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Impact of mental wellbeing of construction workers on project performance: A multi-group structural equation model

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Abstract

Strong project performance depends on the mental wellbeing of employees in construction, but more empirical investigation is needed to fully evaluate this impact. The research attempts to quantify the impact of mental health conditions on project outcomes and to investigate how demographic traits mitigate this link. Data from 309 construction workers in Turkey was used to design and test a conceptual model and related hypotheses. After that, multi-group structural equation modelling was used to assess the hypotheses and validate the resulting model. The findings show that mental health disorders have a negative effect on project performance in construction. Anxiety was shown to have a modest effect, whereas depression and stress were found to have the greatest impact. Furthermore, the association between mental wellbeing and project performance was found to be strongly moderated by demographic factors such as marital status, tobacco usage, place of residence, work experience, and income. According to these results, adverse impacts could be mitigated by personalized support plans tailored to the demographic profiles of workers, especially with regard to experience, marital status, and income. Additionally, improving living conditions, particularly in labor camps, may encourage construction workers to perform better and be more motivated.

1. Introduction

Mental health is critical to construction workers' overall wellbeing, productivity and project performance. According to research, workers in construction are susceptible to a variety of mental health issues, including psychological distress, stress, anxiety, and depression [1-3]. These challenges are often exacerbated by adverse working conditions, job insecurity, and the dominant masculine norms prevalent in construction workplaces [1, 4]. However, it has been discovered that workers in the construction industry have poor mental and physical health outcomes, and these difficulties require treatments [4]. Workers' mental health in the construction sector is a complicated issue that requires all-encompassing care and assistance.

In the construction sector, achieving better project performance outcomes necessitates a thorough comprehension and efficient management of these aspects. Mental health disorders in the construction industry is a serious problem that might impact their output and project performance [5]. To maintain a healthy and productive workforce, it is imperative to consider these concerns that construction workers encounter [6]. However, not much research has been done on how construction workers' mental health affects project performance. Therefore, an empirical assessment of the relationship between construction workers' mental health and project performance is necessary.

Therefore, this study's main goal is to evaluate how mental health issues in the construction industry affect project performance. A crucial first step in attaining successful project outcomes and creating a safe workplace in construction projects is methodically determining the association between worker mental wellbeing and project performance. Thus, it is essential to conduct an empirical investigation into the connection between mental health status of construction workers and project performance. This study attempts to evaluate the impact of mental health disorders on the project performance in the construction industry. Building this relationship methodically is essential to enhancing project results and creating a more wholesome, encouraging workplace for construction workers.

2. Background

2.1. Mental wellbeing in construction

Concerns regarding construction workers' mental health are raised by the high rates of stress, anxiety, depression, and overall mental suffering. Studies have shown that construction workers who have poor working conditions also experience significant levels of occupational stress [7]. The mental health problems that workers in demanding work environments face have also been made clear by a study on psychological discomfort among construction workers in Australia [8]. According to other studies [1-3, 9], the three most prevalent mental health conditions among construction workers are anxiety, depression and stress.

The effects of a variety of stressors, such as job stress, occupational stress, and physical strain have been highlighted as common mental issues among construction workers in numerous studies. Workplace stress is a significant issue in the construction sector that impairs employees' performance in terms of safety, especially when it leads to burnout [10]. Anxiety is another complex issue for the productivity of construction workers and mental health. Awkward postures, repeated tasks, and manual material handling are just a few of the bodily requirements of construction that have been found to be major sources of stress for construction workers [11]. Numerous studies have looked at how different anxiety-related factors, such as stress at work, exposure to occupational dangers, and the influence of outside factors, affect construction workers [11, 12]. Additionally, studies have looked at the connection between construction workers' anxiety levels, job risk index, and physical health. Additionally, studies have looked at the connection between construction workers' anxiety levels, job risk index, and physical health. According to Langdon and Sawang [13], this study has identified a number of variables that may make anxiety worse in high-stress situations.

Depression is among the mental health conditions that construction workers experience most frequently. Research has shown that depression affects 2.4% to 11.0% of construction workers, depending on the workplace [14]. The prevalence and associated factors of depression in labor camp workers have also been studied. The report claims that workers in these environments deal with mental health problems [13]. Construction workers may experience symptoms of depression as a result of the physical demands of their jobs, job insecurity, low socioeconomic status, and stress at work [15]. In summary, mental health conditions can have a detrimental impact on the physical and mental health, safety, and productivity of construction workers. Numerous environmental, occupational, and physical stressors contribute to these disorders.

2.2. Project performance in construction

In the construction sector, project performance is a complex concept encompassing customer satisfaction, safety, quality, timeliness and cost-effectiveness. It is influenced by factors such as efficient project management, trained staff, adherence to safety standards, project management techniques and the use of cutting-edge construction technologies. High project performance in the construction industry hinges on skilled workers and labour productivity [16].

However, construction projects can be affected by a number of performance issues, including delays, cost overruns, safety mishaps and quality errors. These problems can significantly impact the effective completion of building projects and the industry's financial viability. Reasons why construction projects frequently experience delays include poor project planning, customer requests, rework, design modifications, inclement weather, material shortages and labour issues [17]. Inaccurate cost projections, changes to the scope of the project, unforeseen circumstances on site and poor risk management can all lead to cost overruns. Safety mishaps are one of the most talked-about subjects on construction sites, as they can cause delays to project timelines, increase costs, and diminishes worker morale, health, and productivity. To improve project outcomes and encourage sustainable practices of construction projects, addressing these concerns is necessary by implementing proactive risk management, efficient project planning, robust safety procedures, hygienic working conditions and open communication among project stakeholders.

2.3. Knowledge gap and research aims

Previous studies of construction project performance have examined various elements that influence productivity and success. These elements include team performance [18], project organizational culture and team diversity [19]. In order to define the factors that influence project performance, researchers have also examined organizational competencies [20], construction productivity [21], conflict factors [22], project leadership and quality performance [23], the risk impact on construction project performance [24] and artificial intelligence usage for planning of construction projects. Researchers looked at severe weather conditions, poor decision-making, and delayed material deliveries to better understand the reasons behind building project delays [25]. The most significant factors affecting labour productivity were also assessed. These include low-skilled workers, poor working conditions, inadequate labour supervision, payment delays and adverse weather conditions [26]. Furthermore, it has been determined that construction project cost overruns are caused by a number of factors, including construction productivity, project profit, project design cost, material waste, and change order cost [21].

However, compared to the general population, construction workers experience higher incidence of psychological disorders, mental anguish, and occupational injuries [7, 27]. A number of factors, including pain, accidents, musculoskeletal complaints and stress at work, contribute to mental health problems in this group.

Additionally, the social and occupational context of the construction business, which includes elements like excessive work hours and exposure to mistreatment, has been connected to poor mental health outcomes [28]. Additionally, studies have demonstrated how social variables, job quality, and workplace interventions affect construction workers' mental health and general well-being [29]. According to the literature, employees in high mental wellbeing are more likely to perform at their best, highlighting the importance of employee well- being in improving workplace performance overall [30]. The connection between the mental health and well-being of construction workers and project performance is an important topic for further study. Studies have shown that mental health conditions can substantially affect a person's overall performance and well-being. These conditions include somatization, anxiety and sadness [9]. Additionally, studies show that mental health conditions may negatively impact construction workers' productivity. A quantitative analysis of the psychological health of construction workers shows that mental health problems are likely to negatively affect workplace safety and productivity [15]. However, no comprehensive empirical study has yet been conducted to evaluate the influence of individual mental health conditions on construction workers' overall performance in building projects. This study's primary objective is to bridge the knowledge gap by conducting an empirical investigation into the connection between the mental health of construction workers and the overall project performance, as determined by three key metrics: cost, time and safety. The study's second objective is to determine how significant demographic traits of construction workers, such as marital status, tobacco use, weekly working hours, housing, income and experience, modify the correlation between mental wellbeing and overall performance of construction projects.

3. Research Methodology

The primary hypotheses based on the conceptual model in this study are established after identifying the research gap in the body of knowledge has been defined. The purpose of the literature review was to create a survey based on the identified hypotheses. Then, a random sample technique was adopted to gather the required data. To determine each measuring item's factor loading, the data were first checked for normality. The proposed model's dependability using a number of metrics was assessed. Finally, the main and sub-hypotheses using multi-group structural equation modelling were tested.

3.1. Conceptual model and hypotheses development

According to surveys, significant psychological distress is highly prevalent among construction workers. This demonstrates how mental health issues affect employees' ability to job productivity. Studies have indicated a link between mental health issues and various workplace factors, including self- stigma, job motivation and notions of masculinity [4]. Furthermore, employees' job retention and performance depend on their mental health [31]. The significance of addressing mental health in the construction industry is highlighted by the connection between mental health conditions and work hazards. Mental health conditions can impact occupational functioning, resulting in decreased productivity, absenteeism and poorer performance. Construction projects may experience delays, errors, and reduced quality as a consequence [32]. Mental wellbeing affects project performance by influencing workers' cognitive functioning, motivation, and behavior, which in turn shape safety, productivity, and work quality outcomes. Mental wellbeing influences project performance through its impact on managerial decision-making, communication, and team coordination under high-pressure construction environments. These earlier studies therefore provide compelling evidence in support of main hypothesis, which examines the effect of mental health issues on worker productivity (Fig. 1).

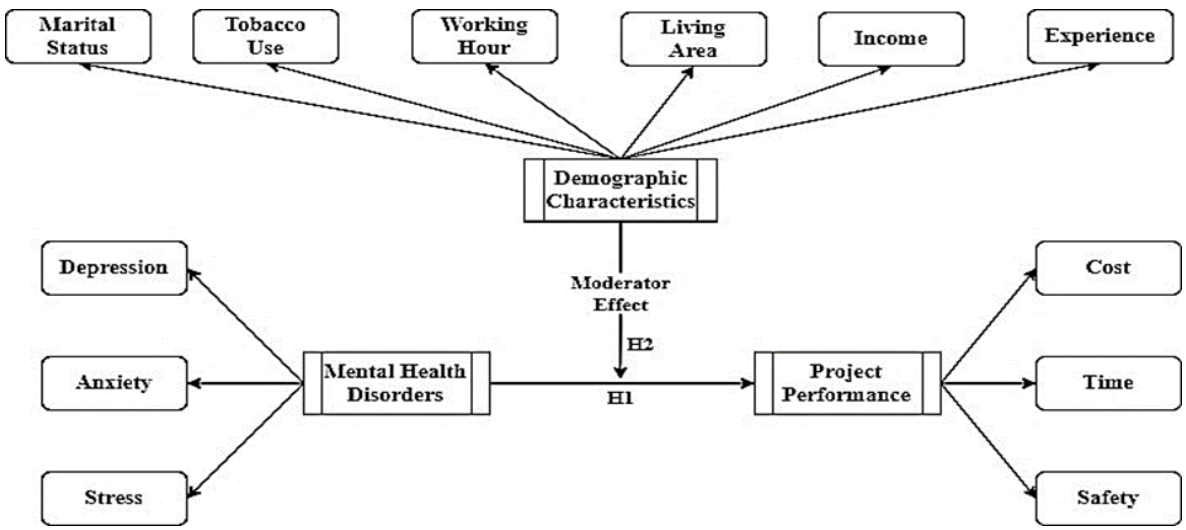

Fig. 1. Conceptual model

H1: Mental health issues including stress, anxiety, and depression have a great effect on how well construction projects perform.

It has also been discovered that mental health conditions are associated with other lifestyle choices or behaviours, such as addiction, tobacco use, and eating disorders. These co-morbidities may impact both general well-being and productivity at work [33]. Furthermore, studies have demonstrated a strong and favourable correlation between work-life satisfaction and wellbeing. However, a number of variables, including work-life conflict, work pressure and working hours, may modify this association. Additionally, it was investigated how construction workers' mental health was affected by occupational difficulties; the findings revealed a decline in mental health when workers encountered adversity, highlighting the potential link between job quality, mental well- being, and project performance. Differences in age, work experience, education, and working hours affect how individuals perceive risks, manage workload, and respond to project demands, thereby influencing overall project performance. Demographic characteristics are associated with variations in safety behavior, productivity, and work quality, and are therefore considered important control factors when examining construction project performance. Furthermore, studies have shown that marital status can impact mental health, with unmarried, separated, divorced or widowed individuals often experiencing higher levels of anxiety [34]. Additionally, studies have shown a substantial link between family income and mental health problems, highlighting the significance of taking economic considerations into account when assessing vulnerable groups [35]. Overall, the research emphasizes the significance of personal demographic characteristics in determining mental health outcomes, such as marital status, working hours, income, tobacco use, geographical location, and work experience. Therefore, testing the moderating impact of personal background and mental health status on project performance is highly essential. In light of these indicators and the findings of earlier research, the next hypothesis is established as follows (Fig. 1).

H2: The association between mental wellbeing and project performance in construction is significantly moderated by the demographic background of construction workers, including factors like marital status, income, tobacco usage, experience, living location, and work experience.

3.2. Data collection and analysis

To test the developed hypotheses, it is employed a self-administered survey. Three sections comprised the survey: i) Demographics of participants ii) Evaluation of the severity of mental disorders, iii) Performance assessment of construction projects. tobacco use, place of residence, marital status, weekly hours worked, job experience, monthly income, age, project type, and work area (such as bricklaying, façade work, finishing, formwork, ironwork, and mechanical work) were among the demographic details requested in the first section. The prevalence of significant mental diseases was investigated in the second portion using the Depression, Anxiety, and Stress Scale (DASS-21) including total 21 questions and seven items developed for each mental status. Lovibond & Lovibond [36] developed the Depression Anxiety Stress Scale-21 (DASS-21), a widely used research tool for evaluating the severity of mental health conditions and it is used its developed form in this study without any adaptation. This mental wellbeing survey form is widely used in literature, particularly in the social sciences [55, 56]. To assess construction project performance, questions about the cost, schedule, and safety performance of projects in which workers were employed at the time were asked [37]. To assess the effectiveness of construction projects, two questions about cost, time, and safety were asked in sections two and three, respectively. The project completion within the allotted budget and timescale is the main goal of the cost and time performance questions [38]. Additionally, based on the company's salary payment performance, construction workers were asked to assess the project's budgetary success. Questions concerning safety performance also addressed the frequency of work-related incidents (deaths and injuries) and the efficacy of safety instruction given to construction workers [39]. A Likert scale, with 1 representing "strongly disagree" and 5 representing "strongly agree," was used to rate each item related to mental health and project performance. After it was finalized, the survey was administered in person to increase the number of responses. Prior to data collection, the university ethics committee granted the required ethical approvals. It is briefly explained the study to participants at the beginning of the survey and informed them that no personal information would be collected and that any information collected would only be utilized for research.

The generated hypotheses were validated and a path analysis was performed using multi-group Structural Equation Modeling (SEM). SEM enables us to investigate intricate correlations between variables. It is appropriate for researching phenomena containing numerous interconnected elements since it can handle both latent (unobservable) variables and models with multiple independent and dependent variables. SEM allows the investigation of mediation (indirect effects) and moderation (interaction effects) within a single analytical framework [40]. For data analysis, a statistical software package called AMOS was used, which is widely used in the literature for SEM. Prior to the analysis, the scores were entered manually, so there is no missing data. However, outliers were detected and extracted using Q-Q plots prior to the analysis. Additionally, the moderator effects of categorical variables such marital status, experience, living location, tobacco usage, working hours, and income between two latent constructs are tested using a multi-group analysis within SEM [59, 60]. In this step, it is aimed to identify which demographic characteristics

exacerbated the effect of mental disorders on project performance. In other words, when demographic characteristics and mental disorders interact, what kind of effects on project performance should be investigated. To do this, the slope analysis was performed to determine how the effect of mental disorders changes with different background characteristics. In Structural Equation Modelling (SEM), slope analysis is a post-estimation technique used to interpret moderation effects. Moderation occurs when the relationship between an independent variable (X) and a dependent variable (Y) changes depending on a third variable, known as the moderator (M). In SEM, moderation is tested by including an interaction term (X × M) in the structural model. If the interaction coefficient is statistically significant, this indicates the presence of a moderating effect. After identifying a significant interaction, simple slope analysis is performed to examine the conditional effects of X on Y at specific moderator levels, typically low (−1 SD), mean and high (+1 SD). This approach enables researchers to ascertain how the magnitude and direction of the X–Y relationship change across moderator levels. The conditional slopes are calculated using the estimated main and interaction effects, and their significance is assessed using analytical methods or bootstrapping. Slope analysis improves the interpretability of moderation effects by providing substantive insights into conditional relationships beyond the significance of interaction terms. In SEM, it can be applied to both observed and latent variables using approaches such as latent interaction modelling or multi-group analysis for categorical moderators. Overall, slope analysis is essential for the meaningful interpretation and clear reporting of moderator effects in SEM-based research.

4. Results

A total of 309 Turkish construction workers participated from 36 different construction companies in this study to evaluate and test the hypotheses. Approximately 10 construction workers from each company attended the study. These companies have projects in locations ranging from west to east Turkey. The construction companies were selected on the basis that they have different project types in various locations across Turkey. Therefore, the results of the study can be generalised for the Turkish construction industry. The data were also mainly collected in three different project types such as building (36.89%), transportation (32.69%) and infrastructure (30.42%). 54.37% of these workers are married and 61.81% of them are tobacco users. While more of them live in an apartment (60.84%), 39.16% of them live in labor camps. They work in different areas such as masonry (9.06%), formwork (16.50%), ironwork (13.27%), finishing (26.54%) and facade/roof (10.36%). More than half of the respondents are under 40 years of age and have less than 10 years of experience (Table 1). The cut-off points for each categorical variable were selected in the literature and the similar categories were used in previous studies as used in this study [57, 58].

4.1. Validity of conceptual model

The validity of the measures of stress, anxiety, depression, and project performance were assessed before the proposed hypotheses were tested. First, the skewness and kurtosis values were used to analyze each group of latent variables' normal distribution. The results demonstrated that the dataset was normally distributed, with kurtosis values lying between -3 and +3 and skewness values of all the metrics ranging between -1 and +1 [41]. The one-dimensionality and convergent validity of the latent variables were subsequently assessed using confirmatory factor analysis (CFA). This allows us to determine whether each latent variable is appropriately reflected in the measurement items. It is also possible to ascertain whether items assessing a latent construct provide only one associated latent variable by examining convergent validity. Items H-A4, H-A7, H- S2, H-S3, and P-SF2 were eliminated based on CFA prior to testing the hypotheses since their factor loadings are less than 0.6 ($p > 0.05$) [42]. Therefore, it is aimed to increase the dataset's reliability and internal consistency. Composite reliability (CR) and Cronbach's alpha coefficient, which are measures of dependability, were taken into account [43]. Given that the latent constructs' Cronbach's alpha coefficient and CR value are both greater than 0.7, the results demonstrate their suitability. According to Fornell and Larcker [44], these constructs include performance ($\alpha = 0.745$, CR = 0.866), stress ($\alpha = 0.825$, CR = 0.852), anxiety ($\alpha = 0.753$, CR = 0.847), and depression ($\alpha = 0.838$, CR = 0.906). Average Variance Extracted (AVE) calculated from the factor loadings of the observed items in each latent construct group was also used to assess convergent validity

The latent constructs AVE values are greater than the 0.5 cut-off mark recommended by the literature, indicating convergent validity [44]. The model fit indices included the chi-squared value ($\chi 2$) based on the ratio of degrees of freedom ($\chi 2/df$), the goodness of fit index (GFI), and the root mean square error of approximation (RMSEA). For instance, the latent construct Depression satisfies the model fit requirements with RMSEA = 0.001 being less than 0.1 and GFI = 0.985 being greater than 0.9. Additionally, for the depression construct [42], $\chi 2/df = 0.892$ is less than 3 (Table 2). Another parameter, discriminant validity, introduced by Fornell and Larcker [44], was checked for each latent construct. Discriminant validity, which is concerned with determining whether two measures indicate different constructs, is distinct from convergent validity. To meet the requirement of discriminant validity, the absolute correlation coefficient should be less than the square root of the average variance extracted (AVE) [44].

Table 1. Descriptive statistics for respondents

Category	Subcategory	Frequency	Percentage (%)
Marital status	Married	168	54.37
	Unmarried	141	45.63
Tobacco usage	Yes	191	61.81
	No	118	38.19
Weekly working hour	40-45	92	29.77
	45-50	88	28.48
	50-55	69	22.33
	More than 55	60	19.42
Living space	Apartment	188	60.84
	Labor camp	121	39.16
Income (per month/TL)	12.000-15.000	73	23.62
	15.000 - 18.000	73	23.62
	18.000-21.000	80	25.89
	More than 21.000	83	26.86
Work experience (years)	0-5 years	71	22.98
	5-10 years	93	30.10
	10-15 years	78	25.24
	More than 15 years	67	21.68
Age	Between 20-30	107	34.63
	Between 30-40	97	31.39
	Between 40-50	62	20.06
	More than 50	43	13.92
Working area	Bricklaying	28	9.06
	Formwork	51	16.50
	Ironwork	41	13.27
	Finishing works	82	26.54
	Facade/Roof	32	10.36
	Mechanical	38	12.30
	Other	37	11.97
Project type	Building	114	36.89
	Transportation	101	32.69
	Infrastructure	94	30.42

Table 2. Reliability and validity of measurement items

	Latent construct	Observed item	Mean	Std. dev.	Factor loading	Cronbach's alpha	Composite reliability	GFI	RMSEA	$\chi 2/df$	AVE
Mental health disorders	Depression	H-D1	3.151	1.071	0.781	0.838	0.906	0.985	0.001	0.892	0.582
		H-D2			0.818						
		H-D3			0.664						
		H-D4			0.745						
		H-D5			0.789						
		H-D6			0.694						
		H-D7			0.832						
	Anxiety	H-A1	2.334	1.324	0.728	0.753	0.847	0.988	<0.001	0.686	0.529
		H-A2			0.776						
		H-A3			0.628						
		H-A4			Deleted						
		H-A5			0.832						
		H-A6			0.651						
		H-A7			Deleted						
	Stress	H-S1	2.898	1.011	0.713	0.825	0.852	0.989	0.006	0.775	0.537
		H-S2			Deleted						
		H-S3			Deleted						
		H-S4			0.657						
		H-S5			0.709						
		H-S6			0.881						
		H-S7			0.684						

Table 2. Cont'd

Project performance	Cost	P-C1	2.114	0.938	0.706	0.745	0.866	0.992	<0.001	0.631	0.599
		P-C2			0.717						
	Time	P-T1			0.725						
		P-T2			0.812						
		P-T3			0.794						
	Safety	P-SF1			0.876						
		P-SF2			Deleted						

The results show that the square root of the AVE for depression (0.763), anxiety (0.727), stress (0.733), and performance (0.774) and the absolute correlation coefficients (depression/performance; $\rho = 0.548$, anxiety/performance; $\rho = 0.421$, stress/performance; $\rho = 0.483$) between each latent construct meet the criteria for discriminant validity. Several indices were employed for testing, including the goodness-of-fit index (GFI), Tucker-Lewis index (TLI), comparative fit index (CFI), incremental fit index (IFI), root mean square error approximation (RMSEA), and the ratio of chi-square to degrees of freedom ($\chi 2/df$). The model fit of the suggested conceptual framework as a last step. According to a previous study [42], all goodness of fit indices ($\chi 2/df = 1.330$, IFI = 0.911, CFI = 0.909, TLI = 0.901, RMSEA = 0.038) fall within the acceptable range for the model validity.

4.2. Hypotheses test findings

The findings of the SEM indicate that mental health conditions, including stress ($\beta = -0.516$, $p < 0.001$), anxiety ($\beta = -0.346$, $p < 0.05$) and depression ($\beta = -0.624$, $p < 0.001$), have a significant negative effect on construction project performance. In light of this outcome, the primary hypothesis (H1) and its sub- hypotheses (H1-1, H1-2 and H1-3) can be accepted (Table 3).

On the other hand, the results of the moderator effect tests based on multi-group SEM show that marital status ($\beta = -0.327$, $p < 0.05$) has a significant moderator role between anxiety and project performance, which supports H2-2. In addition, tobacco use ($\beta = -0.596$, $p < 0.05$) significantly moderates the effect of stress on project performance, which allows us to accept sub- hypothesis H2-6.

Table 3. Hypotheses test results

Main hypothesis	Sub-hypothesis	Path	Standardized path coefficient (β)	p-value	Result
H1	H1-1	Depression → Performance	-0.624	<0.001	Supported
	H1-2	Anxiety → Performance	-0.346	0.002	Supported
	H1-3	Stress → Performance	-0.516	<0.001	Supported
H2	H2-1	Depression → Marital Status→ Performance	0.768	0.171	Not Supported
	H2-2	Anxiety → Marital Status→ Performance	-0.327	0.041	Supported
	H2-3	Stress → Marital Status→ Performance	0.338	0.638	Not Supported
	H2-4	Depression → Tobacco Usage→ Performance	0.156	0.458	Not Supported
	H2-5	Anxiety → Tobacco Usage→ Performance	-0.244	0.638	Not Supported
	H2-6	Stress → Tobacco Usage→ Performance	-0.596	0.051	Supported
	H2-7	Depression → Working Hour→ Performance	0.254	0.788	Not Supported
	H2-8	Anxiety → Working Hour→ Performance	0.496	0.649	Not Supported
	H2-9	Stress → Working Hour→ Performance	0.413	0.319	Not Supported
	H2-10	Depression → Living Space→ Performance	-0.732	0.021	Supported
	H2-11	Anxiety → Living Space→ Performance	0.331	0.631	Not Supported
	H2-12	Stress → Living Space→ Performance	0.232	0.989	Not Supported
	H2-13	Depression → Income→ Performance	-0.676	0.011	Supported
	H2-14	Anxiety → Income→ Performance	0.486	0.514	Not Supported
	H2-15	Stress → Income→ Performance	-0.312	0.032	Supported
	H2-16	Depression → Experience→ Performance	-0.217	0.84	Not Supported
	H2-17	Anxiety → Experience→ Performance	-0.36	0.659	Not Supported
	H2-18	Stress → Experience→ Performance	0.486	0.038	Supported

The results indicate a significant negative moderator effect of living area ($\beta = -0.732$, $p < 0.05$) and income ($\beta = -0.676$, $p < 0.05$) on the relationship between depression and project performance. In addition, income ($\beta = -0.312$, $p < 0.05$) and experience ($\beta = 0.486$, $p < 0.05$) have a significant moderating role between mental health disorders and project performance. Thus, the second main hypothesis H2 is partially supported in this study (Table 3).

5. Discussion

5.1. Main effects of mental wellbeing on project performance

The SEM data supports the first primary hypothesis, H1, which states that mental health issues negatively impact project performance. Depression has been shown to have the most detrimental impact on construction project performance. The link between depression and poor project performance due to low work productivity is also well documented in the literature. Mental wellbeing exerts a direct main effect on project performance by supporting effective decision-making, safe work behaviours, and efficient task execution. Mental wellbeing directly affects project performance by influencing individuals' cognitive functioning and behavioural responses to work demands in construction environments. One study has shown that depression, even at low or subthreshold levels, is associated with poorer work performance [45]. Employees with depression are often present at work, but their performance can be significantly reduced, resulting in significant costs to employers [46, 47]. Stress, which is another major mental health disorder observed in construction workers, is also a significant driver of poor project performance in construction. Research has shown that productivity losses due to work stress represent a significant economic burden. It was discovered that stress affected men's production more than it did women's [48], which could be valid for male dominated construction workers. Additionally, the study's results demonstrate that anxiety can significantly impair project performance. Although anxiety significantly reduces employee performance and productivity, the effect size of anxiety is moderate (between 0.3-0.5) compared to other two health disorders such as depression and stress (between 0.5-1.0) [49]. The negative impact of anxiety is further emphasized by the fact that employees experiencing anxiety suffer from reduced inability to multi-task, concentration and quick task completion, all of which contribute to poor work performance [50].

5.2. Moderator effects of demographic characteristics

Several demographic factors, such as income, marital status, tobacco use, experience and living area, have a substantial moderating influence on project performance when paired with mental health issues. After discovering the moderating effects of certain demographic traits, the study's focus shifted towards gaining a detailed understanding of the reasons and mechanisms by which these traits mitigate the effect of mental health conditions in construction. Demographic background matters for project performance because it conditions skills, physical and cognitive capacity, and exposure to job demands within construction environments.

Project performance is considerably and adversely moderated by living area when it comes to depression. The result of the slope analysis shows that when construction workers live in labor camps, they experience high levels of depression and project performance decreases significantly due to low productivity (Fig. 2). Most construction workers, especially migrant workers, live in labor camps away from their families with poor living conditions. Existing literature on labor camp conditions has also highlighted these challenges faced by workers such as cramped living space, lack of privacy, unclean and unhealthy environment, limited access to amenities and substandard housing. These conditions could affect construction workers' mental health and lead to a stressful and demanding work environment [51]. Negative living conditions, combined with the physically and mentally demanding nature of construction jobs, may make construction workers more susceptible to stress, anxiety and depression [52].

Additionally, it is found that income significantly alters the negative relationship between project performance and sadness. According to slope research, low-paid construction workers are more prone to feel depressed and stressed than their higher-paid peers (Fig. 3). This may impact their productivity and project performance. These results align with previous social science research despite the absence of a study specifically designed to evaluate the effect of wealth on the productivity of construction workers. Research has shown that income is associated with depression, with some studies suggesting a stronger association between depression and lower income levels. For instance, a systematic review revealed that the correlation between income and depression is present across all income groups, but is more significant for those in lower income brackets [12].

The association between stress and project effectiveness is significantly moderated by income. Income inequality has been found to be a contributing factor to stress, and there is evidence that it is associated with poor mental health outcomes (Fig. 4). Among working people, income level has been found to impact the relationship between stress and unemployment risk; reported daily stress nearly doubles the probability of future unemployment [53]. Construction workers are especially concerned about this unemployment risk because construction projects are impermanent.

The results of the study indicate that experience has a positive moderating effect on how stress affects project performance. Slope analysis indicates that project performance improves significantly when the most experienced construction workers are subjected to higher stress levels than the least experienced workers (Fig. 5).

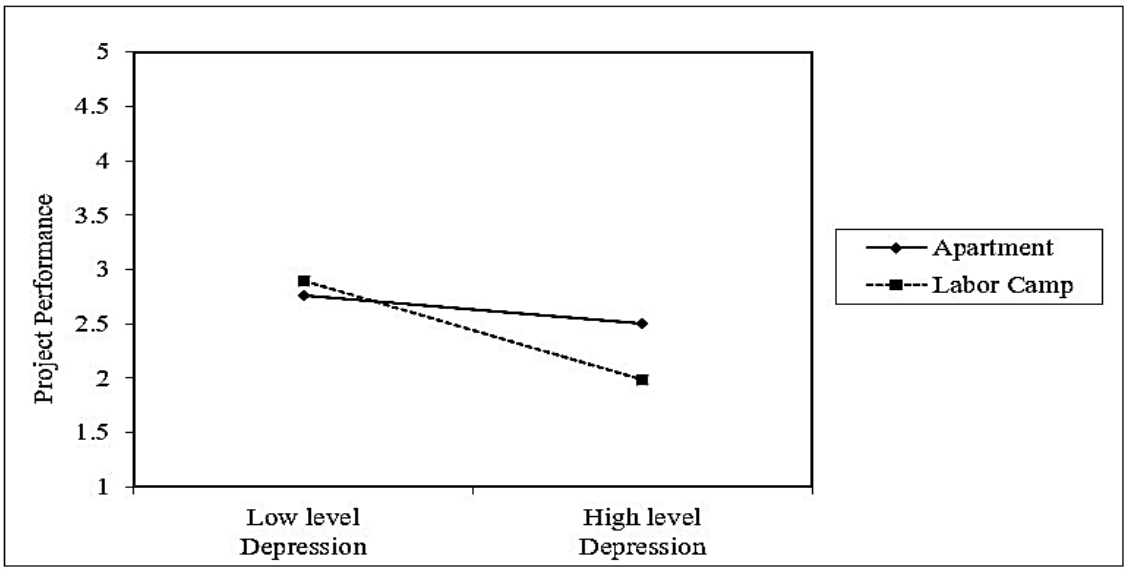

Fig. 2. Living area moderation effect between depression and project performance

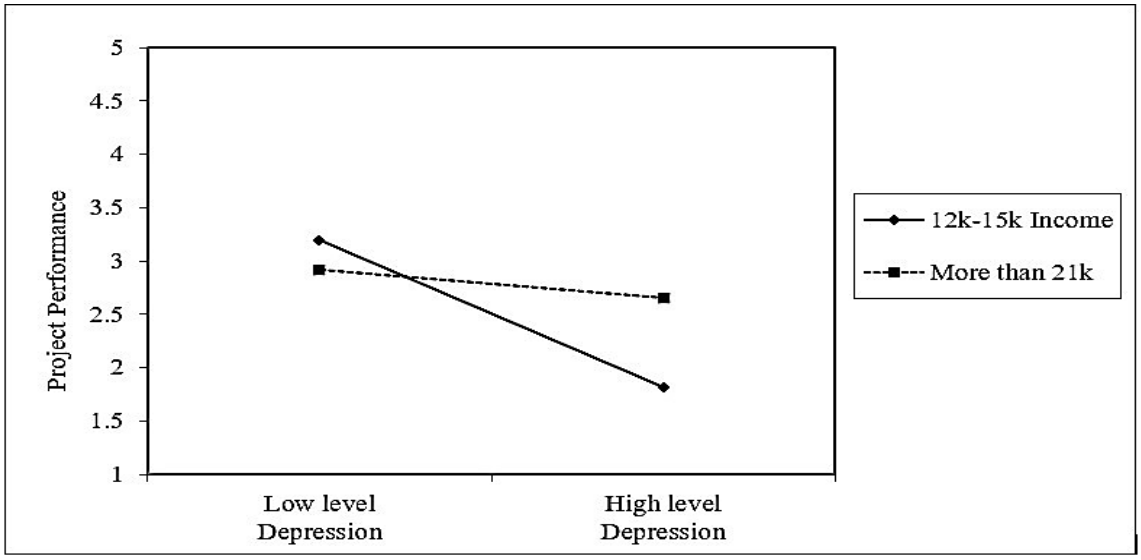

Fig. 3. Income moderation effect between depression and project performance

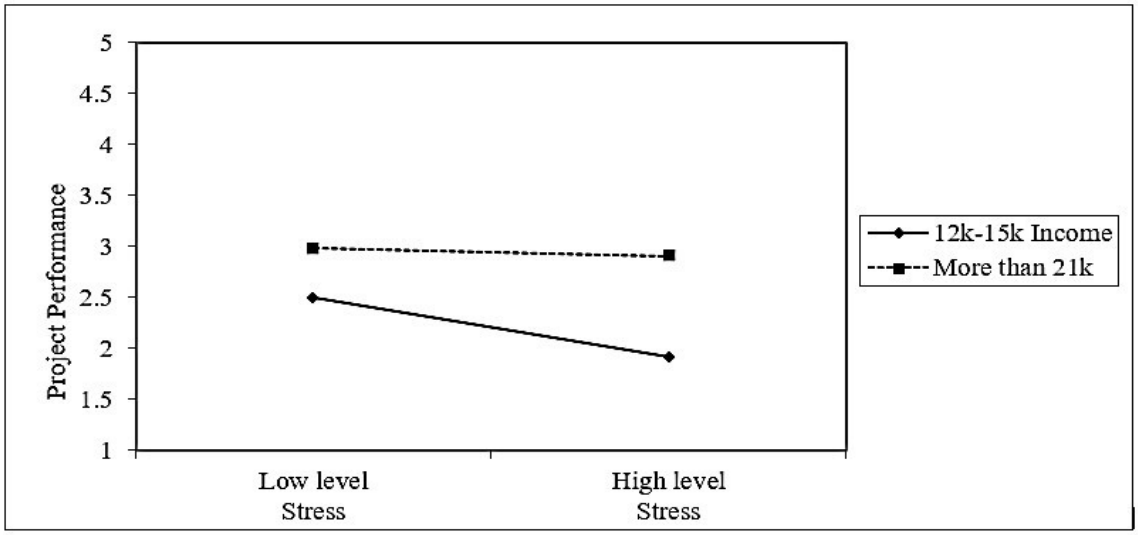

Fig. 4. Income moderation effect between stress and project performance

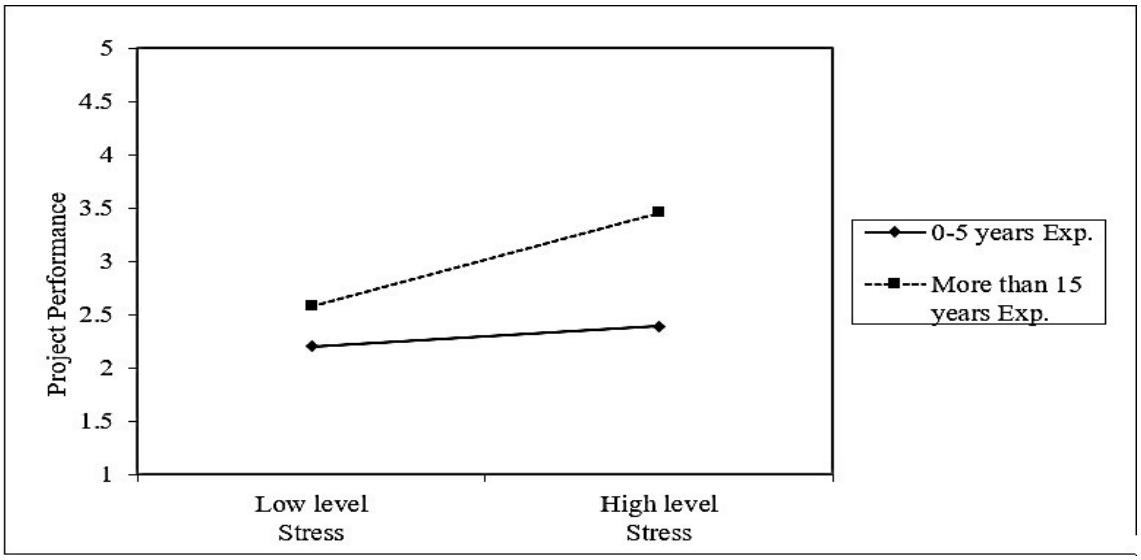

Fig. 5. Experience moderation effect between stress and project performance

A number of studies have linked high levels of work experience to successful job stress management [29, 41]. According to Dar et al. [41], authentic leadership has been linked to favorable workplace outcomes, including good job performance and work engagement under pressure. Additionally, it is emphasized that balancing positive and negative indirect effects can improve employees' work performance when faced with challenging tasks, such as those involving high complexity and time pressure [29]. Construction workers are often under constant pressure due to the demanding work environment and time, quality, safety and cost constraints. Experienced workers are better able to understand and handle these stressful events over time than less experienced individuals, which improves their job performance.

Employee mental health and wellness are closely linked to several project performance aspects in the construction industry, including productivity, safety, quality, teamwork, decision-making, morale, cost management, client relations, regulatory compliance, and legal risk. Recognizing the importance of mental health in construction and implementing policies to support employee well-being can enhance project outcomes, mitigate risks, and cultivate a productive and enduring work environment. Additionally, it has been found that social support from social networks and capital is a powerful tool for enhancing construction workers' productivity, efficiency, and physical and mental health [32]. Thus, coping strategies, stress-reduction tactics, and the development of stress-reduction programs have been the main topics of research into the management of construction workers' mental health. Construction workers can also receive individualized mental health support depending on their demographics [54].

6. Conclusions

This study examines empirically the impact of mental health disorders on construction workers' productivity and project performance. This was accomplished by creating and evaluating a conceptual model along with related theories. A prepared survey was gathered from 309 Turkish construction workers who worked for 36 different companies. The established hypotheses were tested using multi-group SEM. According to the study, decreased productivity among construction workers is a major effect of mental health problems including on project performance. By examining the connection between construction workers' mental health and project performance, this study is thought to fill a gap in the literature. Additionally, the study determined which demographic factors were most important in causing mental health problems and evaluated how demographic traits affected the association between project success and mental health disorders.

The study's conclusions may be of interest to both construction business practitioners and scholars of construction management. Mental wellbeing is a key factor in the performance of construction projects, as psychological strain can impair attention, decision-making and engagement at work, resulting in reduced productivity, defects in quality and delays to schedules. Due to the high-risk and time-critical nature of construction projects, mental wellbeing has a direct impact on safety behaviors and risk perception. Effective leadership, communication and coordination in construction teams depend on mental wellbeing. Its deterioration undermines managerial effectiveness and collaboration, ultimately weakening overall project performance. Poor psychological health can lead to accidents, rework and associated cost overruns. The primary theoretical contribution is the helpful data on how construction workers' well-being affects project productivity and performance. Slope diagrams were then employed to ascertain whether demographic traits considerably lessen the impact of mental health issues on project performance. These findings make a secondary theoretical contribution to the literature of current knowledge. It is crucial to keep in mind that the productivity of

construction workers directly impacts their well-being, which in turn enhances project performance. Therefore, construction companies and management should closely monitor the living circumstances of construction workers, particularly in labor camps. Additionally, less experienced employees on lower earnings could be offered personalized mental health support. These are the current study's key contributions.

However, the study has some limitations. The survey was only conducted with Turkish construction workers, which limits the generalization of the research's findings. The measurement of project performance relies heavily on subjective measures derived from the literature, rather than objective indicators for project performance such as numerical budget, time and number of accidents data. In addition, data on a single phase rather than a longitudinal basis was collected. This study did not include other psychological impact factors such as job demands and resources, burnout and job satisfaction. Future studies can address these limitations to improve understanding of poor project performance due to low productivity among construction workers. The conceptual model developed to link mental health disorders and project performance in construction may lead to new research directions for understanding poor project performance in terms of the mental status of construction workers.

Stigma and a lack of mental health literacy may reduce worker productivity. To solve this problem, construction businesses should prioritize their workers' health and implement appropriate measures to promote mental wellbeing in the workplace. This could include promoting work-life balance, offering personalized mental healthcare and providing training in stress management and coping mechanisms. Such measures could improve project performance, safety and overall company outcomes. These actions could benefit employees and the company as a whole. Construction organizations must take proactive measures to address mental health issues that lead to low worker productivity. Businesses and construction professionals can use the study's findings to enhance the mental health of their employees and boost project productivity.

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Author Contributions

G. Kazar: Data curation, Writing- Original draft preparation, Visualization, Investigation, Software, Validation, Analysis, Writing- Reviewing and Editing.

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Data Availability Statement

The data presented in this study are available on request from the corresponding author.

Ethics Committee Permission

The authors acquired ethics committee permission for surveys implemented in this paper from the Istanbul Gelişim University Ethics Commission (Decision Number: 2023-08-112).

Conflict of Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

[1] Dong XS, Brooks RD, Brown S, Harris W (2022) Psychological distress and suicidal ideation among male construction workers in the United States. Am J Ind Med 65(5):396–408.

[2] Pirzadeh P, Lingard H, Zhang RP (2022) Job quality and construction workers' mental health: Life course perspective. J Constr Eng Manag 148(12):04022132.

[3] Oni OZ, Olanrewaju A, Khor SC, Akinbile BF (2023) A comparative analysis of construction workers' mental health before and during COVID-19 pandemic in Nigeria. Front Eng Built Environ 3(1):63–75.

[4] Kotera Y, Green P, Sheffield D (2019) Mental health shame of UK construction workers: Relationship with masculinity, work motivation, and self-compassion. Rev Psicol Trab Organ 35(2):135–143.

[5] Lindhard S, Larsen JK (2016) Identifying the key process factors affecting project performance. Eng Constr Archit Manag 23(5):657–673.

[6] Rodriguez FS, Spilski J, Hekele F, Beese NO, Lachmann T (2020) Physical and cognitive demands of work in building construction. Eng Constr Archit Manag 27(3):745–764.

[7] Jacobsen HB, Caban-Martinez A, Onyebeke LC, Sorensen G, Dennerlein JT, Reme SE (2013) Construction workers struggle with a high prevalence of mental distress, and this is associated with their pain and injuries. J Occup Environ Med 55(10):1197–1204.

[8] Bowers J, Lo J, Miller P, Mawren D, Jones B (2018) Psychological distress in remote mining and construction workers in Australia. Med J Aust 208(9):391–397.

[9] Nwaogu JM, Chan AP, Sunindijo RY, Darko A, Yang JY, Salihu D (2023) Prevalence and risk factors for poor mental health and suicidal ideation in the Nigerian construction industry. J Constr Eng Manag 149(3):05022021.

[10] Enshassi A, Al Swaity E, Arain F (2016) Investigating common causes of burnout in the construction industry. Int J Constr Proj Manag 8(1).
[11] Chan AP, Nwaogu JM, Naslund JA (2020) Mental ill-health risk factors in the construction industry: Systematic review. J Constr Eng Manag 146(3):04020004.
[12] Lim S, Chi S, Lee JD, Lee HJ, Choi H (2017) Analyzing psychological conditions of field-workers in the construction industry. Int J Occup Environ Health 23(4):261–281.
[13] Langdon RR, Sawang S (2018) Construction workers' well-being: What leads to depression, anxiety, and stress? J Constr Eng Manag 144(2):04017100.
[14] Roche AM, Pidd K, Fischer JA, Lee N, Scarfe A, Kostadinov V (2016) Men, work, and mental health: A systematic review of depression in male-dominated industries. Saf Health Work 7(4):268–283.
[15] Park HJ, Jeong BY (2021) Older male construction workers and sustainability: Work-related risk factors and health problems. Sustainability 13(23):13179.
[16] Durdyev S, Ismail S, Kandymov N (2018) Structural equation model of the factors affecting construction labor productivity. J Constr Eng Manag 144(4):04018007.
[17] Gündüz M, Nielsen Y, Özdemir M (2013) Quantification of delay factors using the relative importance index method for construction projects in Turkey. J Manag Eng 29(2):133–139.
[18] Yap JBH, Leong WJ, Skitmore M (2020) Capitalising teamwork for enhancing project delivery. Eng Constr Archit Manag 27(7):1479–1503.
[19] Wu G, Zhao X, Zuo J, Zillante G (2019) Effects of team diversity on project performance in construction projects. Eng Constr Archit Manag 26(3):408–423.
[20] Omar MN, Fayek AR (2016) Modeling and evaluating construction project competencies. Autom Constr 69:115–130.
[21] Dixit S, Saurabh K (2014) Impact of construction productivity attributes. Int J Proj Manag 32(8):1494–1510.
[22] Egwim CN, Alaka H, Toriola-Coker LO, Balogun H, Ajayi S, Oseghale R (2023) Extraction of factors causing construction delays in Nigeria. J Eng Des Technol 21(5):1323–1342.
[23] Gunduz M, Abu-Hijleh A (2020) Assessment of human productivity drivers. Sustainability 12(20):8614.
[24] Lingard H, Turner M (2015) Improving the health of male construction workers. Constr Manag Econ 33(1):18–34.
[25] Jebelli H, Choi B, Lee S (2019) Application of wearable biosensors to construction sites. J Constr Eng Manag 145(12):04019079.
[26] Chen YQ, Zhang YB, Zhang SJ (2014) Impacts of owner-contractor conflict on cost performance. J Constr Eng Manag 140(6):04014017.
[27] Buba SPG, Tanko BL (2017) Project leadership and quality performance. Int J Built Environ Sustain 4(2).
[28] Liu S, Wang L (2019) Impact of risks on performance in construction projects. Period Polytech Archit 50(1):89–96.
[29] Wang C, Mohd-Rahim FA, Chan YY, Abdul-Rahman H (2017) Fuzzy mapping on psychological disorders. J Constr Eng Manag 143(2):04016094.
[30] Adams JM (2019) The value of worker well-being. Public Health Rep 134(6):583–586.
[31] Chen X, Zhang SX, Jahanshahi AA et al (2020) COVID-19 conspiracy beliefs and mental health. JMIR Public Health Surveill 6(3):e20737.
[32] Lingard H, Turner M (2017) Promoting construction workers' health. Constr Manag Econ 35(5):239–253.
[33] Wang T, Li Y, Li G, Wu S (2015) Prefabricated systems for migrant workers. In: MOC Summit Proceedings, pp 233–246.
[34] Rim SJ, Hahm BJ, Seong SJ et al (2023) Prevalence of mental disorders in Korean adults. Psychiatry Investig 20(3):262.
[35] Mokhtari M, Dehghan SF, Asghari M et al (2013) Epidemiology of mental health problems in students. J Epidemiol Glob Health 3(2):83–88.
[36] Lovibond SH (1995) Manual for the depression anxiety stress scales. Sydney Psychology Foundation.
[37] Moradi S, Ansari R, Taherkhani R (2022) Construction performance management analysis. Iran J Sci Technol Trans Civ Eng 46(1):15–31.
[38] Unegbu HCO, Yawas DS, Dan-Asabe B (2022) Relationship between project performance measures. J King Saud Univ Eng Sci 34(4):240–249.
[39] Peñaloza GA, Formoso CT, Saurin TA (2021) Safety performance measurement systems. Saf Sci 142:105364.
[40] Werner C, Schermelleh-Engel K (2009) Structural equation modeling: Advantages and challenges. In: Introduction to Structural Equation Modeling with LISREL, pp 1–4.
[41] Dar F, Bukhari I, Hamid M (2016) Authentic leadership and job stress. Peshawar J Psychol Behav Sci 2(2):235–247.
[42] Oturakçı M, Yıldırım RS (2022) Supply chain risks analysis. Pamukkale Univ Muh Bilim Derg 28(1):117–127.
[43] Hair JF, Black WC, Babin BJ, Anderson RE (2013) Multivariate Data Analysis. Pearson.
[44] Fornell C, Larcker DF (1981) Evaluating structural equation models. J Mark Res 18(1):39–50.
[45] Watanabe K, Tsutsumi A (2022) Passive monitoring of depression and anxiety. JMIR Form Res 6(11):e40339.
[46] Rojanasarot S, Bhattacharyya SK, Edwards N (2023) Productivity loss costs. J Med Econ 26(1):262–270.
[47] Clark M, DiBenedetti D, Perez V (2016) Cognitive dysfunction and productivity. Expert Rev Pharmacoecon Outcomes Res 16(4):455–463.
[48] Sandoval-Reyes J, Idrovo-Carlier S, Duque-Oliva EJ (2021) Remote work and stress. Int J Environ Res Public Health 18(13):7069.
[49] Demirkesen S (2020) Lean implementation and safety performance. Prod Plan Control 31(5):412–433.
[50] Coventry P (2022) Workplace mental health programs. Int J Environ Res Public Health 19(13):7735.
[51] Chen H, Gao J, Dai J et al (2021) Anxiety during COVID-19 pandemic. BMC Public Health 21(1):1830.
[52] Adar T, Delice EK (2020) İş yükü analizi. Pamukkale Univ Muh Bilim Derg 26(1):254–267.
[53] Mæhlisen MH, Pasgaard AA, Mortensen RN et al (2018) Perceived stress and unemployment. BMC Public Health 18(1):728.
[54] Kahya E (2018) Wage model based on job performance. Pamukkale Univ Muh Bilim Derg 24(4):720–729.
[55] Leung CH, Pong HK (2021) Spiritual wellbeing and psychological health. PLoS One 16(4):e0249702.
[56] Zhang Z, Lin R, Qiu A et al (2024) Application of DASS-21 in Chinese students. BMC Public Health 24(1):2934.
[57] Kazar G, Rahmanzadeh P (2024) Mental health disorders and job performance. J Occup Health 66(1):uiae060.

[58] Ceyhan B, Kazar G (2024) Demographic characteristics and mental health. J Constr Eng Manag Innov 7(2):127–143. https://doi.org/10.31462/jcemi.2024.02127143.

[59] Demirkesen S, Tezel A, Uysal F, Ozturk Z (2024) Blockchain and project risk management. IEEE Trans Eng Manag 71:8356–8368.

[60] Caglayan S, Ozorhon B (2023) Building information modeling effectiveness. Autom Constr 151:104861.