respondents were married. This implied that those who applied and worked as construction workers were those who were married. For Filipinos, age 18 is already considered independent; thus, even if they are single, they are expected to have income and sustain their own needs. For those who were married, they need to work in order to provide for the needs of their families.

The data revealed that the highest frequency was the high school with 153 or 70.20 percent, and the lowest frequency was the doctoral degree with zero percent. The data disclosed that the majority of the respondents were high school graduates. This indicates that the construction is a type of work that accepts applicants who are not degree holders or just high school graduates. This implied that the high school graduates do not have the skills and the confidence to apply for a job aside from construction work.

The distribution of respondents according to the job description showed that the highest frequency was the skilled worker with 127 or 58.30 percent, and the lowest frequency was contractor and area manager, both had 5 or 2.30 percent. The result indicated that there were more respondents who were skilled workers. This means that the respondents had already acquired the skills needed for construction work. This is because one of the requirements to finish a construction project is to have a higher number of construction workers, skilled and semi-skilled. The distribution of respondents according to years of experience revealed that the highest frequency was less than 5 years of experience, with 96 or 44.00 percent, and the lowest frequency was 21 years of experience and above, with 9 or 4.10 percent. This result discloses that most of the respondents had worked as construction workers for less than 5 years. This implies that the construction workers were not staying for a long time at a particular construction site.

Accident Determinants Experienced by the Workers

Lack of Safety Training

The result divulges that "lack of safety and training may cause injuries to workers" is the prevailing accident determinant experienced by construction workers in a construction project. This means that the respondents strongly agree that a lack of safety training is a factor that can cause many injuries.

Overconfidence

Among the four indicators, they strongly agreed that "improper placing and stacking of objects and materials in dangerous locations can result in unpredictable accidents" (M = 3.50, SD = 0.59). Razali et al. (2017) pointed out that there must be signs and warnings posted on walls to guide workers for the proper placement and storage of objects. On the other hand, "failure to warn or to secure members out of danger is considered an unsafe act" was the indicator that they rated least, relative to the four indicators (M = 3.42, SD = 0.58). However, it still belonged to "strongly agree", meaning they have experienced this to a greater degree throughout their working years.

Unsafe Behavior

The item "the limitations of facilities in the construction industry make it difficult to allocate management resources for the prevention influence workers of unsafe behavior" had the highest mean among the four items that measure the influence of unsafe, (M=3.40, SD = 0.53). Bowmaster and Rankin (2019) stated that in terms of innovation maturity, there is very little study being done on automation technology deployment and acceptance, as well as very little study on technology development and prototyping.

However, they still strongly agreed on this. Thus, construction agencies must continue to employ these factors in their work process. According to Guo et al. (2017), construction sites are more complicated and variable than other industries, making safety management more challenging to implement.

Shortage of Equipment

As indicated, the accident determinants in terms of shortage of equipment were rated as "strongly agree" (M = 3.38, SD = 0.61). This means that the respondents experienced having a shortage of equipment throughout their working years.

Among the four indicators, they strongly agreed that "short supply of equipment without safety devices causes construction accidents among workers" (M = 3.43, SD = 0.55). This finding is supported by Jo et al. (2019), who said that one of the elements that causes accidents in the construction industry is a lack of equipment. On the other hand, "limited availability of equipment leads to workers' accidents" is the indicator that they rated least, relative to the four indicators (M = 3.32, SD = .68). However, it still belonged to "strongly agree", meaning they have experienced this to a greater degree throughout their working years. As pointed out by Mohammad and Hadikusumo (2017), focusing on the technical intervention with five crucial safety practices helps improve workers' safety behavior: workplace safety inspections, personal protective equipment (PPE) programs, safety equipment availability and maintenance, safe work practices, and safety permits.

Safety Culture Experienced by the Construction Workers

Enforcement of Safety Regulation

The item "implementing a safety program and enforcement of safety regulations for the success and in meeting construction objectives" had the highest mean among the four items that measure enforcement of safety (M=3.45, SD = 0.66).

This implied that the respondents believed that implementing a safety program and enforcement of safety regulations are important for the success and in meeting construction objectives.

Technical Guidance

The respondents have experienced implementing technical guidance in one way or another. The small-to-medium construction site has a high safety accident rate due to a lack of a safety management system, a lack of safety management capacity, a lack of safety investment, and the owner's lack of safety awareness (Keun & Su, 2016).

On the other hand, “the absence of competition among technical guidance agencies influences the safety culture of construction workers” was the indicator that they rated least, relative to the four indicators (M = 3.26, SD = 0.70). However, it still belonged to a great extent, meaning they have experienced this to a greater degree throughout their working years. As emphasized by Lim et al. (2018), the number of disasters on the construction site is increasing every year, accounting for more than 80% of the total number of casualties.

Safety Management Manual

Having a safety management manual had been practiced among the respondents, with the overall mean of 3.41. The item “the manual states the checklist of workers wearing protective equipment” had the highest mean among the four items that measure safety management manual (M=3.47, SD = 0.62).

This result is supported by Srinivas et al. (2020) that the manual must have a system that checks if workers are wearing the prescribed protective equipment, and site managers should monitor when they are in danger. As construction projects become increasingly complicated, a variety of data can be generated. As a result, interdisciplinary and systematic collaboration necessitates a significant quantity of communication and data transfer (Park & Kim, 2015).

Safety Poster Display

The workers generally agreed that such practice had been experienced in an excellent manner, with an overall mean of 3.32. The item “the management provides for an adjustable and portable display of posters, capable of being arranged in either a working position or a non-working position” was rated excellent (M = 3.37, SD = 0.64).

On the other hand, the item “the management prepares a suitable for displaying a poster and erected without the use of tools by assembling a set of members” had been rated relatively the lowest among the four, but still, it was rated excellent by the workers (M = 3.28, SD = .68). This shows the skills of the management in erecting posters even without the use of tools. According to Harianto et al. (2019), employee consistency in behaving properly in the workplace can be improved through the use of safety posters.

Safety Consciousness

Generally, the respondents rated such practice as an excellent one (M = 3.44, SD = 0.64). The highest score among the four items was on the practice that workers “strengthen personal safety consciously during the construction process” (M = 3.49, SD = 0.71). This result signified that the workers are conscious of their personal safety, particularly during the construction process. The Hong Kong Commissioner for Labor identifies worker behavior as the root cause of construction accidents. Behavior-based safety (BBS) is one effective approach in managing employee safety issues (Li et al., 2015). Failure to wear safety helmets appears to be one of the leading reasons for an increase in accidents; technology to monitor whether or not safety helmets are being used is required (Kim et al, 2018).

Working on Moving Equipment

Working on moving equipment is generally rated excellent (M = 3.56, SD = 0.58). As assessed by the workers on this practice, the highest rating was both on the items “need to focus on my work while using moving equipment for the safety of all workers.” and “I find it easy to work with moving equipment when I am familiar with its safety.” (M = 3.58, SD .55).

This result suggests that the respondents were aware that they needed to focus on their work while using moving equipment for their safety. The selection of the equipment is best performed by personnel with experience in earth-moving operations. The continuous tracking and monitoring of tasks performed by construction heavy equipment are vital for project managers and job site personnel (Cheng et al., 2017).

Unsafe Speed

Overall, the rating was excellent (M = 3.40, SD = 0.63). This means that the workers were excellent in terms of their “focus on a task when working to avoid speeding up and to meet the target accomplishments” (M = 3.52, SD = 0.58).

Wearing Personal Protective Equipment

They rated highest when workers “follow the rules in wearing protective equipment as the safety requirements and rules of the company to avoid an accident” (M = 3.60, SD = 0.57). This indicates that the management should make sure that the workers have the right attitude so that rules and regulations inside the working premises are always followed.

Wong et al. (2020) mentioned the grounded theory projects and identified those elements in personal, technological, and environmental contexts that influence construction workers' usage and non-use of personal protective equipment (PPE). The consequence of following the rule is the actualization of such a rule. Indeed, workers rated themselves excellent also in terms of the item that workers “wear personal protective equipment while operating the machines and equipment needed at the construction site” (M = 3.51, SD = 0.56). It must be noted that this protective equipment should be worn, especially while in “actual operation”. PPE is the lowest measure in the hierarchy of hazard control that works because it depends on workers’ behavior (Tadesse & Israel, 2016).

Preventive Maintenance

Overall, the workers were very cautious and were excellent in the way they implemented preventive maintenance (M = 3.33, SD = 0.60). They had observed and found it excellent that “suitable safety equipment is provided and maintained within a suitable timeframe” (M = 3.41, SD = 0.46). The keyword is “suitable timeframe,” so that maintenance is done in a systematic and timely manner. As stated by Zhu et al. (2016), each year, the construction sector reports tens of thousands of injuries and deaths, the majority of which are caused by workers being injured by mobile equipment on building sites. To address this issue of site safety, proactive warning systems are required.

They also find it excellent that “workers are required to undertake regular health examinations and pre-employment medicals” (M = 3.16, SD = 0.78). Indeed, the health of the workers must be of utmost importance in any company. Comprehensive programs that target health promotion to prevent obesity and ergonomic interventions to reduce physical workload are important to facilitate sustained employment.

Causes of Man-Hour Loss of Construction Workers

Accidents

Overall, the respondents found it to a moderate extent or they rated it as very good (M = 3.14, SD = 0.72). The highest among the four indicators of possible losses due to accidents was that workers "believe that an accident happens due to the absence of good working conditions" (M = 3.29, SD = 0.57). This implies that workers are aware that accidents can always occur, but are minimized if management ensures that the working conditions are at their "best". The principal accidental agents include substandard work surroundings, transportation, and lifting equipment, such as scaffolds (Ayob et al., 2018).

Relatively, the lowest among the four indicators was the notion that workers "confirm that the accident occurs due to a lack of work experience" (M = 3.01, SD = 0.81). However, workers should also meet the minimum working experience required to ensure fewer, if not, accidents at all. It has been discovered that when there are insufficient corporate policies, risky practices, poor attitudes of construction people, weak management commitment, and insufficient safety knowledge and training of workers, site accidents are more likely to occur (Teo et al., 2005).

Mortality

Overall, this survey found out that workers' rating on the extent of man-hour loss of construction workers due to mortality was at moderate extent (M = 2.85, SD = 0.95).

Based on the observations of the respondents, workers notice that falls from height are one of the causes of death of the construction workers (M = 2.89, SD = 0.91). This implies that there is a need to have a safety harness below the ground or a specific protective gear for this matter (i.e., falling from higher floors). Fung et al. (2010) stressed that occupational health and safety issues, such as falling goods or people from great heights, stumbling on things, and being wounded by hand tools, are all common in the construction sector.

Aside from workers falling from a certain height, the possibility that "being struck by a moving vehicle" was one of the causes of death of the construction workers (M = 2.80, SD = 0.93). This means that there should be enough manpower so that in a situation where logistics are being carried on. One could act as a watcher, and another as a trafficman, to facilitate such a dangerous working process involving moving vehicles. The three most prevalent causes of accidents in Kampala are mechanical hazards, being hit by falling objects, and falls from height (Irumba, 2014).

Hospitalization

Generally, the worker felt that such hospitalization policy, for that matter, was not being met; thus, they rated it at "less extent" M = 2.14, SD = 0.84). Specifically, workers noticed that contact with temperature extremes was one of the causes of my hospitalization (M = 2.82, SD = 0.92). Especially on a very hot day, workers always complained about the very hot temperature; thus, proper ventilation in the working space should be put in place. This finding is in consonance with the findings of Li et al. (2016), which showed that high-temperature settings put the human body under stress and reduce labor productivity in the construction business.

On the other hand, the lowest rating was that workers "noticed that contact with radiation is one of the causes of my hospitalization" (M = 1.48, SD = 0.74). This implies that the respondents knew that construction work is not exposed to radiation; thus, they did not agree that radiation is one of the causes of hospitalization.

Construction workers, unlike chemical plant workers, are less exposed to radiation and chemicals. The most important but influential risk factor in the development of skin cancer is unprotected exposure to solar ultraviolet (UV) radiation. To assure adequate and effective protection against UV exposure, a level of knowledge about solar radiation and its effects is required (Hault et al., 2016).

Downtime

Overall, workers' ratings were moderately extensive. This means that they have experienced downtime one way or another (M = 2.94, SD = 0.92). The highest indicator that workers rated was on the "experience not reporting for duty due to wet weather" M = 3.13, SD = 0.90). In this area of the country, rain can cause floods and worsen traffic; therefore, the workers have no other choice but to stay off duty. However, the weather in the United Kingdom extends project durations by an average of 21%. When planning, however, using climatological data obtained from weather observations could result in average project length reductions of 16 percent, with equivalent savings in indirect and overhead expenses (Pérez et al, 2018).

The lowest among the four indicators for downtime was that workers "experienced not working on the construction site due to a lack of proper equipment" (M = 2.85, SD = 0.88).

Again, the management and the workers have other choices rather than stopping a particular operation due to a lack of proper equipment; conventional methods can be used as a temporary replacement. Sun et al. (2018) supported that in the future development of buildings, the energy-saving of construction equipment and technology will become an important symbol of construction technology progress.

Firm's Performance in Implementing the Safety Culture

Increase in Productivity

The overall mean of 3.43 (SD = 0.58) has an interpretation of excellent. This means that the respondents highly practiced this increased productivity factor.

Besides, the indicator "having clear guidelines and approach to work" obtained the highest mean of 3.50 (SD = 0.59), which has a description of excellent. This entails that the respondents are well informed about the guidelines and approach to work.

As expressed by Malekitabar et al. (2016), design attributes and environmental conditions are found to play a key role in the occurrence of 363 accidents reported by three different sources and are associated with object-oriented rules that are classified into four categories depending on how they are to be processed by rule checking engines.

On one hand, the indicator "A good relationship between the supervisor and workforce in the construction site" obtained the lowest mean of 3.35 (SD = 0.57); however, it still has a description of excellent.

Individual worker safety performance is highly determined by how the worker responds to the work environment, particularly the mental work environment, according to a study of construction road maintenance teams in Missouri. The workers who had solid working ties with their foreman and the employer were the ones who were safer (Hinze, 1981).

Cost Reduction

The firm's performance in implementing the safety culture is usually contributed to by the workers of the construction project in the city in terms of cost reduction. The overall mean of 3.37(SD =0.60) has an interpretation of excellent. This means that the respondents highly practiced this cost reduction factor.

Also, the indicator "favorable selection of a project site for the reduction of construction costs" obtained the highest mean of 3.41 (SD = 0.56), which has a description of excellent. This means that it is necessary to be selective in the project site for the reduction of construction costs. Toole (2005) stated that reviewing their designs, creating design documents, assisting the owner in procuring construction, reviewing submittals, and inspecting work in progress are five tasks that design civil engineers could perform differently than current custom and practice to contribute to construction worker safety.

In addition, the indicator "consideration of local wage rate to minimize labor cost in construction project" obtained the lowest mean of 3.33 (SD = 0.62), which has a description of excellent. Individual attribute differentials (e.g., human capital) within the same industry sector were the primary cause of salary disparities in both 2002 and 2013, and the problem of discrimination against migrants within the same industry sector became increasingly significant from 2002 to 2013 (Ma, 2018).

Quality Improvement

The overall mean of 3.37(SD = 0.62) has an interpretation of excellent. This means that the respondents highly practiced this quality improvement factor.

Likewise, the indicator "using the structuring of design and design process into sequential segments" obtained the highest mean of 3.40 (SD = 0.59), which has a description of excellent. This indicates that this indicator was excellently practiced by the respondents.

Bansal (2011) highlighted that in the construction safety planning process, execution schedules and 2D drawings are commonly employed for danger detection. To grasp the execution sequence in safety planning, the planner visualizes 2D drawings into a 3D model and mentally integrates its components with the respective tasks indicated in the schedule.

Moreover, the indicator "using a design tool that ensures projects are designed based on the client's set cost and time set targets" obtained the lowest mean of 3.33 (SD = 0.60); however, it still has a description of excellent. This implies that this indicator was practiced by the firm, but not always observed by the respondents among the four indicators.

Zimina et al. (2012) pointed out that target value design is a management approach that takes the best features of target costing and adapts them to the peculiarities of construction.

Organizational Commitment

The overall mean of 3.38 (SD = 0.65) has an interpretation of excellent, which indicates that the respondents highly practiced this organizational commitment factor.

Also, the indicator "attachment of professional commitment to the firm and their profession" obtained the highest mean of 3.43 (SD = 0.66), which has a description of excellent. This reflects that this indicator was highly practiced by the firm. Schwatka et al. (2016) stated that the validation of safety climate with safety and health performance data offers the potential for using safety climate measures as a leading indicator of performance.

However, the indicator "a positive emotional state resulting from the appraisal of one's job or job experiences" obtained the lowest mean of 3.35 (SD = 0.63), which has a description of excellent. This means that this indicator was practiced to a great extent, but was less observed by the respondents.

Hwang et al. (2018) expressed that construction workers' emotional states (e.g., pleasure, displeasure, excitement, and relaxation) are known as critical factors that affect their performance (e.g., safety, health, and productivity). To avoid negative effects on work performance, assessing emotional states should be prioritized in order to better understand how employees' emotions change while they work.

A significant difference in the respondents' perception of safety culture when grouped according to their profile

Table 1 presents the results of the test of differences in safety culture when grouped according to their profile. The profile of the respondents in terms of age and civil status showed no significant difference in their perception in safety culture such as enforcement of safety, technical guidance, safety management manual, safety poster display, safety consciousness, working on moving equipment, working at an unsafe speed, wearing personal protective equipment, and preventive maintenance since all the P-Values were more than 0.05. Therefore, the null hypothesis "there is no significant difference in the respondents' perception of safety culture when grouped according to their profile" was accepted.

Also, the profile of the respondents in terms of sex reveals a significant difference in safety culture, such as enforcement of safety (F-Value=.120, P-Value=.038) because the P-Value was less than 0.05, which means that the null hypothesis was rejected. Whereas, the other factors of safety culture, such as technical guidance, safety management manual, Safety poster display, Safety consciousness, working on moving equipment, working at an unsafe speed, wearing personal protective equipment, and preventive maintenance, showed no significant difference. Thus, the null hypothesis was accepted since the P-values under these factors were more than 0.05.

Considering the years of experience of the respondents, it showed a significant difference in safety culture, such as enforcement of safety (F-Value=.202**, P-Value=.003), and safety management manual (F-Value=-0.167*, P-Value=0.014), since the P-values were less than 0.05, which means that the null hypothesis was rejected. But, the other factors of safety culture, such as technical guidance, safety poster display, safety consciousness, working on moving equipment, working at an unsafe speed, wearing personal protective equipment, and preventive maintenance, showed no significant difference. Therefore, the null hypothesis was accepted since the P-values under these factors were more than 0.05.

Furthermore, Table 24 indicated that there is a significant difference in respondents' perception of the enforcement of safety regulations when grouped according to educational attainment. This signifies that it is the highly educated individual who adheres to the safety culture. On the job description, those on the supervisory levels were not usually exposed to the construction site; thus, the construction workers have more experience in the enforcement of safety regulations due to exposure. The findings conform with the study of Mohammadi et al. (2018), which revealed that the hierarchical structure explicitly states that safety performance is impacted not just by management activities at project levels, but also by interactions among components at various levels.

Table 1
Test of Differences in Safety Culture when Grouped According to their Profiles

Profile of the respondents	Safety Culture								
	Enforcement of safety regulation			Technical guidance			Safety management manual		
	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho
Age	-.108	.111	failed to reject	-.068	.316	failed to reject	-.123	.070	failed to reject
Sex	.141*	.038	rejected	.047	.492	failed to reject	.087	.201	failed to reject
Civil Status	-.043	.530	failed to reject	.022	.746	failed to reject	-.061	.368	failed to reject
Educational Attainment	.202**	.003	rejected	.035	.606	failed to reject	.154*	.023	rejected
Years of Experience	-.177**	.009	rejected	-.094	.168	failed to reject	-.167*	.014	rejected
Job Description	-.137*	.043	rejected	-.083	.222	failed to reject	-.137*	.043	rejected

Significant if P-value <0.05

Legend: Ho is rejected if Significant, Ho is accepted if Not Significant

Table 1 (continuation)
Test of Differences in Safety Culture when Grouped According to their Profiles

Profile of the respondents	Safety poster display			Safety consciousness			Working on moving equipment		
	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho
Age	.007	.918	failed to reject	-.071	.297	failed to reject	.098	.150	failed to reject
Sex	.027	.696	failed to reject	.120	.077	failed to reject	.033	.626	failed to reject
Civil Status	.081	.234	failed to reject	-.005	.946	failed to reject	-.013	.847	failed to reject
Educational Attainment	.015	.822	failed to reject	.196**	.004	rejected	.143*	.035	rejected
Years of Experience	-.026	.699	failed to reject	-.095	.161	failed to reject	.016	.811	failed to reject
Job Description	-.037	.588	failed to reject	-.143*	.035	rejected	-.073	.282	failed to reject

Safety Culture

Significant if P-value <0.05

Legend: Ho is rejected if Significant, Ho is accepted if Not Significant

Table 1 (continuation)
Test of Differences in Safety Culture when Grouped According to their Profiles

Profile of the respondents	Working in unsafe speed			Wearing personal protective Equipment			Preventive maintenance		
	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho	F-Value	P-Value	Decision on Ho
Age	.061	.371	failed to reject	.088	.198	failed to reject	-.037	.584	failed to reject
Sex	-.005	.940	failed to reject	.108	.112	failed to reject	.003	.962	failed to reject
Civil Status	.028	.682	failed to reject	-.091	.183	failed to reject	-.012	.856	failed to reject
Educational Attainment	-.054	.428	failed to reject	.061	.368	failed to reject	.009	.890	failed to reject
Years of Experience	-.013	.844	failed to reject	-.031	.646	failed to reject	-.092	.175	failed to reject
Job Description	.072	.293	failed to reject	-.026	.706	failed to reject	.036	.600	failed to reject

Safety Culture

Significant if P-value <0.05

Legend: Ho is rejected if Significant, Ho is accepted if Not Significant

A significant relationship between the accident determinants and the safety culture

Every indicator of the accident determinants is significantly correlated (i.e., though the correlation is weak) with all the indicators of the safety culture. This means that accident determinants are connected with safety culture. This implies that safety culture can be affected by accident determinants.

This is supported by Sanchez et al. (2017) that occupational safety and health (OSH) have become a very essential issue for stakeholders to take care of the human resource because of the high number of accidents that occur in construction and the effects that this has on workers, organizations, society, and countries.

Where the safety culture such as enforcement of safety regulation, technical guidance, safety management manual, safety poster display, safety consciousness, working on moving equipment, working on unsafe speed, wearing personal protective equipment, and preventive maintenance had a significant relationship with accident determinants in terms of lack of safety training, overconfidence, influence of unsafe behavior, and shortage of equipment because the P-value of each variable is less than 0.05 which means that the decision to the null hypothesis "there is no significant relationship between the accident determinants and the safety culture" was rejected.

This result is supported by the study of Wang et al. (2016) which disclosed that safety management contributes the most to workers' safety risk tolerance through its direct effect and indirect effect.

Significant relationship between the safety culture and the firm's performance on safety culture

Table 2 presents the significant positive relationship between the safety culture and the firm's performance on safety culture. The data in the table show that safety culture in terms of enforcement of safety, technical guidance, safety management manual, safety poster display, safety consciousness, working on moving equipment, working at an unsafe speed, wearing personal protective equipment, and preventive maintenance had a significant relationship with the performance of safety cultures such as increase of productivity, cost reduction, quality improvement, and organization commitment since all the P-Values were less than 0.05. Therefore, the null hypothesis "there is no significant relationship between the safety culture and the firm's performance on safety culture" was rejected.

The result is aligned with the result of the study of Kim et al. (2019), which disclosed that safety performance is significantly improved when safety incentives, subcontractor involvement, and safety accountability are combined with safety management systems.

Table 26
Test of the Relationship between the Performance of Safety Culture and the Safety Culture

Safety Culture	Performance of Safety Culture											
	Increase of Productivity			Cost reduction			Quality Improvement			Organization commitment		
	r-Value	P-Value	Decision on Ho	r-Value	P-Value	Decision on Ho	r-Value	P-Value	Decision on Ho	r-Value	P-Value	Decision on Ho
Enforcement of safety regulation	.204**	0.00	rejected	.274**	0.00	rejected	.714**	0.00	rejected	.936**	0.00	rejected
Technical guidance	.219**	0.00	rejected	.307**	0.00	rejected	.608**	0.00	rejected	.908**	0.00	rejected
Safety management manual	.206**	0.00	rejected	.238**	0.00	rejected	.593**	0.00	rejected	.860**	0.00	rejected
Safety poster display	.240**	0.00	rejected	.353**	0.00	rejected	.637**	0.00	rejected	.748**	0.00	rejected
Safety consciousness	.279**	0.00	rejected	.287**	0.00	rejected	.592**	0.00	rejected	.737**	0.00	rejected
Working on moving equipment	.219**	0.00	rejected	.210**	0.00	rejected	.526**	0.00	rejected	.645**	0.00	rejected
Working on unsafe speed	.341**	0.00	rejected	.390**	0.00	rejected	.598**	0.00	rejected	.639**	0.00	rejected
Wearing personal protective equipment	.258**	0.00	rejected	.219**	0.00	rejected	.532**	0.00	rejected	.683**	0.00	rejected
Preventive maintenance	.279**	0.00	rejected	.233**	0.00	rejected	.424**	0.00	rejected	.454**	0.00	rejected

Significant if P-value <0.05

Legend: Ho is rejected if Significant, Ho is accepted if Not Significant

CONCLUSION

The implementation of safety culture among construction workers contributes to the firm's performance. Thus, it is important to study safety culture from different perspectives, including demographic profile, accident determinants, safety culture, and causes of man-hour loss.

The study concludes that firm's performance on safety culture in terms of increase in productivity, cost reduction, quality improvement, and organizational commitment, is greatly affected by the lack of safety training, influence of the unsafe behavior, shortage of equipment, enforcement of safety regulation, technical guidance and wearing of personal protective equipment. If the safety culture is followed, there will be a positive effect on the firm's performance.

Finally, the findings of this study proved the theory of Heinrich's (1931) that 88% of all accidents were caused by a human decision to carry out an unsafe act.

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