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Validating The Impact of Psychological, Physical and Social Factors on Workplace Well-Being at Construction Sites

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Abstract: A good workplace well-being environment can increase employee resilience, work engagement, project performance, and productivity, as well as reduce sick days. Research suggests that physical, psychological, and social factors are the underlying factors for a good workplace well-being However, the underlying factors for workplace well-being at construction sites may differ. This study aims to validate the relationships between underlying factors (i.e., physical, psychological, and social) and workplace well-being at construction sites. A questionnaire survey was developed from a list of factors influencing workplace well-being and distributed to construction professionals. The collected data was analyzed using confirmatory factor analysis (CFA) to validate the relationships between the underlying factors and workplace well-being at construction sites. The analysis revealed that physical, psychological, and social factors are also influencing workplace well-being at construction sites. Researchers and industry practitioners can use these findings to confidently establish strategies to increase workplace well-being of construction workers.

Keywords: Well-being, construction industry, building construction, confirmatory factor analysis, PLS-SEM

1. Introduction

Workplace well-being can be defined as workplace attributes that encourage healthy behavior, enhance health outcomes, and strengthen workplace culture. Poor workplace well-being can lead to decreased productivity and project failures. However, construction remains a high-risk industry for health and workplace well-being issues. For example, Europe's construction industry reported 782 fatal accidents in 2014, including people falling and tools, equipment, and machines breaking, collapsing, or losing control [1]. Other factors contributing to high-stress levels among workers in the construction industry include hard workloads, rushed deadlines, long working hours, financial concerns, and isolation. In the United States, 16% of construction workers interviewed are in serious distress [2]. Furthermore, the workplace well-being of construction workers is worse than that of the general population in Australia [3]. So, in addition to health risks, the circumstances in the construction industry put people at risk for poorer workplace well-being. In other words, prior works demonstrated that it is challenging for construction workers to achieve good

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workplace well-being. Therefore, organizations must develop strategies to enhance workplace well-being at construction sites to prevent negative consequences.

Compared to other industries, such as manufacturing and agriculture, the construction industry has the second-highest rate of suicide among workers [4]. In addition, 20% to 25% of construction workers experience workplace well-being issues [5]. Based on a survey, approximately 73% of construction workers feel inadequate support from employers on workplace well-being. Although prior works demonstrated workplace well-being concerns in the construction industry, there is currently little to no support for construction workers. Organizations have always prioritized health over workplace well-being. As a result, even though the number of fatalities on construction sites has reduced over the past years, suicides connected to workplace well-being have remained constant [6]. These numbers highlight the seriousness of workplace well-being issues at construction sites. Construction workers can better balance their professional and personal lives and improve their quality of life by having a good health and working well-being environment [7]. Therefore, in addition to health, industry stakeholders must also concentrate on the workplace well-being of construction workers.

There has been increased work related to the workplace well-being of construction workers. For example, work has investigated workplace well-being stressors of construction workers and divided them into five categories: organizational, task, personal, physical, and gender-related stressors [8]. Also, another work has recommended strategies for improving the workplace well-being of construction workers, including site-specific briefings with appropriate visual aids, self-help programs and books, volunteer work, health examinations, and group activities in appropriate settings [9]. On the contrary, bullying and harassment, work pressure, and emotional and physical demands are the top causes of workplace well-being issues for construction workers [10]. Additionally, that work found that effective ways to reduce the number of workplace well-being issues and their detrimental effects include communication among coworkers and the support of supervisors [10]. On the contrary, investing in workplace well-being can lead to increased employee resilience, work engagement, project performance, and productivity, as well as reduce sick days. Prior works suggest that physical, psychological, and social factors are the underlying factors for good workplace well-being. However, the underlying factors for workplace well-being at construction sites may differ.

This study aims to validate the relationships between underlying factors (i.e., physical, psychological, and social) and workplace well-being at construction sites. A questionnaire survey was designed and distributed to construction professionals in Malaysia. Confirmatory factor analysis (CFA) was employed using partial least square-structural equation modeling (PLS-SEM) to validate the relationships. The study contributes to the body of knowledge by validating the underlying factors influencing workplace well-being at construction sites. Researchers, policymakers, and organizations can use the study findings to confidently establish strategies that enhance the workplace well-being of construction workers. Enhanced workplace well-being helps construction workers achieve good health and well-being and improves construction project performance.

2. Literature Review

2.1 Workplace Well-Being in The Construction Industry

Workplace well-being includes all aspects of working life, including the quality and safety of the physical environment and how workers feel about their jobs [11]. Employers are responsible for providing a workplace that promotes good workplace well-being to achieve sustainable development. Also, employers must create and uphold a positive workplace well-being culture to have a thriving and effective industry. Nevertheless, due to organizational structure and poor working conditions such as noise, dirt, natural lighting, and ventilation, construction work may make more challenging than white-collar jobs in terms of maintaining excellent workplace well-being [12]. According to prior reports, 70% of construction professionals feel stress, worry, or despair because of their jobs [13]. Additionally, 20% to 25% of construction workers are experiencing workplace well-being issues. Stress and anxiety account for more work absences than the flu, other diseases, or accidents. In addition, high worker presenteeism rates (i.e., the rate of workers who continue to work while experiencing health symptoms with lower productivity) are linked to workplace well-being issues.

To address workplace well-being issues in the construction industry, researchers have started to explore the topic. For instance, Rani et al. [14] have identified the critical factors influencing workplace well-being in construction projects [14]. Also, Mostert et al. [15] have identified the negative impact of burnout on workplace well-being in the construction industry. On the contrary, Campbell and Gunning [9] suggest that the construction industry in the United Kingdom (UK) has serious workplace well-being issues. The work also identified strategies that enhance workplace well-being, including group activities, self-help books and programs, volunteering, health checks, and site-specific briefings with suitable visual aids [9]. Furthermore, Sang et al. [16] developed a framework to examine workplace well-being in the UK construction industry. The work suggests a link between poor workplace well-being and the culture of long hours and fragmentation [16]. Finally, Asare et al. [17] investigated the effects of shift work on workplace well-being of construction workers. According to the research, shift work is connected to unhealthy habits and outcomes, including insufficient sleep, smoking, drinking alcohol, and being overweight or obese.

In summary, researchers have attempted to address workplace well-being issues in the construction industry, such as developing improvement strategies and identifying the influential factors. Nevertheless, the current body of knowledge still lacks insights into the relationships between the underlying factors and workplace well-being at construction sites. The current study leverages that knowledge gap by validating those relationships using data from construction professionals. The subsequent subsection details the background of the underlying factors for workplace well-being used in this study.

2.2 Factors Affecting Workplace Well-Being

Workplace well-being is directly related to higher productivity, worker loyalty, positive business culture, worker satisfaction, and lower absenteeism due to illness. One of the essentials for an individual to function efficiently and thrive is food [18]. Construction workers often skip lunch on a busy workday or choose less healthy but more convenient options. Physical fitness plays a significant role in daily operations in the construction industry. Most construction workers work outside in the hot sun or in unfavorable conditions. Employers must ensure that everyone drinks enough water. Dehydration is hazardous and can result in serious side effects such as heatstroke, seizures, and even fatality. Even slight dehydration impairs performance and makes the body tired. Therefore, ensuring workers eat well and stay hydrated can enhance workplace well-being. Most people's time is spent at work. These incidents accumulate over time, lowering morale and performance. Recent research shows that unfavorable working conditions can harm worker effectiveness, productivity, and satisfaction. On the contrary, a well-designed workspace promotes a calmer, more productive environment. Therefore, employers must examine the working conditions. Workers need to feel relaxed and at ease in the work environment to function at their best. Workers often commute to work for longer than they would like. It was found that commuting has different effects on workers' well-being depending on the form of transportation used to get to work. Even with the same travel length, people who walk or cycle (i.e., active commuters) view the commute as a more productive use of time than other commuters.

Table 1 - Factors affecting workplace well-being at construction sites

Constructs	Code	Factors affecting workplace well-being	References
Physical factors	PH07	Food at the rest area	[23]
	PH08	Comfort at the rest area	[23]
	PH09	Workload	[14], [24], [25], [26], [27]
	PH17	Transportation facilities for construction workers	[14], [28]
Psychological factors	PS02	General safety and health monitoring	[14], [24], [28], [29], [23],[30], [31], [32], [33],[26], [34], [35]
	PS04	Worker facilities	[14], [28]
	PS06	Project progress	[14], [29], [33], [34]
	PS10	Insurance for construction workers	[14]
	PS12	Workers' welfare	[14], [36]
	PS13	Planning of the project	[14]
	PS14	Salary package	[14], [37]
	PS15	Timeline of salary payment	[14], [37]
	PS18	Working environment	[24], [29], [31]
	PS19	Working hours	[14], [24], [36], [38], [29], [26], [39], [40]
Social factors	S01	Communication between workers	[14], [41], [42], [28], [25], [36], [38], [29]
	S03	Worker work monitoring	[24], [38]
	S05	Collaboration between top management and workers	[14]
	S11	Project leadership	[26], [34], [35], [27], [39]
	S16	Relationship between top management and workers	[26], [35], [39], [43]

Long working weeks significantly increase worker stress, which can harm workplace well-being [19]. Construction workers are obliged to work irregular hours, especially on weekends, which causes work-family issues and psychological harm [20]. The unpredictability of construction projects can be detrimental to workers' well-being and work-life balance. Low income continues to be the greatest contributor to job stress [21]. Stress and strain brought on by low pay prohibit construction workers from meeting their fundamental needs. Late and unfair payments severely harm the construction industry. Workers who receive late payments miss out on paying their rent or mortgage and other significant obligations like utilities and loan repayments. As a result, employee morale suffers, and workplace disputes and alternative employment arrangements arise. It is common for construction projects to run awry due to late or defective materials deliveries, weather-related delays, and change orders. Construction workers experience the most

stress when projects are delayed, which results in unrealistic work schedules and pressuring workers to work more quickly. Welfare is a fundamental need for workers and is mandated by law. In addition to creating problems like increased absenteeism, decreased productivity, and higher staff turnover, neglecting worker welfare increases employers' liability for any problems, including additional expenses related to compensation claims and replacement of project team members.

When it comes to workplace well-being, inadequate and poor communication with workers can be an employer's biggest enemy. High staff turnover rates, decreased customer satisfaction, and declining productivity are possible outcomes of poor communication with workers. Additionally, without strong leadership, workers may experience emotional exhaustion. An emotionally exhausted person frequently has trouble falling asleep, leading to lower productivity. Emotionally worn-out workers might harm organizational capability as emotionally exhausted individuals are less committed, perform badly in tasks, and show fewer helpful behaviors. Moreover, they are more likely to seek new jobs elsewhere and are more inclined to leave the organization [22].

Prior works have identified and reported factors affecting workplace well-being at the workplace (Table 1). Therefore, a questionnaire survey was developed based on the nineteen factors identified through an in-depth literature review on workplace well-being in the construction industry. The factors were grouped under three categories, as in Table 1.

2.3 Conceptual Model

A conceptual model was developed based on the literature review on the factors affecting workplace well-being. The factors are categorized into three main groups, namely, physical factors (PH), psychological factors (PS), and social factors (S), as listed in Table 1. Hence, the categories provide a basis for developing the conceptual model of this study, as represented in Fig. 1.

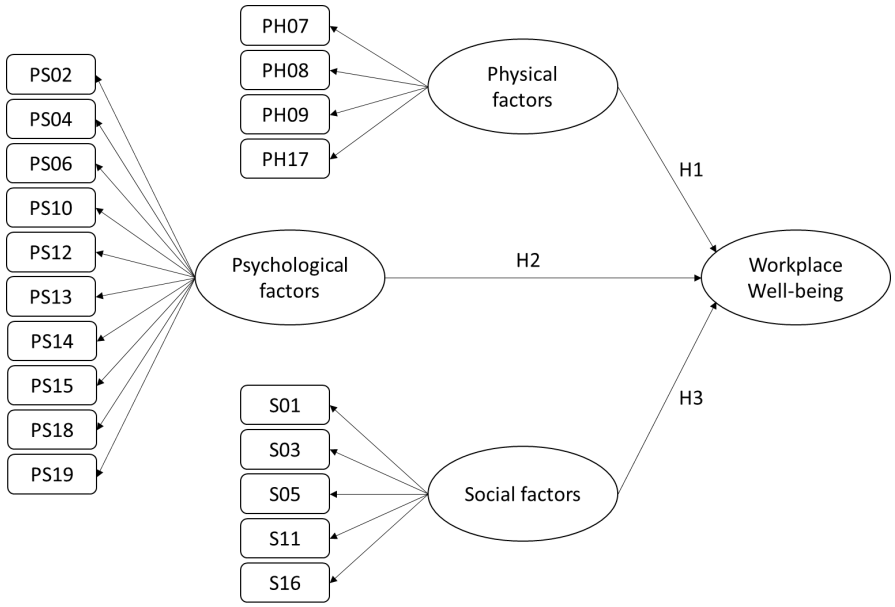

Fig. 1 - Conceptual model

2.4 Hypotheses Development

The categorization of the affecting factors into three groups (physical factors, psychological factors, and social factors) was based on the literature. Accordingly, the categorizations are tested and validated by confirmatory factor analysis. Based on the conceptual model (Fig. 1), the following hypotheses were established:

- Hypothesis 1: Physical factors have a significant positive impact on workplace well-being.
- Hypothesis 2: Psychological factors have a significant positive impact on workplace well-being.
- Hypothesis 3: Social factors have a significant positive impact on workplace well-being.

3. Methodology

3.1 Questionnaire Development

A questionnaire survey is a quick and economical way to gather information from different individuals [44]. It was used in this study for data collection to model the affecting factors for workplace well-being. The first section of the

questionnaire listed background and organization questions, which are essential to ensure the reliability of respondents. In the second section, nineteen identified factors affecting workplace well-being were listed. Respondents were asked to rank the criticality of the factors on a five-point Likert scale, with 1 being not critical, 2 being less critical, 3 being moderately critical, 4 being critical, 5 being extremely critical. The five-point Likert scale is often used in questionnaires from prior works because of its short length [45], [46] and its ability to provide clear information [47].

Then, a pilot test was conducted with four participants. The participants include two construction professionals and two academicians with more than ten years of experience in the construction management domain. Ambiguous phrases could be eliminated, and proper use of technical jargon could be checked based on the result of the pilot test. The survey form was distributed to participants in the pilot test and were requested to comment on each of the survey items. After the fourth participant, the authors found that the information retrieved had reached data saturation. The information retrieved had been saturated by the fourth participant. After the pilot survey, using the comments from the participants, the survey was amended and finalized.

3.2 Data Collection

The target population for this study is construction professionals. These industry professionals were not on any list and difficult to clearly identify. Thus, the sampling approach used was the nonprobability sampling approach [48]. The nonprobability sampling approach is appropriate when a random sampling approach cannot be used to select respondents from the entire population. Hence, the snowball sampling technique was employed to reach the target population because this technique allows data to be collected from industry experts by referrals and social media [49]. To begin the data collection, potential respondents were invited to forward the survey link to others they considered suitable based on their industrial or academic experience. After two weeks following the first contact with respondents, two follow-ups were sent to the target populations to increase the survey success rate. Finally, 102 valid responses from construction professionals were retrieved.

Table 2 presents the background of the respondents. The respondents were divided into groups based on the type of organization, their years of experience, and the number of construction projects they had experienced. All respondents were construction professionals with adequate knowledge of the construction industry, including engineers, project managers, architects, and quantity surveyors. Contractors (68.6%) made up the majority of the respondents, followed by consultants (23.5%) and owners (7.8%). More than 80% of the respondents are not novices in the construction industry, with at least two years of experience in construction projects, indicating that they have a great experience in the field. Only 11.8% of respondents had less than two years of professional experience in the construction industry. In addition, most respondents have experienced at least two construction projects (94.1%). Only 5.9% of the respondents have experienced less than two construction projects.

Table 2 - Respondent profile

Characteristics	Categories	Frequency	Percentage (%)
Type of organization	Owners	8	7.8
	Contractors	70	68.6
	Consultants	24	23.5
Years of experience in the construction industry	Less than 2 years	12	11.8
	2-5 years	47	46.1
	6-9 years	23	22.5
	More than 10 years	20	19.6
Number of construction projects experienced	Less than 2 projects	6	5.9
	2-5 projects	55	53.9
	6-9 projects	21	20.6
	More than 10 projects	20	19.6

4. Confirmatory Factor Analysis

Confirmatory factor analysis can assess the relationships between indicators and their constructs [48]. Thus, CFA was employed by using PLS-SEM to examine the relationships between affecting factors for workplace well-being. First, the validity and reliability of the measurement models were examined. Cronbach's alpha and composite reliability were used to evaluate the reliability of the measurement model, which indicates internal consistency. The minimum Cronbach's alpha and composite reliability values need to be higher than 0.70 [50]. According to Table 3, all constructs have Cronbach's alpha values higher than the necessary cutoff, indicating that internal consistency reliability is satisfactory.

Convergent and discriminant validity tests were then used to assess the validity of the measurement model. Convergent validity shows whether the indicators expected to measure in a specific construct measure the construct and are not measuring other constructs [51]. First, the loadings of the indicators were assessed, which should be more than 0.50. High loadings mean the relationship between the indicators and their assigned constructs is strong [52]. Next,

average variance extracted (AVE) was used to assess convergent validity. Each construct in the measurement model should have an AVE value of more than 0.50, which implies that at least 50% of the indicators' variance is captured by the construct [53]. Based on Table 3, all the loading values and the AVE values are more than the recommended value (0.50), which indicates a satisfactory level of convergent validity.

Discriminant validity refers to the extent to which the construct differs. The discriminant validity of the measurement model was evaluated using the Fornell-Larcker criterion [53]. The variance between the same construct should be the highest when compared with the variance between the construct and any other construct. However, the results show that physical and psychological factors are not distinct from other constructs. In other words, these constructs are related to each other. Another approach for estimating the discriminant validity is by assessing the cross-loadings of the indicators. Table 5 shows that all the indicators had the highest loading on the construct it was assigned to measure in the model. The results indicate that the measurement model exhibits satisfactory discriminant validity.

Table 3 - Measurement model assessment

Constructs	Indicators	Outer loadings	Cronbach's Alpha	Composite Reliability	AVE
Physical Factors	PH07	0.857	0.874	0.914	0.727
	PH08	0.905			
	PH09	0.785			
	PH17	0.860			
Psychological Factors	PS02	0.875	0.963	0.968	0.750
	PS04	0.826			
	PS06	0.909			
	PS10	0.862			
	PS12	0.873			
	PS13	0.908			
	PS14	0.849			
	PS15	0.862			
	PS18	0.869			
	PS19	0.824			
Social Factors	S01	0.901	0.955	0.965	0.847
	S03	0.908			
	S05	0.928			
	S11	0.938			
	S16	0.926			

Table 4 - Discriminant validity

Constructs	Physical Factors	Psychological Factors	Social Factors
Physical Factors	0.853	-	-
Psychological Factors	0.890	0.866	-
Social Factors	0.832	0.941	0.921

Table 5 - Cross - loadings

Indicators	Physical Factors	Psychological Factors	Social Factors
PH17	0.860	0.773	0.732
PH07	0.857	0.703	0.641
PH08	0.905	0.783	0.723
PH09	0.785	0.770	0.734
PS10	0.789	0.862	0.786
PS12	0.795	0.873	0.797
PS13	0.815	0.908	0.899

PS14	0.758	0.849	0.790
PS15	0.716	0.862	0.819
PS18	0.787	0.869	0.837
PS19	0.739	0.824	0.786
PS02	0.791	0.875	0.816
PS04	0.765	0.826	0.755
PS06	0.752	0.909	0.854
S01	0.721	0.809	0.901
S11	0.777	0.884	0.938
S16	0.784	0.892	0.926
S03	0.756	0.849	0.908
S05	0.789	0.892	0.928

After assessing the measurement model, the structural model was evaluated. The bootstrapping technique was employed to test the significance of the path coefficient and test the proposed hypotheses. It is a technique useful for estimating the distribution of any statistic of any distribution. As recommended by Hair et al. [54], the number of bootstrap samples was set at 5,000. The critical t-value for a two-tailed test was 1.65 (significance level = 10%), 1.96 (significance level = 5%), and 2.58 (significance level =1%). Table 7 shows the bootstrapping analysis results. The results suggest that psychological factors are the most influential component positively influencing workplace well-being at construction sites, followed by social and physical factors.

Table 6 - Structural model evaluation

Hypotheses	Path coefficients	T Statistics	P Values	Results
H1: Physical Factors → Workplace well-being	0.199	32.330	0.000	Supported
H2: Psychological Factors → Workplace well-being	0.535	74.083	0.000	Supported
H3: Social Factors → Workplace well-being	0.296	40.276	0.000	Supported

5. Discussion

5.1 Relationship Between Physical Factors and Workplace Well-Being

Table 6 demonstrates that physical factors have a significant relationship with workplace well-being. In this study, physical factors include food at the rest area (PH07), comfort at the rest area (PH08), workload (PH09), and transportation facilities for construction workers (PH17). Food is fundamental to a person's ability to function well and thrive [55]. There are a few ways employers may encourage workers to eat healthier. If employers supply a fridge, microwave, cutlery, and basic condiments, it is easier for workers to bring in and store their own lunches at construction sites. Homemade food is always cheaper and healthier. Offering nutritious breakfast alternatives is another economical method to promote healthy eating habits. Supplying fruits, nuts, yogurt, and healthy cereal options, encourages workers to start their day with the right type of food. Therefore, food in the rest area positively influences workplace well-being at construction sites. Healthy and nutritious food and a well-designed workspace promotes a comfortable, calmer, and more productive environment. Employers must recognize their workers' actual working conditions. Workers must feel relaxed and at ease in their physical work environments to function at their best. Therefore, employers should offer a relaxing rest area for workers. The WELL Building Standard is the first standard that focuses on workplace well-being in building design, construction, and operations [56]. It focuses on seven concepts: comfort, air, nourishment, fitness, mind, water, and light. Workers' productivity, health, and contentment, as well as their general workplace well-being, can be greatly influenced by the design of their workplace in terms of air quality, lighting, views of nature, and the interior's general layout. In other words, comfort in the rest area positively influences workplace well-being at construction sites.

5.2 Relationship Between Psychological Factors and Workplace Well-Being

Table 6 shows that psychological factors positively influence workplace well-being. Psychological factors include general safety and health monitoring (PS02), worker facilities (PS04), project progress (PS06), insurance for the worker (PS10), workers' welfare (PS12), planning of the project (PS13), salary package (PS14), the timeline of salary payment (PS15), working environment (PS18), and working hours (PS19). Workers tend to feel more motivated and that their job is being valued when they sense that the organization is concerned about their personal lives and needs, which

eventually results in lower stress levels. Insurance for workers is one of the aspects related to psychological well-being that positively influences workplace well-being. Workers who are healthy, content, and happy are the foundation of every successful business, so employers should take proactive measures to ensure that their physical and emotional well-being is taken care. Medical insurance gives worker's reassurance regarding any possible medical costs and concerns. Consequently, workers can concentrate on their daily tasks because they know that their workplace well-being are taken care of, leading to increased productivity. Therefore, insurance for workers positively influences workplace well-being.

The salary package is another factor that affects workplace well-being. When employees are appreciated and respected by their employers, they become more dedicated to their work and the company success. One of the ways that employers can show their appreciation for workers is by increasing their pay rate. Additionally, employers can expect better job quality and productivity in exchange for higher remuneration [57]. On the contrary, low-wage workers, especially those making the minimum wage, may struggle financially. These people may not be able to buy proper meals, which could impair their well-being. Due to financial constraints, they may delay or skip necessary medical care, increasing the likelihood of falling ill. A lower income may also lead to more stress, which can harm one's well-being and capability to work. As workers with good workplace well-being are more productive and efficient, the investment in a higher wage may have a favorable effect on their lives, improving the quality of their job. In other words, salary packages have a beneficial impact on workers' well-being. Additionally, the working environment is also a factor that affects workplace well-being. A positive work environment is a workplace that promotes worker safety, development, and goal achievement. Workers are inspired to perform their job the best they can in a positive work environment, leading to a productive workforce [58]. Some strategies for organizations to create good workplace well-being include encouraging worker development and providing workers with a safe and comfortable working environment.

5.3 Relationship Between Social Factors and Workplace Well-Being

In addition, social factors also positively influence workplace well-being (see Table 6). Social factors include communication between workers (S01), worker work monitoring (S03), the collaboration between top management and workers (S05), project leadership (S11), and the relationship between top management and workers (S16). Social factors such as communication between workers significantly contribute to workplace well-being. It is possible to create a more effective, productive, and fulfilling workplace by taking additional steps to improve communication with workers. Employers should develop creative ways to communicate frequently without being monotonous, especially with younger workers who have trouble following patterns. For instance, monthly one-on-one meetings or regular staff meetings can be held. Employers should also identify ways to get workers' feedback. By doing this, two-way communication is facilitated, and workers are made aware that their opinions matter. Project leadership is another factor affecting workplace well-being. According to recent work, leaders may significantly improve workplace well-being at construction sites by reducing emotional exhaustion, which is a major cause of burnout [59]. Worker well-being cannot be solved by simply giving them more resources and training to care for themselves. Another important leadership responsibility is creating a supportive workplace atmosphere that reduces the stress and emotional exhaustion caused by role uncertainty, ambiguity, and meaninglessness.

6. Conclusion

This study aims to validate the relationships between underlying factors and workplace well-being at construction sites. A questionnaire survey was developed based on the literature review. Then, the survey was disseminated to construction industry professionals. Finally, 102 valid responses from construction professionals were retrieved. Confirmatory factor analysis was employed using PLS-SEM to examine the relationships between the underlying factors and workplace well-being at construction sites. The results revealed that physical, psychological, and social factors positively influence workplace well-being at construction sites. Accordingly, this study can assist in promoting the workplace well-being of construction workers and offer new insights into the topic. This study's theoretical contribution is to better understand the relationship between underlying factors and workplace well-being at construction sites.

Despite the importance of the findings, there are certain limitations in this study that should be addressed in future research. First, each country has special characteristics that might significantly impact the outcomes. Therefore, the findings should be used cautiously and modified to apply to other nations. A broader range of data collecting across different nations can enable comparisons and provide insights into how implementing the results can affect them. Second, the data used was gathered through surveys of high-rise construction projects. Also, future scholars may replicate this study for other types of construction projects, such as roads and other infrastructure. Third, the survey was not distributed to hands-on construction workers. Instead, the survey was given to construction professionals, such as engineers, project managers, architects, and quantity surveyors. A construction worker is hired to carry out different physically demanding practical tasks on a construction site. Hence, future scholars could focus future research on

hands-on construction workers. Construction workers may be affected by new and distinct workplace well-being factors differently compared to construction professionals.

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References

[1] Winge, S., & Albrechtsen, E. (2018). Accident types and barrier failures in the construction industry. Safety Science, 105, 158-166.
[2] Jacobsen, H. B., Caban-Martinez, A., Onyebeke, L. C., Sorensen, G., Dennerlein, J. T., & Reme, S. E. (2013). Construction workers struggle with a high prevalence of mental distress and this is associated with their pain and injuries. Journal of Occupational and Environmental Medicine/American College of Occupational and Environmental Medicine, 55(10), 1197.
[3] Lingard, H., & Turner, M. (2015). Improving the health of male, blue collar construction workers: a social ecological perspective. Construction Management and Economics, 33(1), 18-34.
[4] Centers for Disease Control and Prevention (CDC) (2016). Suicide rates by industry and occupation. https://www.cdc.gov/mmwr/volumes/69/wr/mm6903a1.htm#:~:text=The%20five%20major%20industry%20groups,3)%20Other%20Services%20(e.g.%2C
[5] Holistic Healthcare Group (2020). Mental health in the construction industry. https://theholistichealthcaregroup.com/2020/02/mental-health-in-the-construction-industry/
[6] Safety and Health Practitioner. (2017). Mental health focus: what is the construction industry helpline? https://www.shponline.co.uk/what-is-the-construction-industry-helpline-bill-hill-explains/
[7] Turner, M., & Lingard, H. (2016). Work-life fit: identification of demand and resource typologies within a systems framework. Construction Management and Economics, 34(6), 377-392.
[8] Tijani, B., Jin, X., & Osei-Kyei, R. (2020). A systematic review of mental stressors in the construction industry. International Journal of Building Pathology and Adaptation, 39(2), 433-460.
[9] Campbell, M. A., & Gunning, J. G. (2020). Strategies to improve mental health and well-being within the UK construction industry. Proceedings of the Institution of Civil Engineers-Management, Procurement and Law, 173(2), 64-74.
[10] Rouhanizadeh, B., & Kermanshachi, S. (2021). Causes of the mental health challenges in construction workers and their impact on labor productivity. In Tran-SET 2021 (pp. 16-26). Reston, VA: American Society of Civil Engineers
[11] International Labour Organization (ILO) (2022). Workplace well-being. https://www.ilo.org/safework/areasofwork/workplace-health-promotion-and-well-being/WCMS_118396/lang--en/index.htm
[12] Eaves, S., Gyi, D. E., & Gibb, A. G. (2016). Building healthy construction workers: Their views on health, well-being and better workplace design. Applied Ergonomics, 54, 10-18.
[13] Chartered Institute of Building, (2006). Occupational stress in the construction industry. https://www.ciob.org/sites/default/files/CIOB%20research%20-%20Occupational%20Stress%20in%20the%20Construction%20Industry%202006_0.pdf
[14] Rani, H. A., Radzi, A. R., Alias, A. R., Almutairi, S., & Rahman, R. A. (2022). Factors affecting workplace well-being: building construction projects. Buildings, 12(7), 910.
[15] Mostert, K., Peeters, M., & Rost, I. (2011). Work-home interference and the relationship with job characteristics and well‐being: a South African study among employees in the construction industry. Stress and Health, 27(3), e238-e251.
[16] Sang, K. J., Dainty, A. R., & Ison, S. G. (2004, September). The impact of the structure and culture of the construction industry on employee well-being: Directions for future research. In 20th Annual ARCOM Conference (pp. 1-3).
[17] Asare, B. Y. A., Kwasnicka, D., Powell, D., & Robinson, S. (2021). Health and well-being of rotation workers in the mining, offshore oil and gas, and construction industry: a systematic review. BMJ Global Health, 6(7), e005112.
[18] Hamidi, M. S., Boggild, M. K., & Cheung, A. M. (2016). Running on empty: a review of nutrition and physicians' well-being. Postgraduate Medical Journal, 92(1090), 478-481.

[19] Langdon, R. R., & Sawang, S. (2018). Construction workers' well-being: What leads to depression, anxiety, and stress? Journal of Construction Engineering and Management, 144(2), 04017100.
[20] Lingard, H., Francis, V., and Turner, M. (2010). The rhythms of project life: a longitudinal analysis of work hours and work-life experiences in construction. Construction Management and Economics, 28(10), 1085-1098.
[21] American Psychological Association. (2017). Stress in America. https://www.apa.org/news/press/releases/stress/2017/state-nation.pdf
[22] Cropanzano, R., Rupp, D. E., & Byrne, Z. S. (2003). The relationship of emotional exhaustion to work attitudes, job performance, and organizational citizenship behaviors. Journal of Applied Psychology, 88(1), 160.
[23] Anger, W. K., Kyler-Yano, J., Vaughn, K., Wipfli, B., Olson, R., & Blanco, M. (2018). Total Worker Health® intervention for construction workers alters safety, health, well-being measures. Journal of Occupational and Environmental Medicine, 60(8), 700-709.
[24] Carvajal-Arango, D., Vasquez-Hernandez, A., & Botero-Botero, L. F. (2021). Assessment of subjective workplace well-being of construction workers: A bottom-up approach. Journal of Building Engineering, 36, 102154.
[25] Pretorius, F. I. H., & Taylor, R. G. (1986). Conflict and individual coping behaviour in informal matrix organizations within the construction industry. Construction Management and Economics, 4(2), 87-104.
[26] McCabe, B., Loughlin, C., Munteanu, R., Tucker, S., & Lam, A. (2008). Individual safety and health outcomes in the construction industry. Canadian Journal of Civil Engineering, 35(12), 1455-1467.
[27] Ofori, G. (2008). Leadership for future construction industry: Agenda for authentic leadership. International Journal of Project Management, 26(6), 620-630.
[28] Erlanger, T. E., Sayasone, S., Krieger, G. R., Kaul, S., Sananikhom, P., Tanner, M., ... & Utzinger, J. (2008). Baseline health situation of communities affected by the Nam Theun 2 hydroelectric project in central Lao PDR and indicators for monitoring. International Journal of Environmental Health Research, 18(3), 223-242.
[29] Chen, Y., Zhang, F., Wang, Y., & Zheng, J. (2020). Work-family conflict, emotional responses, workplace deviance, and well-being among construction professionals: A sequential mediation model. International Journal of Environmental Research and Public Health, 17(18), 6883.
[30] Umar, T., Egbu, C., Honnurvali, M. S., Saidani, M., & Al-Bayati, A. J. (2019). Briefing: Status of occupational safety and health in GCC construction. Proceedings of the Institution of Civil Engineers-Management, Procurement and Law, 172(4), 137-141.
[31] Loudoun, R., & Townsend, K. (2017). Implementing health promotion programs in the Australian construction industry: Levers and agents for change. Engineering, Construction and Architectural Management, 24(2), 260-274.
[32] Wu, C., Wang, F., Zou, P. X., & Fang, D. (2016). How safety leadership works among owners, contractors and subcontractors in construction projects. International Journal of Project Management, 34(5), 789-805.
[33] Gatti, U., Migliaccio, G., Bogus, S. M., Priyadarshini, S., & Scharrer, A. (2013). Using workforce's physiological strain monitoring to enhance social sustainability of construction. Journal of Architectural Engineering, 19(3), 179-185.
[34] Mohandes, S. R., & Zhang, X. (2021). Developing a holistic occupational health and safety risk assessment model: an application to a case of sustainable construction project. Journal of Cleaner Production, 291, 125934.
[35] He, C., McCabe, B., Jia, G., & Sun, J. (2020). Effects of safety climate and safety behavior on safety outcomes between supervisors and construction workers. Journal of Construction Engineering and Management, 146(1), 04019092.
[36] Dodanwala, T. C., & Shrestha, P. (2021). Work-family conflict and job satisfaction among construction professionals: the mediating role of emotional exhaustion. On the Horizon: The International Journal of Learning Futures, 29(2), 62-75.
[37] Turner, M., & Mariani, A. (2016). Managing the work-family interface: Experience of construction project managers. International Journal of Managing Projects in Business, 9(2), 243-258.
[38] Sadeghi, H., Mohandes, S. R., Hosseini, M. R., Banihashemi, S., Mahdiyar, A., & Abdullah, A. (2020). Developing an ensemble predictive safety risk assessment model: case of Malaysian construction projects. International Journal of Environmental Research and Public Health, 17(22), 8395.
[39] Ju, L., Zhao, W., Wu, C., Li, H., & Ning, X. (2020). Abusive supervisors and employee work-to-family conflict in Chinese construction projects: How does family support help? Construction Management and Economics, 38(12), 1158-1178.
[40] Bowen, P., Edwards, P., Lingard, H., & Cattell, K. (2014). Predictive modeling of workplace stress among construction professionals. Journal of Construction Engineering and Management, 140(3), 04013055.
[41] Rach, V., Osakwe, I., Medvedieva, O., Rossoshanska, O., & Borulko, N. (2019). Method for configuring the composition of a project team based on the criteria of subjective well-being. Восточно-Европейский журнал передовых технологий, (2 (3)), 48-59.
[42] Jacobsen, H. B., Caban-Martinez, A., Onyebeke, L. C., Sorensen, G., Dennerlein, J. T., & Reme, S. E. (2013). Construction workers struggle with a high prevalence of mental distress and this is associated with their pain and

injuries. Journal of Occupational and Environmental Medicine/American College of Occupational and Environmental Medicine, 55(10), 1197.
[43] Chih, Y. Y., Kiazad, K., Cheng, D., Lajom, J. A. L., & Restubog, S. L. D. (2017). Feeling positive and productive: Role of supervisor-worker relationship in predicting construction workers' performance in the Philippines. Journal of Construction Engineering and Management, 143(8), 04017049.
[44] Adabre, M. A., & Chan, A. P. (2019). Critical success factors (CSFs) for sustainable affordable housing. Building and Environment, 156, 203-214.
[45] Radzi, A. R., Rahman, R. A., Doh, S. I., & Esa, M. (2022). Construction readiness for highway projects: key decision criteria. Journal of Construction Engineering and Management, 148(2), 04021196.
[46] Munianday, P., Radzi, A. R., Esa, M., & Rahman, R. A. (2022). Optimal strategies for improving organizational BIM capabilities: PLS-SEM approach. Journal of Management in Engineering, 38(3), 04022015.
[47] Zhang, X., Shen, L., & Wu, Y. (2011). Green strategy for gaining competitive advantage in housing development: A China study. Journal of Cleaner Production, 19(2-3), 157-167.
[48] Zhao, X., Hwang, B. G., Pheng Low, S., & Wu, P. (2015). Reducing hindrances to enterprise risk management implementation in construction firms. Journal of Construction Engineering and Management, 141(3), 04014083.
[49] Mao, C., Shen, Q., Pan, W., & Ye, K. (2015). Major barriers to off-site construction: the developer's perspective in China. Journal of Management in Engineering, 31(3), 04014043.
[50] Nunnally, J.C. (1978). Psychometric Theory. McGraw-Hill, New York, NY
[51] Aibinu, A. A., & Al-Lawati, A. M. (2010). Using PLS-SEM technique to model construction organizations' willingness to participate in e-bidding. Automation in Construction, 19(6), 714-724.
[52] Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. European Business Review.
[53] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.
[54] Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed, a silver bullet. Journal of Marketing Theory and Practice, 19(2), 139-152.
[55] Drewnowski, A. (2020). Impact of nutrition interventions and dietary nutrient density on productivity in the workplace. Nutrition Reviews, 78(3), 215-224.
[56] Kohll, A. (2019). How your office space impacts employee well-being? Forbes Magazine.
[57] Yellen, J. L. (1984). Efficiency wage models of unemployment. The American Economic Review, 74(2), 200-205.
[58] Massoudi, A. H., & Hamdi, S. S. A. (2017). The Consequence of work environment on employee's productivity. IOSR Journal of Business and Management, 19(01), 35-42.
[59] Gregersen, S., Vincent-Höper, S., & Nienhaus, A. (2016). Job-related resources, leader-member exchange and well-being-a longitudinal study. Work & Stress, 30(4), 356-373