

Work Stress, Workload, and Shift Work on Employee Productivity: A Nasa-TLX Study

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ABSTRAK

Produktivitas karyawan merupakan penentu penting kinerja organisasi, terutama di lingkungan operasional yang ditandai dengan tekanan kerja, beban kerja, dan jadwal shift. Studi ini bertujuan untuk meneliti efek stres kerja, beban kerja, dan kerja shift terhadap produktivitas karyawan serta menilai beban kerja mental yang dirasakan menggunakan Indeks Beban Tugas NASA (NASA-TLX). Desain penampang kuantitatif digunakan di PT Sutracco Nusantara Megah, Unit Makassar. Populasi terdiri dari 115 karyawan, dengan 89 responden dipilih sebagai sampel penelitian. Data dikumpulkan menggunakan kuesioner terstruktur dan instrumen NASA-TLX serta dianalisis menggunakan regresi linier ganda, termasuk tes signifikansi parsial dan simultan. Hasilnya menunjukkan bahwa stres kerja memiliki efek positif dan signifikan terhadap produktivitas karyawan ($B=0,479$, $p=0,028$), sementara beban kerja juga memiliki efek positif dan signifikan ($B=0,336$, $p=0,027$). Sebaliknya, kerja shift tidak memiliki pengaruh signifikan terhadap produktivitas ($B=0,066$, $p=0,735$). Secara bersamaan, stres kerja, beban kerja, dan kerja shift secara signifikan memengaruhi produktivitas karyawan ($F=29.751$, $hlm<0.001$). Penilaian NASA-TLX juga menunjukkan bahwa 85,39% responden mengalami beban kerja mental yang tinggi hingga sangat tinggi. Temuan ini berkontribusi pada pemahaman tentang bagaimana tuntutan terkait pekerjaan berhubungan dengan produktivitas karyawan sekaligus menyoroti pentingnya memantau beban kerja mental. Studi ini menyarankan bahwa manajemen produktivitas harus disertai dengan pengelolaan stres kerja dan beban kerja yang tepat untuk mendukung kinerja karyawan yang berkelanjutan.

ABSTRACT

Employee productivity is an important determinant of organizational performance, particularly in operational environments characterized by work pressure, workload, and shift schedules. This study aims to examine the effects of work stress, workload, and shift work on employee productivity and to assess perceived mental workload using the NASA Task Load Index (NASA-TLX). A quantitative cross-sectional design was employed at PT Sutracco Nusantara Megah, Makassar Unit. The population comprised 115 employees, with 89 respondents selected as the research sample. Data were collected using structured questionnaires and the NASA-TLX instrument and analyzed using multiple linear regression, including partial and simultaneous significance tests. The results indicate that work stress has a positive and significant effect on employee productivity ($B=0.479$, $p=0.028$), while workload also has a positive and significant effect ($B=0.336$, $p=0.027$). In contrast, shift work does not have a significant

effect on productivity ($B=0.066$, $p=0.735$). Simultaneously, work stress, workload, and shift work significantly affect employee productivity ($F=29.751$, $p<0.001$). The NASA-TLX assessment further shows that 85.39% of respondents experience high to very-high mental workload. These findings contribute to the understanding of how work-related demands are associated with employee productivity while highlighting the importance of monitoring mental workload. The study suggests that productivity management should be accompanied by appropriate management of work stress and workload to support sustainable employee performance.

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1. INTRODUCTION

Employee productivity is a fundamental indicator of organizational effectiveness because it reflects employees' ability to transform available resources, time, skills, and effort into expected work outcomes. In industrial and operational organizations, productivity is particularly important because employees are required to achieve production targets while maintaining work quality, accuracy, and timeliness. Productivity, however, is not determined solely by technical competence or organizational systems. Working conditions, psychological pressure, workload, fatigue, and work schedules may also shape employees' ability to perform effectively. Previous research has demonstrated that employee productivity is associated with several organizational and individual factors, including motivation, discipline, workload, fatigue, and working conditions (Wulandari & Lailiyah, 2022; Yanti et al., 2025). These findings indicate that productivity should be examined not only as an output measure but also in relation to the conditions under which employees perform their work.

Work stress and workload are particularly important because employees in operational environments frequently face competing demands involving task quantity, time constraints, responsibility, concentration, and performance expectations. Work stress may arise when employees perceive that job demands require substantial psychological or physical effort. If such pressure becomes excessive or prolonged, employees may experience fatigue, reduced concentration, emotional strain, and difficulties maintaining consistent performance. Recent evidence confirms the importance of stress as a productivity-related factor. Putri et al. (2023), for example, examined the effect of work stress on employee productivity in a cement-packaging operation, while Ilmiyah and Anshori (2025) investigated the relationship between work stress and employee productivity in an industrial setting. More recent evidence from Zunina et al. (2026) further demonstrates the relevance of examining work stress and workload together with sleep quality and nutritional status in explaining productivity.

Workload represents another important dimension of employees' working conditions. It refers not only to the amount of work assigned but also to the intensity, complexity, time requirements, and effort needed to complete tasks. A workload that exceeds employees' capacity may result in fatigue and reduced work effectiveness, whereas an appropriate level of workload may encourage employees to allocate greater effort toward task completion. Fausiah et al. (2023) found

that workload significantly influenced employee productivity at Politeknik Negeri Ujung Pandang, indicating that workload can be positively associated with productivity under particular working conditions. Wulandari and Lailiyah (2022) also examined productivity in relation to motivational and disciplinary factors, reinforcing the importance of understanding productivity as a multidimensional organizational outcome. More recent research by Yanti et al. (2025) examined factors associated with productivity among production workers, while Zunina et al. (2026) examined workload and stress together with other employee conditions. These findings suggest that workload should be evaluated within the broader context of employee capacity and workplace conditions rather than automatically being classified as either beneficial or detrimental.

The problem becomes more complex when workload involves substantial cognitive demands. Employees may be required not only to complete physical tasks but also to monitor processes, make decisions, maintain concentration, respond to time pressure, and ensure that work is completed accurately. Consequently, the quantity of work alone may not adequately represent employees' actual workload. The NASA Task Load Index (NASA-TLX) provides a multidimensional approach for assessing perceived mental workload through six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration. Previous research has demonstrated the applicability of NASA-TLX in different occupational environments. Septiansyah et al. (2021) found moderate to high mental workload among employees, while Masniar et al. (2022) reported a high average NASA-TLX score among operators. Rahdiana and Hakim (2021) also applied NASA-TLX to assess the mental workload of marketing employees. These studies demonstrate that subjective mental workload can provide information that may not be captured adequately through conventional workload measures.

Further evidence demonstrates that mental workload may remain high even when physical workload is not necessarily excessive. Yuslistyari et al. (2022), for example, combined cardiovascular workload measurement with NASA-TLX among forklift operators and found different patterns between physical and mental workload. Erliana et al. (2023) similarly examined physical and mental workload using cardiovascular load and NASA-TLX and reported substantial workload conditions among employees. These findings are important because they demonstrate that employee workload should be viewed as multidimensional. In operational environments, cognitive demands such as concentration, monitoring, decision-making, and time pressure may contribute substantially to employees' perceived workload even when physical demands are relatively manageable.

Work schedules represent another factor that may influence employee productivity. Shift work is widely used in organizations requiring operational continuity, but working at different times of the day may affect employees' fatigue, recovery, sleep patterns, and ability to maintain alertness. Auliyah and Wikansari (2017) examined shift work in relation to fatigue and performance among production operators, while Ratih et al. (2020) investigated the relationship between shift work and work effectiveness. Ernawati et al. (2023) further examined shift work and work stress in relation to employee performance and found that work scheduling and psychological conditions were relevant to employee outcomes. More recent research by Kurniawan et al. (2025) connected workload assessment with shift rescheduling and reported the importance of balancing work schedules to manage workload and fatigue. These findings indicate that shift work should be considered together with workload and psychological conditions rather than treated as an isolated scheduling variable.

The general problem addressed by this study is therefore the challenge of maintaining employee productivity while employees are exposed to multiple work demands. In operational organizations, increasing work demands may encourage employees to increase effort and achieve organizational targets, but excessive demands may simultaneously increase fatigue and mental workload. Similarly, shift work may support operational continuity while potentially influencing recovery and alertness. Effective human-resource management consequently requires an understanding of how these factors interact with productivity and how employees subjectively experience their workload.

Previous studies have proposed several specific approaches for addressing this problem. Workload assessment using NASA-TLX has been applied to identify the dimensions of workload that most strongly affect employees (Septiansyah et al., 2021; Masniar et al., 2022; Yuslistyari et al., 2022). Other studies have examined workload and productivity directly, providing evidence that workload may have significant implications for employee output (Fausiah et al., 2023). Research on shift work has emphasized the importance of scheduling and fatigue management (Auliyah & Wikansari, 2017; Ratih et al., 2020; Kurniawan et al., 2025). Meanwhile, studies focusing on work stress have demonstrated its relevance to employee productivity and performance (Putri et al., 2023; Ernawati et al., 2023; Ilmiyah & Anshori, 2025). Collectively, these studies provide useful evidence but tend to examine selected variables or relationships rather than integrating them into a single empirical framework.

This situation creates an important research gap. Although previous studies have separately examined work stress, workload, shift work, productivity, and mental workload, relatively limited evidence integrates work stress, workload, and shift work as predictors of employee productivity while simultaneously assessing perceived mental workload using NASA-TLX. In particular, statistical analysis of productivity does not necessarily explain how demanding employees perceive their work to be. Conversely, NASA-TLX can describe the intensity and dimensions of perceived mental workload but does not by itself establish whether workload predicts productivity. Combining the two approaches therefore provides complementary evidence: regression analysis examines the statistical relationships between work conditions and productivity, while NASA-TLX provides a multidimensional description of employees' perceived workload.

This gap is particularly relevant in the context of PT Sutracco Nusantara Megah, Makassar Unit, where employees are involved in operational activities requiring task completion, accuracy, consistency, and achievement of organizational targets. Production and logistics activities may involve both physical requirements and cognitive demands such as monitoring, concentration, and decision-making. The organizational setting therefore provides an appropriate context for examining whether work stress, workload, and shift work are associated with employee productivity and for identifying the level of perceived mental workload among employees.

Accordingly, this study aims to examine (1) the effect of work stress on employee productivity, (2) the effect of workload on employee productivity, (3) the effect of shift work on employee productivity, and (4) the simultaneous effect of work stress, workload, and shift work on employee productivity. In addition, the study assesses employees' perceived mental workload using NASA-TLX. The principal contribution of the study lies in integrating these organizational work-demand variables with employee productivity and a multidimensional mental-workload assessment within a single organizational context. The study is limited to employees of PT Sutracco Nusantara Megah, Makassar Unit; therefore, its findings should primarily be interpreted within the organizational context examined. This integrated approach is expected to provide a more comprehensive understanding of the relationship between work demands, perceived mental workload, and employee productivity.

2. LITERATURE REVIEW

The literature reviewed in this study was selected according to its relevance to the research framework, namely the relationships among work stress, workload, shift work, employee productivity, and perceived mental workload. Priority was given to journal articles that directly examine these constructs in organizational or operational settings, while theses and general reference books were treated as supplementary sources. The reviewed evidence indicates that employee productivity is shaped by the interaction between work demands and employees' capacity to respond to those demands.

2.1 *Work Stress and Employee Productivity*

Work stress refers to psychological strain arising when employees face work demands that require sustained adaptation, effort, or coping. In operational environments, stress may emerge from workload, time pressure, production targets, responsibility, interpersonal demands, and work schedules. Its relationship with productivity, however, should not automatically be assumed to be negative. The effect may depend on the intensity of demands and employees' ability to manage them.

The empirical evidence in the uploaded reference set supports the importance of examining this relationship. Putri et al. (2023) specifically investigated the effect of work stress on employee productivity in a cement-packaging operation, while Ilmiyah and Anshori (2025) examined the relationship between work stress and employee productivity in an industrial setting. Ernawati et al. (2023) further examined work stress together with shift work and employee performance. More recent evidence from Zunina et al. (2026) considers work stress and workload simultaneously with other employee conditions in relation to productivity.

These studies indicate that work stress should be analyzed within its organizational context rather than treated as an isolated psychological condition. For employees working under operational targets, a certain level of work pressure may coincide with greater effort and task focus, whereas excessive and prolonged stress may undermine sustainable performance. Accordingly, this study proposes that work stress may have a significant relationship with employee productivity.

H1: Work stress has a positive and significant effect on employee productivity.

2.2 *Workload and Employee Productivity*

Workload represents the quantity, intensity, complexity, and time requirements associated with employees' tasks. It may include physical and cognitive demands and therefore cannot be adequately understood solely from the number of tasks completed. In operational organizations, workload is particularly important because employees must often meet production targets while maintaining accuracy, quality, and timeliness.

The empirical literature provides evidence that workload is associated with employee productivity, although the direction of the relationship may vary according to organizational conditions. Fausiah et al. (2023) reported a significant relationship between workload and employee productivity, while Yanti et al. (2025) examined determinants associated with productivity among production workers. Yanti and Bausad (2025) further demonstrated the relevance of workload in relation to employee stress, suggesting that workload may operate through broader psychological consequences. Fatkah and Raharjo (2025) also examined workload and the work environment in relation to employee performance.

These findings suggest that workload should be interpreted in relation to employee capacity and workplace conditions. A manageable workload may encourage effort and task completion, whereas workload that exceeds available capacity may contribute to fatigue and reduced effectiveness. Thus, the present study does not assume that greater workload is inherently beneficial; rather, it empirically examines whether workload is associated with productivity in the specific organizational context under investigation.

H2: Workload has a positive and significant effect on employee productivity.

2.3 *Shift Work and Employee Productivity*

Shift work is an organizational arrangement in which employees perform work during different periods of the day to maintain operational continuity. Although shift systems are often necessary in operational organizations, working at different times may influence fatigue, recovery, sleep, alertness, and work effectiveness. The

consequences of shift work may therefore depend on shift duration, rotation, rest periods, workload, and employees' adaptation.

The uploaded literature provides mixed evidence. Auliyah and Wikansari (2017) examined shift work, fatigue, and performance among production operators, while Ratih et al. (2020) investigated the effect of shift work on employee work effectiveness. Ernawati et al. (2023) examined shift work and work stress in relation to employee performance. Kurniawan et al. (2025) further linked workload assessment with shift rescheduling, highlighting the importance of workload balance in managing shift-related conditions. Marchelia (2018) also examined work stress in relation to shift work.

The variation across these studies indicates that shift work should not automatically be expected to reduce productivity. Its influence may depend on how schedules are implemented and how employees respond to them. Accordingly, the present study tests the direct relationship empirically.

H3: Shift work has a significant effect on employee productivity.

2.4 *Mental Workload and the NASA-TLX Framework*

Workload is inherently multidimensional because employees may experience cognitive, physical, temporal, and emotional demands simultaneously. Consequently, measuring workload only through task quantity may fail to capture the subjective demands experienced during work. NASA-TLX provides a complementary approach for assessing perceived mental workload across six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration.

The uploaded studies demonstrate the applicability of NASA-TLX across different occupational contexts. Septiansyah et al. (2021) applied NASA-TLX to assess employee mental workload, while Masniar et al. (2022) used the method among operators and reported relatively high mental workload. Rahdiana and Hakim (2021) applied NASA-TLX to marketing employees, and Yuslistyari et al. (2022) combined NASA-TLX with cardiovascular workload assessment among forklift operators. Erliana et al. (2023) similarly integrated NASA-TLX with cardiovascular load to evaluate physical and mental workload. More recent studies, including Al Hayy et al. (2025), Kurniawan et al. (2025), and Zunina et al. (2026), further demonstrate the continuing application of workload assessment in organizational settings.

In the present framework, NASA-TLX is treated as a complementary diagnostic assessment rather than an interchangeable measure of the regression-based workload construct. Regression analysis evaluates whether workload predicts productivity, whereas NASA-TLX describes the intensity and dimensions of employees' perceived mental workload. This distinction strengthens the analytical framework by connecting the statistical relationship between workload and productivity with employees' subjective experience of work demands.

2.5 *Employee Productivity as the Outcome*

Employee productivity represents the effectiveness with which employees convert time, skills, effort, and organizational resources into expected work outputs. It may be reflected in the quantity and quality of output, timeliness, efficiency, task completion, and achievement of organizational targets. Wulandari and Lailiyah (2022) examined productivity in relation to motivation, wages, and discipline, while Yanti et al. (2025) investigated factors associated with productivity among production workers. Esse et al. (2025) also examined productivity as an important factor in improving employee performance.

Taken together, the literature indicates that productivity should be understood as an outcome of working conditions rather than solely as an individual characteristic. Work stress, workload, and shift work represent distinct aspects of employees' work demands and may influence the effort, concentration, and resources available for task

completion. The present study therefore positions employee productivity as the dependent construct, with work stress, workload, and shift work as the principal explanatory variables, while NASA-TLX provides complementary evidence regarding perceived mental workload.

2.6 Research Framework and Gap

Although the reviewed studies provide substantial evidence concerning individual relationships among stress, workload, shift work, and productivity, the literature remains fragmented. Some studies focus on stress and productivity, others on workload and productivity, while NASA-TLX studies primarily characterize mental workload. Fewer studies combine work stress, workload, and shift work within one productivity model while simultaneously using NASA-TLX to characterize perceived mental workload. This integration constitutes the principal research gap addressed by the present study.

3. METHODS

3.1 Research Design and Setting

This study employed a quantitative cross-sectional design to examine the effects of work stress, workload, and shift work on employee productivity and to assess employees' perceived mental workload using the NASA Task Load Index (NASA-TLX). A quantitative approach was appropriate because the study measured predefined variables and tested their relationships using statistical procedures. The cross-sectional design enabled data to be collected from respondents at a specific period, providing an empirical assessment of the relationships among the variables within the organizational context.

The study was conducted at PT Sutracco Nusantara Megah, Makassar Unit, Indonesia. The research focused on employees involved in operational activities, particularly activities associated with production, logistics, and work schedules. These activities involve task demands, performance targets, time requirements, and work scheduling that may influence employees' psychological and mental workload.

3.2 Population and Sample

The population consisted of 115 employees of PT Sutracco Nusantara Megah, Makassar Unit. A sample of 89 employees was determined using Slovin's formula with a 5% margin of error:

$$n = \frac{N}{1 + N \cdot e^2}$$

Where n represents the sample size, N represents the population, and e represents the margin of error. The calculation was:

Where :

n = Sample size required

N = Population

E = Margin of error

$$= \frac{115}{1 + 115 (0.0025)}$$

$$n = \frac{115}{1 + 0.2875}$$

$$n = \frac{115}{1.2875} = 89$$

3.3 Variable and Measurement

The study examined work stress (X1), workload (X2), and shift work (X3) as independent variables, while employee productivity (Y) was the dependent variable. Data for these variables were collected using a structured questionnaire based on the operational indicators established in the research instrument.

Perceived mental workload was additionally assessed using NASA-TLX. The instrument evaluates six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration. NASA-TLX has been applied in various occupational settings to evaluate perceived mental workload, including operator and industrial work environments (Septiansyah et al., 2021; Masniar et al., 2022; Yuslistyari et al., 2022). The use of NASA-TLX in this study provided complementary information regarding employees' subjective experience of workload.

The NASA-TLX assessment used the weighted-rating procedure involving 15 pairwise comparisons among the six dimensions. The resulting scores were used to determine employees' overall perceived mental workload and were subsequently classified into workload categories.

3.4 Data Collection and Instrument Testing

Data were collected through questionnaires, observation, interviews, and documentation. Respondents completed the questionnaire and NASA-TLX assessment based on their actual work experiences and conditions. Observation and interviews provided contextual information concerning employees' work activities, while documentation supported the collection of relevant organizational information.

Prior to hypothesis testing, the questionnaire was evaluated for validity and reliability. Item validity was assessed using item-total correlation, while internal consistency was examined using Cronbach's alpha. The validity results showed corrected item-total correlations ranging from 0.267 to 0.879, while the overall Cronbach's alpha coefficient was 0.837, indicating acceptable internal consistency.

3.5 Data Collection and Analysis

Data were collected through questionnaires, observation, interviews, and documentation. Respondents completed the questionnaire and NASA-TLX assessment based on their actual work experiences.

The data were analyzed using descriptive statistics, validity and reliability testing, classical assumption tests, and multiple linear regression. The regression model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

Normality, multicollinearity, and heteroscedasticity were assessed before regression analysis. Partial effects were examined using the t-test, while the simultaneous effect was assessed using the F-test, with a significance level of 0.05. NASA-TLX scores were analyzed descriptively and classified according to the workload categories established in the research procedure. The regression results and hypothesis testing are presented in the Results section, while the respondent characteristics and measurement results are summarized in Tables 1–3.

3.6 Ethical Considerations

Participation was voluntary, and respondents were informed about the purpose and procedures of the study. Respondent identities were kept confidential and the data were used solely for research purposes. Research permission was obtained from the organization.

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

The study comprised 89 employees of PT Sutracco Nusantara Megah, Makassar Unit. The respondent profile indicates that the sample was predominantly composed of employees working in operational functions. The production division represented the largest proportion of respondents (46.07%), followed by logistics (17.98%) and quality control (11.24%). Other respondents were distributed across purchasing, export-import (EXIM), finance, and personnel functions.

In terms of age, respondents aged 31–35 years constituted the largest group (35.96%), followed by those aged 26–30 years (26.97%) and 36–40 years (20.22%). Respondents aged 20–25 years accounted for 11.24%, while those aged above 40 years represented the smallest proportion (5.62%). Regarding gender, 69 respondents (77.53%) were male, while 20 respondents (22.47%) were female.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency (n)	Percentage (%)
Work station	Production	41	46.07
	Quality Control	10	11.24
	Logistics	16	17.98
	Purchasing	5	5.62
	EXIM	5	5.62
	Finance	4	4.49
	Personnel	8	8.99
Age	20–25 years	10	11.24
	26–30 years	24	26.97
	31–35 years	32	35.96
	36–40 years	18	20.22
	>40 years	5	5.62
Gender	Male	69	77.53
	Female	20	22.47
Total		89	100.00

The respondent distribution shows that the sample was largely drawn from operational employees, particularly those in production and logistics. This composition is relevant to the study because these work functions involve direct operational demands and performance requirements. The relatively large proportion of respondents aged 31–35 years also indicates that the sample was predominantly composed of employees within an established working-age group. These characteristics provide the demographic and occupational context for interpreting the subsequent analyses of work stress, workload, shift work, productivity, and perceived mental workload.

4.2 Measurement Quality and Regression Assumptions

All questionnaire items demonstrated acceptable item validity. The corrected item-total correlations ranged from 0.267 to 0.879, exceeding the critical value of 0.208. Thus, all 20 questionnaire items were retained for subsequent analysis. Internal consistency was also acceptable, with a Cronbach's alpha of 0.837 for the 20 items.

Table 2. Validity and Reliability Results

Test	Result	Criterion	Decision
Corrected item-total correlation	0.267–0.879	>0.208	All items valid
Cronbach's alpha	0.837	>0.60	Reliable

The regression assumptions were subsequently examined. The normality assessment based on the histogram indicated an approximately normal distribution. The multicollinearity test produced tolerance values of 0.173, 0.346, and 0.190 and VIF values of 5.785, 2.894, and 5.274 for

work stress, workload, and shift work, respectively. All VIF values were below 10 and all tolerance values exceeded 0.10, indicating no evidence of problematic multicollinearity. The residual scatterplot also showed no systematic pattern, supporting the absence of substantial heteroscedasticity.

Table 3. Regression Diagnostic Tests

Variable	Tolerance	VIF	Interpretation
Work stress	0.173	5.785	No problematic multicollinearity
Workload	0.346	2.894	No problematic multicollinearity
Shift work	0.190	5.274	No problematic multicollinearity

These diagnostic results indicate that the multiple regression model was suitable for hypothesis testing.

4.3 Multiple Regression Results

Multiple linear regression was used to examine the effects of work stress, workload, and shift work on employee productivity. The estimated regression equation was:

$$Y = 2.238 + 0.479X_1 + 0.336X_2 + 0.066X_3 + \varepsilon$$

where Y represents employee productivity, X1 work stress, X2 workload, and X3 shift work.

Table 4. Multiple Regression and Partial Hypothesis Testing

Predictor	B	t	p	Approx. 95% CI for B	Decision
Constant	2.238	—	—	—	—
Work stress	0.479	2.242	0.028	0.054 to 0.904	Significant
Workload	0.336	2.245	0.027	0.038 to 0.634	Significant
Shift work	0.066	0.340	0.735	-0.320 to 0.452	Not significant

Note: The approximate 95% confidence intervals were derived from the reported regression coefficients and t-statistics using df=85; they were not directly reported in the original SPSS table.

The positive coefficient for work stress (B=0.479) indicates that, holding workload and shift work constant, a one-unit increase in the work-stress score was associated with an estimated 0.479-unit increase in the productivity score. The effect was statistically significant (t=2.242, p=0.028). Therefore, H1 was supported.

Workload also showed a positive and statistically significant association with productivity (B=0.336, t=2.245, p=0.027). Thus, H2 was supported. In contrast, shift work had a small positive coefficient (B=0.066) but was not statistically significant (t=0.340, p=0.735). Therefore, H3 was not supported.

The absence of a significant effect of shift work is an important null finding and should not be interpreted as evidence that shift work has no consequences for employees. Rather, within this sample, variation in shift work did not provide sufficient statistical evidence of a direct association with productivity after accounting for work stress and workload.

4.4 Simultaneous Effect of Work Stress, Workload, and Shift Work

The simultaneous contribution of the three independent variables was examined using the F-test.

Table 5. Simultaneous Regression Test

Statistic	Result
F	29.751
df	3, 85
p	<0.001
Decision	Significant

The regression model was statistically significant, $F(3,85) = 29.751$, $p < 0.001$. Therefore, H4 was supported, indicating that work stress, workload, and shift work jointly contributed to variation in employee productivity.

The available thesis output does not provide the R^2 or adjusted R^2 value in the extracted results. Therefore, the proportion of productivity variance explained by the model is not reported here rather than being estimated without the original SPSS output.

The significant simultaneous result, despite the non-significant partial effect of shift work, indicates that the variables should be interpreted as a combined work-condition system. In particular, work stress and workload appear to account for meaningful variation in productivity, while shift work contributes little independent explanatory value within this model.

4.5 Summary of Hypothesis Testing

Table 7. Summary of Hypothesis Testing

Hypothesis	Relationship	B	t/F	p	Result
H1	Work stress → Productivity	0.479	2.242	0.028	Supported
H2	Workload → Productivity	0.336	2.245	0.027	Supported
H3	Shift work → Productivity	0.066	0.340	0.735	Not supported
H4	Work stress + workload + shift work → Productivity	—	29.751	<0.001	Supported

Note: H1–H3 are evaluated using the partial t-test, while H4 is evaluated using the simultaneous F-test. The reported coefficients and test statistics are taken from the original research results.

Discussion

The findings indicate that the relationship between work conditions and employee productivity is more complex than a simple assumption that greater work demands necessarily reduce performance. The significant relationships identified for work stress and workload suggest that employees in the observed operational context may respond to work demands through increased effort and task engagement. At the same time, the high level of perceived mental workload identified through NASA-TLX indicates that such productivity should be interpreted cautiously, particularly from the perspective of its sustainability.

The positive and significant relationship between work stress and employee productivity suggests that, within the conditions observed in this study, higher levels of work-related pressure were associated with higher productivity. This finding differs from Lubis and Susilawati (2024), who reported that higher work stress tended to reduce productivity, and from Ernawati et al. (2023), who identified a significant relationship between stress and employee performance. The difference may be explained by the intensity and nature of stress experienced by employees. Work pressure that remains within employees' perceived capacity may stimulate concentration, effort, and responsiveness to organizational targets. Thus, the positive association identified in this study should not be interpreted as evidence that excessive stress is beneficial. Rather, it may indicate that employees were able to convert manageable pressure into additional effort within the observed working conditions.

The finding is particularly important when considered alongside the mental-workload assessment. Employees may maintain productivity despite experiencing substantial cognitive demands because they possess sufficient experience, task familiarity, or capacity to cope with their current responsibilities. However, such adaptation does not necessarily imply that the existing level of stress is sustainable over time. Prolonged exposure to excessive psychological demands may eventually contribute to fatigue and reduced effectiveness. Consequently, managers should distinguish between constructive work pressure and excessive stress when developing productivity-management strategies.

Workload also demonstrated a positive and significant relationship with employee productivity. This finding is consistent with Fausiah et al. (2023), who reported that workload could positively influence productivity when demands remain within employees' capabilities. However, it differs from findings reported by Firmansyah and Widodo (2025) and Saragih and Siska (2025), which indicate that excessive workload tends to impair productivity. These differences reinforce the importance of workload intensity, task characteristics, employee capacity, and organizational context in determining outcomes.

The NASA-TLX findings provide an important qualification to this relationship. The high proportion of employees experiencing high or very-high perceived mental workload indicates that employees were operating under substantial cognitive and temporal demands. Therefore, the positive association between workload and productivity should not be interpreted as justification for continuously increasing employees' workload. Instead, it suggests that workload may support productivity when employees have adequate capacity and resources to meet the demands. Once demands exceed that capacity, the productivity benefit may diminish or potentially become detrimental. This interpretation strengthens the practical value of combining regression analysis with NASA-TLX because statistical productivity outcomes alone cannot establish whether the associated workload is sustainable.

In contrast, shift work did not demonstrate a statistically significant direct relationship with employee productivity. This finding differs from Ernawati et al. (2023), who identified a significant relationship between shift work and employee performance, and from Kurniawan et al. (2025), who emphasized the role of shift rescheduling in managing workload and fatigue. The discrepancy may reflect differences in organizational context, scheduling systems, shift duration, employee adaptation, workload distribution, and recovery opportunities. Employees in the present setting may have adapted to existing schedules, reducing the independent contribution of shift work to productivity after work stress and workload were considered simultaneously.

The non-significant finding should nevertheless be interpreted carefully. It does not demonstrate that shift work is universally unrelated to productivity; rather, it indicates that the study did not identify sufficient evidence of a direct effect within the sampled organization. Shift work may still influence productivity indirectly through fatigue, sleep, mental workload, or work stress. Its non-significant direct relationship therefore represents an important boundary of the present model rather than a reason to disregard scheduling practices.

The significant simultaneous relationship among work stress, workload, and shift work further indicates that employee productivity should be understood within a broader system of working conditions. Although shift work was not significant independently, the combined model was significant, suggesting that productivity is associated with the overall configuration of work demands rather than with a single factor in isolation. This finding supports a more integrated approach to human-resource management in which psychological demands, workload allocation, and scheduling are considered together.

The practical implication is that productivity management should prioritize sustainable performance rather than productivity maximization through increasing work demands. Workload should be aligned with employees' capacity and task complexity, while work-stress management should reduce excessive pressure without eliminating constructive performance expectations. Shift schedules should also be periodically evaluated, particularly with respect to workload distribution and employee recovery, even though shift work was not statistically significant in the present analysis. Overall, the study suggests that maintaining productivity requires an appropriate balance between organizational performance requirements and employees' psychological and cognitive capacity.

5. CONCLUSION

This study concludes that work stress and workload have positive and significant effects on employee productivity, whereas shift work does not have a significant direct effect on productivity. Nevertheless, work stress, workload, and shift work jointly contribute significantly to employee productivity. The NASA-TLX assessment further indicates that a substantial majority of employees experience high to very-high perceived mental workload, highlighting the demanding nature of the work environment examined.

The principal contribution of this study is the integration of work stress, workload, shift work, and employee productivity within a single empirical framework, complemented by NASA-TLX to assess perceived mental workload. This approach provides a more comprehensive perspective by combining statistical evidence of productivity-related relationships with employees' subjective experience of work demands.

From a managerial perspective, the findings emphasize the importance of maintaining work stress and workload at levels compatible with employees' capacity. Productivity improvement should therefore be accompanied by continuous monitoring of mental workload and appropriate workload allocation. Although shift work was not significant as an independent predictor, its scheduling should continue to be managed appropriately as part of overall work-condition management.

The study has several limitations. Its cross-sectional design restricts causal interpretation, while the single-organizational setting and sample size limit the generalizability of the findings.

Furthermore, reliance on self-reported measures may introduce subjective bias. Future research should employ longitudinal designs, larger and more diverse samples, and multiple organizational settings to examine the stability of these relationships over time. Future studies may also investigate additional factors that could explain employee productivity under conditions of substantial work stress and workload.

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