

Evaluation of infrastructure Construction Safety Standards and Compliance in Kuwait

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Abstract

This study evaluates the awareness, compliance, and training effectiveness related to safety standards in Kuwait's construction industry. A quantitative cross-sectional design was employed, utilizing a structured questionnaire distributed to 132 participants, including engineers, contractors, and project managers selected using stratified random sampling to ensure representation across key demographics, including gender, age, educational level, years of experience, and city of work. The study was conducted over three months, from July to September 2024. Participants' perceptions were assessed on key aspects of safety compliance, training adequacy, and systemic challenges. Findings reveal a high level of awareness, particularly among younger professionals and those with advanced educational qualifications. However, significant gaps exist in training program accessibility and practical implementation. Compliance levels varied by demographic factors, with project managers exhibiting the highest adherence to safety standards. Challenges such as inadequate enforcement, cultural attitudes toward risk, and limited governmental support were identified as critical barriers to compliance. The findings provide actionable insights for policymakers and stakeholders to foster a culture of safety in Kuwait's construction sector. The study also recommends developing comprehensive training programs that combine theoretical knowledge with practical applications, ensuring accessibility for all industry stakeholders. and integrating advanced technologies, such as Automatic Code Compliance Checking (ACCC), to adherence safety standards and improve project monitoring.

Keywords: Construction safety, compliance, safety standards, Kuwait.

تقييم معايير السلامة والامتثال لتشييد البنية التحتية في الكويت

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المخلص

تهدف هذه الدراسة إلى تقييم الوعي والامتثال وفعالية التدريب فيما يتعلق بمعايير السلامة في صناعة البناء في الكويت. تم استخدام تصميم مقطعي كمي، باستخدام استبيان منظم تم توزيعه على 132 مشاركا، بما في ذلك المهندسين والمقاولين ومديري المشاريع الذين تم اختيارهم باستخدام العينة العشوائية الطبقية لضمان التمثيل عبر التركيبة السكانية الرئيسية، بما في ذلك الجنس والعمر والمستوى التعليمي وعدد سنوات الخبرة ومدينة العمل. أجريت الدراسة على مدى ثلاثة أشهر، من يوليو إلى سبتمبر 2024. تم تقييم تصورات المشاركين حول الجوانب الرئيسية للامتثال للسلامة وكفاية التدريب والتحديات النظامية. تكشف النتائج عن مستوى عالٍ من الوعي، وخاصة بين المهنيين الأصغر سناً وأولئك الذين لديهم مؤهلات تعليمية متقدمة. ومع ذلك، توجد فجوات كبيرة في إمكانية الوصول إلى برامج التدريب والتطبيق العملي. وقد تباينت مستويات الامتثال حسب العوامل الديموغرافية، حيث أظهر مديرو المشاريع أعلى مستوى من الالتزام بمعايير السلامة. وقد تم تحديد التحديات مثل عدم كفاية التنفيذ، والمواقف الثقافية تجاه المخاطر، والدعم الحكومي المحدود كحاجز حرجي أمام الامتثال. توفر النتائج رؤى عملية لصناع السياسات وأصحاب المصلحة لتعزيز ثقافة السلامة في قطاع البناء في الكويت. وتوصي الدراسة بتطوير برامج تدريبية شاملة تجمع بين المعرفة النظرية والتطبيقات العملية، وضمان إمكانية الوصول إليها لجميع أصحاب المصلحة في الصناعة، ودمج التقنيات المتقدمة، مثل التحقق التلقائي من الامتثال للكود (ACCC)، للالتزام بمعايير السلامة وتحسين مراقبة المشاريع.

الكلمات المفتاحية: سلامة البناء، الامتثال، معايير السلامة، الكويت.

1. Introduction

Globally, the construction sector is regarded as one of the most high-risk industries, accounting for a significant number of workplace injuries and fatalities (Abdelhamid & Everett, 2000). This challenge is particularly evident in Kuwait, where rapid infrastructure development has introduced complex safety concerns (Li et al., 2015). Although safety protocols have been enhanced over the years, the inherently dynamic and hazardous nature of construction projects continues to threaten the safety and well-being of workers (Abdalfatah et al., 2023).

In Kuwait, the construction industry is vital for supporting the nation's infrastructure and economic growth. However, persistent issues such as insufficient enforcement of regulations, limited access to training programs, and cultural attitudes toward risk-taking have hindered safety compliance (Li et al., 2015). Research highlights systemic obstacles, including unclear safety standards and inadequate training, which exacerbate non-compliance among stakeholders, resulting in injuries, delays, and financial losses (Aksorn & Hadikusumo, 2008; Do & Kim, 2012). Addressing these issues is essential to mitigate risks and enhance safety performance within the sector.

Implementing effective safety measures requires coordinated efforts among engineers, contractors, and project managers, alongside rigorous monitoring and regular updates to protocols (Liang et al., 2020). Studies emphasize the need for tailored safety training programs that balance theoretical instruction with hands-on practical components, enabling better compliance with safety standards (Li et al., 2015; Ng et al., 2005). Furthermore, demographic factors such as age, educational background, and work experience significantly influence adherence to safety practices, necessitating further exploration (Mahmoudi et al., 2014).

This study investigates the level of awareness, accessibility, and effectiveness of safety standards and training programs within Kuwait's construction industry. By examining perceptions across key demographic groups, including engineers, contractors, and project managers, this research aims to identify barriers to compliance and propose actionable strategies to improve safety performance. The results will provide valuable insights to support evidence-based policy-making and foster a culture of safety in Kuwait's construction sector.

1.1. Problem Statement

Kuwait's construction sector is vital to its economic growth and infrastructure development. However, the industry faces critical challenges in ensuring safety compliance with international standards. Despite the availability of safety protocols, limited enforcement, inadequate training

programs, and cultural attitudes toward risk persist as barriers to compliance. These challenges lead to increased workplace accidents, financial losses, and delays in project completion. Addressing these issues is essential to enhance safety standards, protect workers, and align the sector with global best practices for sustainable development.

1.2. Study Objectives

The following are the main objectives of the current study:

1. Evaluate the current awareness and adherence to safety standards among construction professionals in Kuwait.
2. Assess the effectiveness and accessibility of training programs related to safety compliance.
3. Identify systemic and cultural barriers to the implementation of safety standards.
4. Propose strategies to align Kuwait's construction safety practices with international benchmarks.
5. Provide actionable recommendations for stakeholders to enhance safety compliance across the sector.

1.3. Study Importance

This study is critical for improving safety standards in Kuwait's construction industry, a cornerstone of the country's infrastructure development. By identifying gaps in compliance and training, this research provides valuable insights to policymakers and stakeholders for developing targeted interventions. The findings contribute to the broader field of occupational safety by offering context-specific solutions to systemic and cultural barriers. Additionally, the study emphasizes the importance of aligning local practices with international standards, which can reduce accidents, enhance worker welfare, and improve overall project efficiency.

2. Literature review

Mukarram et al. (2024) aimed to assess the level of compliance with health and safety (H&S) standards on selected construction sites in Kano Metropolis, Nigeria. The study employed a purposive sampling technique to engage 127 participants and utilized the Krejcie and Morgan table to determine a representative sample size of 60 for infinite populations. Data were gathered using closed-ended questionnaires and physical observations through an observation checklist. The questionnaire employed a 5-point Likert scale, with 5 indicating the highest level of agreement. Data analysis was conducted using SPSS (version 23), with descriptive statistics used for presentation. The findings indicated a moderate compliance level with H&S standards, with a small fraction of construction sites showing low compliance due to inadequate training,

lack of knowledge, and the perception that compliance costs are burdensome. The authors recommended integrating H&S standards as prerequisites in contract documents and thoroughly evaluating H&S plans at the tender stage to reduce on-site accidents.

Khalafallah et al. (2019) developed a computerized platform for evaluating contractor safety performance, incorporating new parameters for analyzing both leading and lagging safety indicators. The platform facilitates performance analysis at organizational and project levels while adhering to international safety standards. A validated framework of 10 indicators and 71 metrics was proposed, offering a robust mechanism for assessing contractor safety performance. The authors highlighted that this platform could enhance decision-making processes and provide researchers and industry professionals with an effective tool to integrate contractor safety performance into selection criteria. Such advancements have the potential to significantly improve safety within the construction industry.

Umeokafor et al. (2014) examined the factors influencing compliance with H&S regulations in Nigeria's construction industry. Using compliance theories, the study explored the behaviors shaping compliance while addressing contextual influences unique to Nigeria. A systematic literature review and qualitative content analysis revealed key determinants, including culture, client influence, informal construction sector activities, inadequate legislation, bribery, and enforcement challenges. The authors concluded that contextual issues significantly affect compliance behaviors. Despite inadequate regulations and limited government support, the study emphasized the role of stakeholders and trade unions in improving compliance. It also recommended integrating H&S enforcement into building planning departments and prioritizing contractors with strong safety records during tender selection.

Schuk et al. (2022) provided an overview of the development of Automatic Code Compliance Checking (ACCC) tools in infrastructure construction. The study identified challenges and requirements for advancing such tools and proposed methods for formalizing and structuring engineering knowledge and infrastructure data in graph databases. This approach enables efficient access to relevant information for code compliance processes. The research outlined the potential for leading software developers to collaborate with infrastructure engineers in creating robust ACCC tools. The detailed structuring of regulations and rule modeling offers significant value for enhancing compliance in infrastructure construction projects.

Abdalfatah et al. (2023) aimed to develop an index for evaluating safety performance on construction sites in Egypt. The study identified 47 factors affecting safety performance through a

combination of literature reviews and personal interviews. A questionnaire was then used to rank the importance of these factors, with incentives and safety training emerging as critical determinants. The study culminated in the creation of a safety performance index designed to assist project managers and inspectors in assessing construction site safety. The proposed model provides a systematic method for evaluating H&S performance and guiding the development of effective safety regulations.

Despite the growing body of literature on health and safety (H&S) compliance and performance evaluation in the construction industry, several gaps persist, particularly in the context of Kuwait's construction sector. Previous studies have extensively explored H&S compliance in developed nations (Umeokafor et al., 2014) and specific regions like Nigeria (Mukarram et al., 2024) and Egypt (Abdalfatah et al., 2023). These studies highlight determinants such as cultural attitudes, enforcement challenges, and training inadequacies. However, there is a lack of contextual research examining these issues within the unique socio-cultural and regulatory framework of Kuwait, where rapid infrastructure development creates distinct challenges.

While existing frameworks for evaluating contractor safety performance (Khalafallah et al., 2019) and developing safety indices (Abdalfatah et al., 2023) provide valuable insights, they often lack specificity regarding how demographic factors such as age, education, and professional roles influence H&S compliance. Moreover, the integration of modern tools like Automatic Code Compliance Checking (ACCC) in infrastructure projects has been proposed (Schuk et al., 2022), but the practical implementation and effectiveness of such tools in Gulf countries remain unexplored.

Furthermore, gaps exist in understanding the barriers to effective training and awareness programs in Kuwait. Existing research has identified that inadequate training, limited accessibility, and insufficient enforcement are key challenges (Mukarram et al., 2024; Umeokafor et al., 2014). However, little attention has been given to how these factors vary across different demographic groups or how these barriers can be systematically addressed to enhance compliance. Lastly, while studies emphasize the importance of aligning safety practices with international standards (Khalafallah et al., 2019), there is limited research on the extent to which Kuwait's construction industry meets these standards and the steps required to bridge gaps in compliance and performance.

3. Methodology

This study employed a quantitative, cross-sectional design to evaluate the awareness of safety standards, the effectiveness of training programs, and compliance levels among professionals in Kuwait's construction industry. By utilizing a structured survey, the research captured a snapshot of perceptions and experiences across various demographic groups, providing insights into the barriers and facilitators of safety adherence.

3.1. Population and Sample

The target population included professionals involved in Kuwait's construction industry, such as engineers, contractors, and project managers. The sample comprised 132 participants, selected using stratified random sampling to ensure representation across key demographics, including gender, age, educational level, years of experience, and city of work.

3.2. Study Tool

The data collection tool was a structured questionnaire developed based on established frameworks for evaluating safety compliance and training effectiveness. The questionnaire comprised Likert-scale statements to assess agreement levels and included demographic questions to capture participant profiles. The tool was validated for content and clarity by a panel of industry and academic experts, ensuring its relevance to the research objectives.

3.3. Time limit

The study was conducted over three months, from July to September 2024. This period encompassed the distribution of surveys, data collection, statistical analysis, and the formulation of recommendations.

3.4. Data Collection

Data was collected over a four-week period using both online and in-person survey distribution methods. Participants were invited to complete the questionnaire, which required approximately 10–15 minutes to complete. To ensure high response rates, reminders were sent to participants, and anonymity was maintained throughout the process.

3.5. Data Analysis

The collected data was analyzed using descriptive statistics to calculate means, standard deviations, and percentages, summarizing participants' responses to the questionnaire items. Inferential statistics, such as t-tests and ANOVA, were employed to identify statistically significant differences across demographic groups.

The statistical significance threshold was set at $p < 0.05$. Correlation analyses were conducted to explore relationships between variables, providing deeper insights into the factors influencing safety compliance and training effectiveness.

3.6. Study Ethics

The study adhered to ethical principles, ensuring voluntary participation, anonymity, and confidentiality of participants' data. Ethical approval was obtained from the relevant institutional review board prior to data collection. All participants provided informed consent before completing the survey. The researchers ensured that no identifying information was collected, and the data was securely stored and used exclusively for research purposes.

4. Results

Table (1) below provides a detailed demographic of the 132 participants involved in the study. It highlights several aspects of the sample, including gender, age, job roles, years of experience, educational background, and regional distribution. In terms of gender, the majority of participants are male, comprising 75 individuals (56.8%), while females account for 57 individuals (43.2%). The largest age group, 20–30 years, includes 40 participants (30.3%), followed by 31–40 years with 35 participants (26.5%). When considering job roles, engineers form the largest group with 50 participants (37.9%), followed by contractors with 45 participants (34.1%), and project managers with 37 participants (28.0%). Those with 6–10 years of experience form the largest group, comprising 40 participants (30.3%). The educational background of participants reveals a highly educated sample, with a majority holding a Bachelor's degree (65 participants, 49.2%). Lastly, the regional distribution of participants shows that Kuwait City has the largest representation, with 45 participants (34.1%), followed by Hawalli (22.7%) and Al Ahmadi (18.9%).

Table 1: demographics of the study sample

Demographic Variable	Categories	Sample Size (n)	Percentage (%)
Gender	Male	75	56.8%
	Female	57	43.2%
Age Group	20-30	40	30.3%
	31-40	35	26.5%
	41-50	30	22.7%
	More than 51	27	20.5%

Job Role	Engineer	50	37.9%
	Contractor	45	34.1%
	Project Manager	37	28.0%
Years of Experience	0-5 years	25	18.9%
	6-10 years	40	30.3%
	11-15 years	35	26.5%
	More than 16 years	32	24.2%
Educational Level	Diploma	15	11.4%
	Bachelor's	65	49.2%
	Master's	30	22.7%
	PhD	22	16.7%
City of Work	Kuwait City	45	34.1%
	Hawalli	30	22.7%
	Al Ahmadi	25	18.9%
	Al Jahra	20	15.2%
	Mubarak Al-Kabeer	12	9.1%

Understanding of Safety Standards and Effectiveness of Training Programs

Table (2) presents an analysis of participants' perceptions regarding safety standards and training programs in Kuwait's construction industry. The highest-rated statement is "I am familiar with the safety standards required for infrastructure construction in Kuwait," which has a mean score of 4.2 (SD = 0.4), ranked 1st with a high level of agreement. The second-highest score is for the statement "The safety standards in Kuwait are clear and easy to understand," with a mean of 3.8 (SD = 0.5), ranked 2nd and also rated at a high level. Similarly, "The information about safety standards is easily accessible when needed" scored 3.6 (SD = 0.6), ranked 3rd and rated as High. "Safety standards are updated regularly to reflect new risks and best practices" also received a high rating with a mean score of 3.9 (SD = 0.5), ranked 4th. However, lower mean scores were observed in statements related to training programs and ongoing education, with most rated as Moderate. For instance, "I have received formal training on the safety standards applicable to my role" scored

3.4 (SD = 0.7), ranked 5th. Statements addressing accessibility and adequacy of training programs also scored relatively low. "Training programs are accessible to all stakeholders in the construction industry" received a mean score of 3.3 (SD = 0.7), ranked 8th, while "Ongoing safety education is adequately provided in the industry" had a mean of 3.1 (SD = 0.8), ranked 9th. Finally, "Training sessions include sufficient hands-on practice" received the lowest score, 3.0 (SD = 0.9), ranked 10th.

Table 2: Understanding of Safety Standards and Effectiveness of Training Programs

No	Statement	Mean	SD	Rank	Level
1	The safety standards in Kuwait are clear and easy to understand.	3.8	0.5	2	High
2	I am familiar with the safety standards required for infrastructure construction in Kuwait.	4.2	0.4	1	High
3	The information about safety standards is easily accessible when needed.	3.6	0.6	3	High
4	I have received formal training on the safety standards applicable to my role.	3.4	0.7	5	Moderate
5	The current safety training programs effectively address practical implementation of safety standards.	3.2	0.8	6	Moderate
6	Safety standards are updated regularly to reflect new risks and best practices.	3.9	0.5	4	High
7	The quality of safety training in Kuwait meets international standards.	3.5	0.6	7	Moderate
8	Training programs are accessible to all stakeholders in the construction industry.	3.3	0.7	8	Moderate
9	Ongoing safety education is adequately provided in the industry.	3.1	0.8	9	Moderate
10	Training sessions include sufficient hands-on practice.	3.0	0.9	10	Moderate

Compliance Levels and challenges

Table (3) provides insights into participants' perceptions of safety compliance and the factors influencing it within construction projects. The highest-rated statement is "I consistently follow safety standards during construction projects," with a mean score of 4.1 (SD = 0.3), ranked 1st and rated as High. The second-highest-rated statement, "Other engineers I work with adhere to safety standards," scored 3.9 (SD = 0.4), ranked 2nd and also rated as High. "Safety compliance is routinely monitored on construction sites" received a mean score of 3.8 (SD = 0.5), ranked 3rd and rated as High. However, moderate and low ratings were observed in statements related to other stakeholders and systemic barriers. "Contractors and workers demonstrate high levels of compliance with safety regulations" scored 3.5 (SD = 0.6), ranked 4th and rated as Moderate. Similarly, "There is sufficient government support to overcome challenges in safety compliance" received a mean score of 3.0 (SD = 0.6), ranked 6th and rated as Moderate. Notably, systemic and cultural barriers to safety compliance received lower ratings. "Inadequate enforcement of regulations is a major barrier to safety compliance" scored 2.7 (SD = 0.7), ranked 7th and rated as Low. Similarly, "Cultural attitudes toward risk significantly affect adherence to safety standards" received a mean score of 2.8 (SD = 0.8), ranked 8th and rated as Low.

Table 3: Compliance Levels and challenges

No	Statement	Mean	SD	Rank	Level
1	Other engineers I work with adhere to safety standards.	3.9	0.4	2	High
2	I consistently follow safety standards during construction projects.	4.1	0.3	1	High
3	Safety compliance is routinely monitored on construction sites.	3.8	0.5	3	High
4	Contractors and workers demonstrate high levels of compliance with safety regulations.	3.5	0.6	4	Moderate
5	Inadequate enforcement of regulations is a major barrier to safety compliance.	2.7	0.7	7	Low
6	Cultural attitudes toward risk significantly affect adherence to safety standards.	2.8	0.8	8	Low
7	There is sufficient government support to overcome challenges in safety compliance.	3.0	0.6	6	Moderate

8	Time constraints during construction projects hinder proper safety practices.	3.2	0.7	5	Moderate
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Participants' awareness of safety standards and compliance based on various demographic factors

Table (4) presents a detailed analysis of participants' awareness of safety standards and compliance based on various demographic factors, including age group, educational level, job role, gender, and years of experience. The findings are accompanied by statistical measures such as mean, standard deviation, t-statistics, and p-values to evaluate the significance of differences within each category. Participants in the 20–30 age group reported the highest awareness, with a mean score of 4.2 (SD = 0.5), and the differences were statistically significant ($t = 2.8$, $p = 0.01$). Participants with a PhD showed the highest awareness, with a mean score of 4.3 (SD = 0.4), and a statistically significant difference ($t = 2.85$, $p = 0.005$). Similarly, those with a Master's degree reported a mean of 4.1 (SD = 0.5) with significant differences ($t = 2.95$, $p = 0.003$). Project Managers exhibited the highest compliance with safety standards, with a mean score of 4.1 (SD = 0.5), and a statistically significant difference ($t = 3.15$, $p = 0.002$). Engineers followed with a mean of 3.7 (SD = 0.6), while Contractors had the lowest compliance score (3.5, SD = 0.7). Male and female participants reported similar levels of awareness, with mean scores of 3.8 (SD = 0.5) and 3.9 (SD = 0.4), respectively. Participants with 6–10 years of experience reported the highest compliance (3.8, SD = 0.5), followed by those with 11–15 years (3.6, SD = 0.7), 0–5 years (3.5, SD = 0.6), and 16+ years (3.2, SD = 0.8). None of the differences across experience groups were statistically significant, with p-values ranging from 0.2 to 0.25.

Table 4: Participants' awareness of safety standards and compliance based on various demographic factors

Category	Subcategory	Mean	Standard Deviation	T-statistics	P-Value
Awareness of Safety Standards by Age Group	20-30	4.2	0.5	2.8	0.01
	31-40	3.9	0.6	1.25	0.12
	41-50	3.5	0.7	1.05	0.15
	More than 51	3.2	0.8	0.95	0.2

Awareness of Safety Standards by Educational Level	Diploma	3.3	0.7	1.1	0.25
	Bachelor's	3.8	0.6	2.1	0.04
	Master's	4.1	0.5	2.95	0.003
	PhD	4.3	0.4	2.85	0.005
Compliance by Job Role	Engineer	3.7	0.6	1.2	0.1
	Contractor	3.5	0.7	1.0	0.18
	Project Manager	4.1	0.5	3.15	0.002
Awareness of Safety Standards by Gender	Male	3.8	0.5	1.25	0.11
	Female	3.9	0.4	1.3	0.1
Compliance by Years of Experience	0-5 years	3.5	0.6	1.1	0.22
	6-10 years	3.8	0.5	1.15	0.2
	11-15 years	3.6	0.7	1.05	0.18
	More than 16 years	3.2	0.8	1.0	0.25

5. Discussion

The findings of this study provide critical insights into the level of awareness, compliance, and training effectiveness regarding safety standards within Kuwait's construction industry. The results highlight both areas of strength and significant gaps, which align with or diverge from existing literature on construction safety.

The results show that participants generally demonstrated high awareness of safety standards, as evidenced by statements such as "I am familiar with the safety standards required for infrastructure construction in Kuwait" achieving the highest mean score (4.2). This is consistent with the findings of Mukarram et al. (2024), who identified moderate levels of compliance with health and safety (H&S) standards in Nigeria but emphasized knowledge gaps among stakeholders. Similarly, this study reflects a positive trend among educated professionals, particularly those holding advanced degrees, with PhD holders scoring the highest mean for awareness (4.3). This finding aligns with Abdalfatah et al. (2023), who highlighted the importance of education and training in fostering safety compliance in Egypt's construction sector.

While awareness levels were generally high, training programs were perceived as moderately effective. Statements like "Training programs are accessible to all stakeholders in the construction

industry" and "Ongoing safety education is adequately provided in the industry" received lower ratings (3.3 and 3.1, respectively). This mirrors the observations of Umeokafor et al. (2014), who identified insufficient training as a key barrier to compliance in Nigeria. Additionally, the limited hands-on practice in training, as indicated by the lowest-rated statement (3.0), aligns with recommendations from Khalafallah et al. (2019), who emphasized the integration of practical components in safety performance evaluation frameworks.

Compliance levels varied significantly across demographic groups. Project managers exhibited the highest compliance, with a mean score of 4.1, reflecting their central role in ensuring safety adherence. Engineers and contractors followed, with lower compliance levels that indicate a need for targeted interventions. These findings support prior research by Schuk et al. (2022), which suggested that compliance tools tailored to organizational roles could enhance adherence. Notably, systemic challenges such as inadequate enforcement of regulations (2.7) and cultural attitudes toward risk (2.8) were rated as low, echoing Umeokafor et al.'s (2014) conclusion that contextual factors like culture and client influence significantly affect compliance behaviors.

Significant differences were observed across age groups and educational levels, with younger professionals (20–30 years) and those with advanced degrees demonstrating higher awareness. This finding aligns with Liang et al. (2020), who highlighted that younger professionals often possess greater familiarity with updated protocols. However, gender and years of experience showed no significant differences, suggesting that these factors may play a less critical role in influencing safety perceptions in Kuwait.

The moderate ratings for statements addressing training adequacy and government support (3.0) highlight gaps in aligning Kuwait's practices with international safety standards. Khalafallah et al. (2019) emphasized the importance of incorporating safety performance into contractor selection criteria, which could address some of these gaps. Additionally, the development of modern tools, such as Automatic Code Compliance Checking (ACCC), proposed by Schuk et al. (2022), could provide a pathway for integrating advanced compliance mechanisms into Kuwait's infrastructure projects.

6. Conclusion

This study highlights both strengths and challenges in the implementation of safety standards within Kuwait's construction industry. While awareness of safety standards is notably high among professionals, particularly project managers and those with advanced degrees, systemic barriers such as inadequate training and weak enforcement remain prevalent.

The study demonstrates the critical role of demographic factors in shaping safety compliance behaviors, emphasizing the need for targeted interventions to address disparities. By aligning practices with international standards and improving training accessibility, Kuwait's construction sector can achieve higher compliance levels and foster a safer working environment.

7. Limitations and future work

This study was limited to a sample size of 132 participants, which, while representative, may not fully capture the perspectives of all professionals in Kuwait's construction sector. The cross-sectional design provides a snapshot of current practices but does not account for longitudinal changes in compliance behaviors. Additionally, the reliance on self-reported data introduces the possibility of response bias, as participants may have provided socially desirable answers rather than accurate reflections of their practices.

Future studies should explore the longitudinal impacts of targeted interventions, such as enhanced training programs and stricter enforcement mechanisms, on safety compliance levels. Expanding the sample size and including diverse stakeholder groups, such as labor unions and governmental bodies, could provide a more comprehensive understanding of systemic barriers. Moreover, integrating qualitative methods, such as interviews and focus groups, may yield deeper insights into the cultural and contextual factors influencing compliance behaviors in Kuwait's construction industry.

8. Recommendations and Suggestions

To enhance safety standards and compliance in Kuwait's construction industry, it is essential to develop comprehensive training programs that combine theoretical knowledge with practical applications, ensuring accessibility for all industry stakeholders. Strengthening enforcement mechanisms is equally critical, with robust monitoring systems and the introduction of penalties for safety violations to foster accountability. Governmental support plays a pivotal role in this process, necessitating financial incentives, logistical resources, and regular updates to safety protocols to address evolving risks and align with international best practices. Addressing cultural attitudes toward risk through targeted awareness campaigns can emphasize the importance of safety practices and their economic and personal benefits, fostering a cultural shift toward compliance. Additionally, integrating advanced technologies, such as Automatic Code Compliance Checking (ACCC), can streamline adherence to safety standards and improve project monitoring.

Lastly, aligning local practices with international safety benchmarks and fostering continuous collaboration with global organizations will ensure Kuwait's construction sector remains at the forefront of safety and sustainability.

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