

The Effect of Empowering Leadership, Perceived Organizational Support, And Job Demands on Work Engagement Through Work Fatigue As A Mediating Variable

Abdel Muammar Rafi Muzakki*, Dewi Susita, Widya Parimita

Universitas Negeri Jakarta, Indonesia

Email: abdelmuzakki10@gmail.com*, dewisusita_man@unj.ac.id,
widya_parimita@unj.ac.id

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Abstract

Employee work engagement is a crucial factor in maintaining productivity and organizational sustainability, particularly in project-based construction environments characterized by high workload intensity, time pressure, and operational complexity. This research aims to examine the effects of empowering leadership, perceived organizational support, and job demands on work engagement through work fatigue as a mediating variable among employees of PT Hutama Karya (Persero) Infrastructure Division I involved in strategic projects in the Jabodetabek area. This research employed a quantitative survey method involving 184 employees selected through purposive sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 to examine the direct and indirect relationships among variables. The results indicate that empowering leadership and perceived organizational support have positive and significant effects on work engagement, whereas job demands have a negative and significant effect on work engagement. Furthermore, empowering leadership and perceived organizational support have negative effects on work fatigue, while job demands positively increase work fatigue. Work fatigue was also found to have a negative and significant effect on work engagement. In addition, mediation analysis confirms that work fatigue significantly mediates the relationships between empowering leadership, perceived organizational support, and job demands and work engagement. These findings highlight the importance of strengthening organizational resources through empowering leadership and organizational support while managing excessive job demands to reduce fatigue and enhance employee engagement. This study contributes to the development of Job Demands-Resources Theory by explaining the psychological mechanism of work fatigue in linking job resources and job demands with employee engagement in construction project environments.

INTRODUCTION

In the absorption dimension, symptoms of declining work engagement can be observed through employees' reduced ability to maintain full focus and concentration while working (Çemberci et al., 2022; Headrick et al., 2023; Neuber et al., 2022; Pratiwi et al., 2023; Sypniewska et al., 2023; Tan & Yeap, 2022). Time pressure, coordination complexity,

and the dynamics of fieldwork may cause employees to focus more on meeting job completion demands than on experiencing positive aspects of their work.

Therefore, the phenomenon of declining work engagement and increasing work fatigue occurring at the operational level of PT Hutama Karya (Persero) cannot be examined partially or separately based on individual dimensions. These two psychological conditions represent complex, simultaneous, and cumulative processes that develop over time (Gernigon et al., 2023; Hellmann et al., 2023; Skinner et al., 2022; Weimer, 2024).

Based on these methodological considerations, this study positions work engagement and work fatigue as higher-order constructs or second-order constructs using a reflective-reflective approach. This multilevel model was applied to ensure that statistical testing did not only examine individual dimensions separately, such as physical fatigue or work morale, but also represented work engagement and work fatigue comprehensively through the contribution of all underlying dimensions.

These comparative findings from the preliminary study provide a strong scientific basis for positioning work engagement as the main dependent variable (Y) in this study. The fundamental problem at PT Hutama Karya (Persero) Infrastructure Division I does not lie in employees' technical competence in performing their duties but rather in the decline of employees' energy, dedication, and absorption in their work, indicating employee disengagement. This psychological condition may reduce work enthusiasm, decrease focus during task execution, and weaken employee involvement in addressing complex and dynamic project operational demands (Ali Ababneh, 2025; Ogolo, 2023; Saleem et al., 2022; Sierra, 2026; Xia et al., 2022; Yang, 2025).

To further explore the psychological and organizational factors underlying work engagement problems, the pre-research data were expanded to capture work fatigue as a mediating variable, as well as job demands and job resources as independent variables.

From the perspective of Job Demands–Resources (JD-R) Theory, this condition can be understood as an early indication of the health impairment process, in which excessive job demands have the potential to drain employees' physical, cognitive, and emotional resources. In addition, preliminary study data showed that some respondents perceived organizational support and empowering leadership as not yet optimal. As many as 73.3% of respondents stated that the company was less responsive in facilitating employee welfare recovery.

Meanwhile, 66.7% of respondents perceived that their supervisors had not fully provided sufficient empowerment opportunities to address technical challenges in the field. Within the framework of Conservation of Resources (COR) Theory, limited job resources may increase the risk of energy depletion when employees face high job demands. Consequently, work fatigue may become a psychological mechanism explaining how job demands, empowering leadership, and perceived organizational support are associated with employee work engagement.

Thus, the empirical phenomenon in this study demonstrates a logical relationship between project operational conditions and the selection of research variables (Amadi, 2023; Amarilli et al., 2023; Rauteda, 2025; Saurav, 2025). Attendance and overtime data were used as initial indicators of high job demands within the construction project environment. The preliminary study results on work engagement indicate that the primary issue requiring investigation is not merely employees' ability to complete tasks but also the decline in

energy, dedication, and absorption in their work. Meanwhile, the high levels of work fatigue and job demands, combined with limited perceived organizational support and suboptimal empowering leadership, indicate that work fatigue has the potential to function as a mechanism linking job demands, job resources, and employee work engagement. Therefore, empowering leadership, perceived organizational support, job demands, work fatigue, and work engagement were selected as research variables because they are directly related to the empirical phenomena identified among employees of PT Hutama Karya (Persero) Infrastructure Division I involved in Jabodetabek projects.

Although the relationships among job demands, empowering leadership, organizational support, work fatigue, and work engagement have been extensively studied, several relevant research gaps remain. These gaps can be identified from empirical, theoretical, and contextual perspectives. First, from an empirical perspective, previous studies have shown inconsistent findings regarding the relationship between job demands and work engagement. On the one hand, certain job demands may be perceived as challenge stressors that encourage motivation and work engagement (Li et al., 2025). On the other hand, research findings indicate that both challenging and hindering job demands may still trigger psychological strain if they are not balanced with adequate job resources (Pindek et al., 2024). These findings are further supported by studies showing that hindering job demands can reduce work engagement through self-regulatory fatigue (Zhou et al., 2025). These inconsistencies indicate that the relationship between job demands and work engagement is not always direct or linear; therefore, further explanation of the psychological mechanisms mediating this relationship is required.

The second theoretical gap concerns the literature on empowering leadership and perceived organizational support. Most previous studies have focused primarily on positive motivational processes. These studies generally explain the effects of these two job resource variables on work engagement through mediating mechanisms such as psychological empowerment (Hashemi et al., 2025; Wen et al., 2023), fulfillment of basic psychological needs (Knevelsrud et al., 2025), and improvements in job characteristics (Helland et al., 2020). Although leadership and organizational support as job resources have been validated as important factors in managing employee emotional burdens, integrative studies that simultaneously position work fatigue as a mechanism of energy depletion within the health impairment process remain limited (Krasniqi & Hoxha, 2025; Nong et al., 2022).

The positioning of work fatigue as a mediating variable requires further investigation because it is supported by recent literature. Pan et al. (2023), in their study entitled *Chronotype and Work Engagement: The Influence of Work Fatigue and Time Management Planning*, demonstrated that work fatigue negatively influences work engagement. However, the study primarily focused on individual internal capacities, such as biological clock tendencies (chronotype) and employees' personal time-management planning. Studies examining the role of external organizational resources, such as empowering leadership in field settings and systematic management support, in protecting employees from physical, mental, and emotional energy depletion remain limited. Within the framework of Job Demands–Resources Theory, the availability of external resources plays an important role as a buffering mechanism when individual capacities begin to decline due to work pressure.

In addition to the theoretical gap, a contextual gap exists because most previous research on work fatigue, biological rhythm orientation, and work engagement has been conducted in sectors with relatively stable work patterns, such as public services, educational institutions, banking, and healthcare. These characteristics differ from the operational conditions of PT Hutama Karya (Persero) Infrastructure Division I. Employees in this division face a project-based work system, strict completion targets, high occupational safety risks, and dynamic overtime demands (Dlouhy et al., 2024; Helland et al., 2020; Nong et al., 2022; Zhou et al., 2025) to achieve National Strategic Project targets. These conditions may reduce employees' recovery time, accelerate the accumulation of physical and psychological fatigue, and ultimately decrease their level of work engagement.

Based on this description, it can be concluded that research gaps remain in terms of inconsistent empirical findings, limitations of integrative models, and the lack of studies conducted in project-based construction environments. Therefore, this study seeks to address these theoretical and contextual gaps by developing a research model that integrates job demands, empowering leadership, and perceived organizational support in explaining work engagement through work fatigue as a mediating variable. By focusing on employees of PT Hutama Karya (Persero) Infrastructure Division I who are involved in strategic projects in the Greater Jakarta area, this study is expected to provide a more comprehensive understanding of the psychological mechanisms occurring in project-based work environments.

Thus, the issue of declining work engagement among employees in this study is not only understood as a consequence of physical fatigue but also as a result of interactions among job demands, organizational support, leadership quality in the field, and employees' experienced work fatigue. This broader perspective is important to ensure that human resource management in construction project environments does not solely focus on achieving work targets but also considers employee psychological conditions that contribute to maintaining quality, safety, and sustainable performance.

The novelty of this study lies in positioning work fatigue as a mediating variable in the relationship between empowering leadership, perceived organizational support, job demands, and work engagement within the context of project-based construction. This study not only examines work engagement as a direct outcome of job demands and resources but also explains how physical, mental, and emotional fatigue may function as psychological mechanisms influencing employee work engagement. Therefore, this research is expected to expand the application of Job Demands–Resources Theory and Conservation of Resources Theory in complex construction work environments.

This research has significant academic and managerial urgency, considering the importance of maintaining employee work engagement in supporting successful construction project implementation. If work fatigue, which has the potential to reduce work engagement, is not properly understood and managed, companies may face decreased productivity, project completion delays, and increased costs resulting from inefficiencies in work processes. Furthermore, these conditions may increase the risk of declining employee psychological well-being and reduce the sustainability of a competent workforce within project environments. Based on the empirical phenomena and research gaps described above, this study is proposed with the title “The Effect of Empowering Leadership, Perceived

Organizational Support, and Job Demands on Work Engagement through Work Fatigue as a Mediating Variable.”

Based on the background, organizational phenomena, previous research, and identified research gaps, this study was formulated to answer ten main research questions regarding whether empowering leadership, perceived organizational support, and job demands affect work engagement and work fatigue; whether work fatigue affects work engagement; and whether work fatigue mediates the effects of empowering leadership, perceived organizational support, and job demands on work engagement among employees of PT Hutama Karya (Persero) Infrastructure Division I involved in Jabodetabek projects. More specifically, this study aims to analyze the effects of empowering leadership and perceived organizational support on work engagement, the effect of job demands on work engagement, the effects of empowering leadership and perceived organizational support on work fatigue, the effect of job demands on work fatigue, the effect of work fatigue on work engagement, and the mediating role of work fatigue in the relationships between empowering leadership, perceived organizational support, and job demands and work engagement.

This research is expected to provide both theoretical and practical contributions. Theoretically, this study contributes to the development of Job Demands–Resources Theory and Conservation of Resources Theory by examining the role of work fatigue as a psychological mechanism linking job resources, job demands, and work engagement. In addition, it provides empirical evidence regarding the interaction between empowering leadership and perceived organizational support as organizational resources in reducing work fatigue within construction project environments. Practically, this study provides recommendations for PT Hutama Karya (Persero) management in developing policies to reduce work fatigue through strengthening empowering leadership, increasing organizational support, and managing job demands more effectively to maintain employee engagement. Furthermore, this study serves as a reference for the construction industry in managing the psychological well-being of project employees and provides a foundation for future research in developing more comprehensive work engagement models by incorporating additional contextual variables.

METHOD

Research Methods Used

This study employed a quantitative approach using an explanatory research design. The approach was selected to examine the causal relationships among the research variables. Specifically, this study analyzed the effects of empowering leadership, perceived organizational support, and job demands on work engagement, as well as the mediating role of work fatigue in the relationship between these variables among operational employees of PT Hutama Karya (Persero) involved in high-intensity construction projects.

Research Location/Place

This research was carried out in the operational environment of PT Hutama Karya (Persero) Infrastructure Division I, with the main focus on employees in charge of strategic construction projects in the Greater Jakarta area. Operationally, the data collection area is focused on the construction project environment which includes MRT CP 203, NPEA Section 1, Jakarta Sewerage Development Project (JSDP), and Huntara Senen. These projects

were chosen because they are in the coordination of the Infrastructure Division I and represent field operational activities with diverse work characteristics, both in terms of the scope of work, project duration, technical complexity, coordination patterns, and work completion targets.

The location of the project in this study refers to the place of assignment of the respondents at the time of data collection. As such, the duration of an ongoing project does not necessarily reflect the overall work experience of respondents. The respondent's working period is calculated based on work experience or cumulative assignments of at least 1 (one) year in the construction project environment of PT Hutama Karya (Persero) or Infrastructure Division I, both in the current project and in the previous project. This affirmation is important because some project employees can experience shifting assignments between projects according to the needs of the organization.

The determination of the location of this study is based on the consideration that the construction industry, especially in the Infrastructure Division I of PT Hutama Karya (Persero), has the characteristics of dynamic, project-based work, and demands adjustment to changes in field conditions. The project work environment in the Greater Jakarta area demands the achievement of time targets, quality standards, cross-functional coordination, and efficiency of work implementation. This condition causes employees to be exposed to job demands that can vary in intensity from project to project, but are still relevant to be studied in relation to empowering leadership, perceived organizational support, work fatigue, and work engagement.

Population and Sample

Populasi

In the terminology of research methodology, a population is represented as a comprehensive aggregation of elements, individuals, or observation units that have specific characteristics and are the center of the researcher's attention to draw conclusions. According to the standard methodology literature guidelines put forward by , population is not just a quantitative projection in the form of a set of numbers, but a representation of an ecosystem of subjects that meet the parameters of relevance to the phenomenon, objectives, and scope of scientific investigation being carried out. Population sets the boundaries of generalized territory, where all empirical findings resulting from research will be returned and applied. (Sekaran & Bougie, 2016)

In the context of this study, the population that became the locus of the investigation was all active employees of PT Hutama Karya (Persero) Infrastructure Division I who were in charge of strategic projects in the Greater Jakarta area in 2026. The determination of this population is based on the characteristics of construction work that is project-based, has a high level of complexity, and is loaded with operational dynamics and project completion pressure. Employees in this population consist of various job functions that are directly involved in construction project operational activities, such as engineering, field operations, Quality, Health, Safety, Security, and Environment (QHSSE), project risk management, project administration, and other technical functions related to the implementation of national strategic projects in the Greater Jakarta area.

The dynamic and stressful work environment conditions of the project put employees in a work situation with high intensity job demands. Employees are required to be able to

manage the technical complexity of the work, meet project completion targets, and face continuous operational pressures. Based on the perspective of Job Demands-Resources Theory, the high demands of work have the potential to drain employees' physical, mental, and emotional energy so that it can increase work fatigue and affect the level of work engagement. Therefore, the population of this study is considered representative to test the influence of empowering leadership, perceived organizational support, and job demands on work engagement through work fatigue as a mediating variable in the construction project environment.

Based on the company's attendance and internal staffing data in 2026, the number of factual population in this study is 338 active employees who are in charge of strategic projects in the Greater Jakarta area. The entire population is used as a sampling frame in determining the number of research samples to be used at the statistical analysis stage using Partial Least Squares Structural Equation Modeling (PLS-SEM).

Sample

A sample is an empirical subsystem extracted from a population framework, whose characteristics and distribution are considered proportional to represent the population entity as a whole. Precise and representative sampling is an important prerequisite for guaranteeing that the resulting empirical findings have an adequate level of external validity, so that the conclusions of the study can be scientifically generalized to the population under study.

To determine the minimum number of samples that meet the statistical representation standards of the total population of 338 employees, this study uses the Slovin formula with a margin of error of 5% or 0.05. The use of the Slovin formula is done because the population number is known for certain, so it can be used to determine the minimum sample size that is representative of the study population. The mathematical formulations used are as follows:

$$n = N / (1 + Ne^2)$$

Description:

n = Minimum target sample size

N = Factual population size (338 employees)

e = Degree of relaxation of inaccuracy due to sampling error (5% or 0.05)

If the population parameter is substituted into the equation, the following calculation is obtained:

$$n = 338 / (1 + 338 \times 0.05^2)$$

$$n = 338 / (1 + 338 \times 0.0025)$$

$$n = 338 / (1 + 0.845)$$

$$n = 338 / 1.845$$

$$n = 183.19$$

Based on the extraction of the Slovin calculation, a minimum threshold of 183.19 was obtained, which was then rounded conservatively upwards to 184 respondents.

Sampling Techniques

The sample collection in this study used a non-probability sampling design with purposive sampling technique. The purposive sampling technique was chosen because this study requires respondents with certain special characteristics that are in accordance with the context of the problem, namely employees who are directly involved in the operational activities of construction projects and experience the dynamics of project work pressure on a

regular basis. This approach is used so that the selected respondents really have relevant experience and understanding related to empowering leadership, perceived organizational support, job demands, work fatigue, and work engagement in the construction project environment.

In order to ensure the accuracy of the analysis units used, the researcher established several specific inclusion criteria as the main basis for selecting respondents, namely:

- **Employment Status:** Employees with active status at PT Hutama Karya (Persero) Infrastructure Division I who are in charge of strategic projects in the Greater Jakarta area.
- **Operational Involvement:** Employees who are directly involved in the operational activities of daily construction projects, such as engineering functions, field operations, Quality, Health, Safety, Security, and Environment (QHSSE), project risk management, project administration, and other technical functions related to the implementation of construction projects. This criterion is set to conclude that upper managerial or administrative employees (back-office) at the head office are not directly related to the risk of extreme fatigue in the field.
- **Actual Working Period:** Employees who have had work experience or assignments of at least 1 (one) year in the construction project environment of PT Hutama Karya (Persero) or Infrastructure Division I, both in the current project and in the previous project. This criterion is set so that respondents have adequate work experience and understand organizational conditions, supervisory leadership patterns, organizational support, and the dynamics of project work demands more comprehensively.
- **Voluntary Aspect:** Employees who express their willingness to be a voluntary research respondent through informed consent attached to the questionnaire.

RESULTS AND DISCUSSION

Data Statistical Analysis

Statistical analysis of the data in this study was carried out using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method with the help of SmartPLS 4 software. The selection of PLS-SEM was based on the purpose of the study to test the direct and indirect relationship between variables in the research model, namely Empowering Leadership, Perceived Organizational Support, Job Demands, Work Fatigue, and Work Engagement.

This study uses a two-stage approach because the variables Work Engagement and Work Fatigue are positioned as higher-order constructs. In the first stage, the test was carried out to obtain a construct score from the dimensions that form Work Engagement, namely vigor, dedication, and absorption, as well as the dimensions that form Work Fatigue, namely physical fatigue, mental fatigue, and emotional fatigue. Furthermore, in the second stage, the dimensional score is used in the final model to test the structural relationships between the research variables. The terms first and second stages in this study refer to the procedure for the formation of a higher-order construct, while the evaluation of indicators that do not meet the criteria is carried out through outer loading testing before the final model is used for inner model and hypothesis testing.

The first stage measurement model was used to obtain a construct score from the Work Engagement and Work Fatigue forming dimensions. The dimensions that form Work Engagement consist of vigor, dedication, and absorption, while the dimensions that form Work Fatigue consist of physical fatigue, mental fatigue, and emotional fatigue. The construct score obtained in the first stage is then used in the second stage model as a high-level construct forming indicator.

The second stage of measurement model is the final model after the evaluation of outer loading. Indicators that do not meet the criteria in the Empowering Leadership, Perceived Organizational Support, and Job Demands constructs have been excluded from the model. This final model is then used for validity, reliability, internal model evaluation, and research hypothesis testing.

Testing Measurement Model (Outer Model)

Measurement model testing (outer model) is carried out to ensure that the indicators used in this study have met the criteria of validity and reliability. The evaluation of the outer model was carried out through the outer loading value, Average Variance Extracted (AVE), Cronbach's Alpha, Composite Reliability, and discriminant validity using the Heterotrait-Monotrait Ratio (HTMT) value.

Convergent Validity

Convergent validity is used to assess the extent to which indicators in a construct are able to explain the construct being measured. In the evaluation of reflective measurement models, outer loading is used to see the contribution of each indicator to its construct. Referring to the guidelines of Hair et al. (2017), the ideal outer loading value is at 0.708 or higher. Indicators with low values need to be evaluated as they can affect the quality of convergent validity.

Based on the results of the initial outer loading evaluation, there are several indicators that have values below 0.70, namely EL1, EL7, EL11, EL13, EL15, POS8, JD5, and JD14. In accordance with the revised directives and guidelines for the evaluation of reflective measurement models in PLS-SEM, such indicators are excluded from the model. After indicators that do not meet the criteria are issued, the measurement model test is re-run so that the final model is obtained. This final model is used for reliability testing, discriminant validity, internal model evaluation, and hypothesis testing.

Based on the results of the outer loading test on the final model, all remaining indicators have an outer loading value above 0.70. Thus, all indicators in the final model are declared valid and feasible to be used to measure each construct in this study. In addition, the dimensions of forming high-level constructs in the Work Engagement and Work Fatigue variables also have a very strong outer loading value, so that the two high-level constructs are suitable for use in structural models.

Construct Reliability and Validity

Reliability and construct validity tests were performed through Cronbach's Alpha, Composite Reliability (ρ_A and ρ_C), and Average Variance Extracted (AVE) scores. The construct is declared reliable if the Cronbach's Alpha and Composite Reliability values are above 0.70, while the convergent validity at the construct level is met if the AVE value is above 0.50.

All constructs have Cronbach's Alpha and Composite Reliability values above 0.70. In addition, the entire AVE value is also above 0.50. These results show that all constructs in the research model have met the criteria of internal reliability and convergent validity. Thus, the indicators remaining after the evaluation of outer loading are able to represent the research construct consistently and adequately.

Discriminant Validity

Discriminant validity is used to ensure that each construct in the research model is completely different from the other. The discriminatory validity test in this study was carried out using the Heterotrait-Monotrait Ratio (HTMT). The construct is declared to meet the discriminant validity if the HTMT value is below 0.90.

The entire HTMT value is below the 0.90 limit. The highest HTMT value was found in the relationship between Work Fatigue and Work Engagement of 0.748. This value is still below the required limit, so it can be stated that all constructs in this study have met the criteria for discriminant validity.

Pengujian Inner Model

Internal model testing was carried out to evaluate the relationship between latent variables in the research model. The evaluation of the structural model was carried out through the R-Square, f-Square, Q-Square, Variance Inflation Factor (VIF), and fit model. This test aims to determine the model's ability to explain endogenous variables and ensure that there are no multicollinearity problems in the relationships between variables.

Collinearity Statistics (VIF)

Multicollinearity tests are performed to ensure that the predictor variables do not have too high a correlation. The model is declared free of multicollinearity problems if the VIF value is below 5

All VIF values are below the limit of 5, so it can be stated that there is no problem of multicollinearity in the structural model. Thus, the relationships between variables in the model can be interpreted better because there is no excessive correlation between predictor variables.

R-Square

The R-Square value is used to see the ability of exogenous variables to explain endogenous variables. In this study, endogenous variables consisted of Work Fatigue and Work Engagement

The R-Square value in the Work Engagement variable is 0.696. This shows that 69.6% of the variation in Work Engagement can be explained by Empowering Leadership, Perceived Organizational Support, Job Demands, and Work Fatigue, while the rest is explained by other variables outside the research model. Furthermore, the R-Square value on the Work Fatigue variable is 0.509, which indicates that 50.9% of the variation in Work Fatigue can be explained by Empowering Leadership, Perceived Organizational Support, and Job Demands.

f-Square

Effect size or f-Square is used to see the amount of contribution of each exogenous variable to the endogenous variable. The value of f-Square is categorized as small, medium, or large based on the amount of contribution made to the model.

The effect of Job Demands on Work Fatigue has the highest f-Square value of 0.332 and is in the medium category. These results show that Job Demands is an important predictor in explaining Work Fatigue. In other words, the higher the work demands felt by employees, such as workload, time pressure, physical, emotional, and cognitive demands, the greater the potential for increased work fatigue. These findings are in accordance with the characteristics of construction project work that demand the completion of targets under strict conditions of time, quality, cost, and work safety.

Q-Square

Predictive relevance or Q-Square is used to look at the model's overall predictive capabilities. A Q-Square value greater than 0 indicates that the model has predictive relevance. The Q-Square value in this study is calculated based on the R-Square value in the endogenous construct.

The Q-Square value obtained in this study was 0.851. The value is greater than 0, so it can be stated that the research model has good predictive relevance. This means that the model built is able to predict endogenous constructs, namely Work Engagement and Work Fatigue. The score also shows that the combination of the variables Empowering Leadership, Perceived Organizational Support, Job Demands, and Work Fatigue has a strong predictive ability in explaining the dynamics of work involvement of employees of PT Hutama Karya (Persero) Infrastructure Division I in the construction project environment.

Model Fit

The model fit test is carried out to determine the level of suitability of the research model. One of the measures used is the Standardized Root Mean Square Residual (SRMR). The model is declared to have an adequate match if the SRMR value is below 0.08.

The SRMR value in the research model was 0.052. The value is below the limit of 0.08, so the research model can be declared to have adequate model suitability. In addition, an NFI value of 0.849 was used as additional information indicating that the model had a good enough fit rate to be used in testing relationships between variables.

Hypothesis Testing

Hypothesis testing is carried out through a bootstrapping procedure on SmartPLS 4. The relationship between variables is stated to be significant if the T-value is greater than 1.96 and the p-value is less than 0.05. This test is used to assess the direction, magnitude, and significance of the influence between variables in the research model.

Path Coefficient

The direction of the path coefficient has been in accordance with the research hypothesis. Empowering Leadership and Perceived Organizational Support have a positive influence on Work Engagement, while Job Demands have a negative influence on Work Engagement. Furthermore, Empowering Leadership and Perceived Organizational Support have a negative effect on Work Fatigue, Job Demands have a positive effect on Work Fatigue, and Work Fatigue has a negative effect on Work Engagement.

T-Statistics

All T-statistics are above 1.96 and all p-values are below 0.05. Thus, the hypothesis H1 to H7 is declared accepted. These results show that the entire direct relationship in the research model is empirically supported.

Mediation Effect Testing

Mediation effect testing was carried out to determine the role of Work Fatigue in bridging the influence of Empowering Leadership, Perceived Organizational Support, and Job Demands on Work Engagement. The test was carried out through the results of specific indirect effects on the bootstrapping procedure. In addition, the amount of mediation contribution is also seen through the Variance Accounted For (VAF) value.

Indirect Effect

All indirect influences have a p-value of less than 0.05. Thus, H8, H9, and H10 were declared accepted. These results show that Work Fatigue plays a mediating variable in the relationship between Empowering Leadership, Perceived Organizational Support, and Job Demands to Work Engagement.

Variance Accounted For (VAF)

The VAF value in the relationship between Empowering Leadership and Work Engagement through Work Fatigue is 15.1%, so the contribution of Work Fatigue mediation in this pathway is relatively small. Meanwhile, the VAF value in the relationship between Perceived Organizational Support and Work Engagement through Work Fatigue was 26.2% and in the relationship between Job Demands and Work Engagement through Work Fatigue was 25.4%, so both were included in the category of partial mediation. However, because all indirect effects are significant, Work Fatigue is statistically proven to have a mediating role in the research model.

The discussion of the results of the research was prepared to relate statistical findings with theories, expert opinions, previous research, and the factual conditions of employees of PT Hutama Karya (Persero) Infrastructure Division I in strategic projects in the Greater Jakarta area. Each hypothesis is discussed based on the path coefficient value, T-statistics value, p-value, theoretical foundation, and the researcher's interpretation of the work dynamics of the construction project.

The Effect of Empowering Leadership on Work Engagement

The results of the hypothesis test showed that Empowering Leadership had a positive and significant effect on Work Engagement with an original sample value of 0.299, a T-statistics value of 7.749, and a p-value of < 0.001 . A positive coefficient value shows that the better the empowering leadership practices, the higher the level of employee work involvement. Thus, H1 that states that Empowering Leadership has a positive effect on Work Engagement is accepted.

Based on the researcher's analysis, these results are relevant to the characteristics of the construction project work of PT Hutama Karya (Persero) Infrastructure Division I. Project employees face dynamic work situations, such as changes in field conditions, the need for quick coordination, technical obstacles, and the pressure of completion targets. In these conditions, a boss who gives trust, involves employees in decision-making, and gives clear direction can increase employees' sense of ownership of work. This involvement makes employees not only carry out instructions procedurally, but also feel an important part of the project completion. Therefore, the stronger the practice of Empowering Leadership, the higher the energy, dedication, and focus of employees in carrying out project work.

Thus, the results of this study support previous theories and research that states that empowering leadership can increase employee work engagement. Therefore, the first

hypothesis that Empowering Leadership has a positive effect on Work Engagement is accepted.

Pengaruh Perceived Organizational Support Terhadap Work Engagement

The results of the hypothesis test showed that Perceived Organizational Support had a positive and significant effect on Work Engagement with an original sample value of 0.282, a T-statistics value of 7.045, and a p-value of < 0.001 . A positive coefficient value shows that the higher the organizational support felt by employees, the higher the level of employee work involvement. Thus, H2 that states that Perceived Organizational Support has a positive effect on Work Engagement is accepted.

Based on the researcher's analysis, organizational support has an important role in the construction project environment because employees work on a system that demands physical, mental, and emotional resilience. Employees who feel that the organization provides adequate work facilities, pays attention to safety, provides development opportunities, and appreciates contributions will be better able to maintain work engagement. In the context of PT Hutama Karya (Persero) Infrastructure Division I, organizational support is an important buffer for employees who are faced with project targets, busy work schedules, and cross-functional coordination demands. When employees feel a real presence in the organization, they tend to be more enthusiastic, more dedicated, and more focused on carrying out their work.

Thus, the results of this study strengthen the theory and previous findings that organizational support perceived by employees plays an important role in increasing work involvement. Therefore, the second hypothesis that states that Perceived Organizational Support has a positive effect on Work Engagement is accepted.

The Influence of Job Demands on Work Engagement

The results of the hypothesis test showed that Job Demands had a negative and significant effect on Work Engagement with an original sample value of -0.319, a T-statistical value of 7.494, and a p-value of < 0.001 . A negative coefficient value indicates that the higher the work demands felt by employees, the lower the level of employee work involvement. Thus, H3 which states that Job Demands have a negative effect on Work Engagement is declared accepted.

Based on the researcher's analysis, the work demands of employees of PT Hutama Karya (Persero) Infrastructure Division I appear in various forms, such as high workloads, time pressure, physical demands, emotional demands, and cognitive demands. Project employees are not only required to complete work according to targets, but also must maintain quality, safety, cross-party coordination, and quick response to changes in field conditions. If the pressure continues, employees will lose energy more easily, have difficulty maintaining enthusiasm, and be less able to enjoy work positively. This condition explains why Job Demands in this study have been proven to reduce Work Engagement.

Thus, the results of this study support the JD-R theory and previous research that explains that high job demands can weaken employee work engagement. Therefore, the third hypothesis that states that Job Demands have a negative effect on Work Engagement is accepted.

The Effect of Empowering Leadership on Work Fatigue

The results of the hypothesis test showed that Empowering Leadership had a negative and significant effect on Work Fatigue with an original sample value of -0.204, a T-statistics value of 4.214, and a p-value of < 0.001 . A negative coefficient value indicates that the better the empowering leadership practice, the lower the level of work fatigue felt by employees. Thus, H4 which states that Empowering Leadership has a negative effect on Work Fatigue is declared accepted.

Thus, the results of this study show that Empowering Leadership not only plays a role in increasing work engagement, but also reduces employee work fatigue. Therefore, the fourth hypothesis that Empowering Leadership has a negative effect on Work Fatigue is accepted.

Pengaruh Perceived Organizational Support Terhadap Work Fatigue

The results of the hypothesis test showed that Perceived Organizational Support had a negative and significant effect on Work Fatigue with an original sample value of -0.384, a T-statistics value of 8.580, and a p-value of < 0.001 . A negative coefficient value shows that the higher the organizational support felt by employees, the lower the work fatigue experienced by employees. Thus, H5 which states that Perceived Organizational Support has a negative effect on Work Fatigue is declared accepted.

Based on the researcher's analysis, organizational support in the construction project environment has a very practical meaning. This support can be in the form of adequate work facilities, clear safety systems, health support, appreciation for contributions, development opportunities, and work policies that pay attention to the welfare of employees. In the context of PT Hutama Karya (Persero) Infrastructure Division I, employees face time pressure and high coordination demands, so organizational support is important to maintain their work capacity. When employees feel that the organization is present and cares, the psychological burden they feel can be reduced and the level of work fatigue is lower.

Thus, the results of this study reinforce the theory and previous research that organizational support can reduce work burnout. Therefore, the fifth hypothesis that states that Perceived Organizational Support has a negative effect on Work Fatigue is accepted.

The Effect of Job Demands on Work Fatigue

The results of the hypothesis test showed that Job Demands had a positive and significant effect on Work Fatigue with an original sample value of 0.417, a T-statistics value of 8.432, and a p-value of < 0.001 . A positive coefficient value shows that the higher the work demands, the higher the work fatigue felt by employees. Thus, H6 which states that Job Demands have a positive effect on Work Fatigue is declared accepted.

Based on the researcher's analysis, Job Demands is the most powerful factor in explaining Work Fatigue in this study. This can be seen from the f-Square value of the Job Demands line to Work Fatigue, which is one of the biggest contributions in the model. In the context of construction projects, the demands of work are not only physical, but also mental, emotional, and cognitive. Employees must face completion targets, changes in field conditions, coordination with various parties, safety pressure, and the need to make quick decisions. The combination of these demands can drain employee energy and increase work fatigue.

Thus, the results of this study support the theory and previous research that high job demands can increase work fatigue. Therefore, the sixth hypothesis that states that Job Demands has a positive effect on Work Fatigue is accepted.

The Effect of Work Fatigue on Work Engagement

The results of the hypothesis test showed that Work Fatigue had a negative and significant effect on Work Engagement with an original sample value of -0.260, a T-statistics value of 4.610, and a p-value of < 0.001 . A negative coefficient value indicates that the higher the work fatigue experienced by employees, the lower the level of employee work involvement. Thus, H7 stating that Work Fatigue has a negative effect on Work Engagement is declared accepted.

Based on the researcher's analysis, these results are relevant to the condition of construction project employees. Project work requires high concentration, physical endurance, the ability to manage emotions, and a focus on work quality and safety. When employees experience physical, mental, and emotional fatigue, they tend to have a harder time maintaining work morale, pride in work, and positive solubility in tasks. This condition explains why Work Fatigue has been proven to reduce Work Engagement in employees of PT Hutama Karya (Persero) Infrastructure Division I.

Thus, the results of this study support the theory and previous research that work fatigue can reduce work engagement. Therefore, the seventh hypothesis that Work Fatigue has a negative effect on Work Engagement is accepted.

Work Fatigue Mediates the Influence of Empowering Leadership on Work Engagement

The results of the specific indirect effect test showed that Work Fatigue mediated the influence of Empowering Leadership on Work Engagement with an original sample value of 0.053, a T-statistics value of 3.114, and a p-value by 0.002. The VAF value of 15.1% shows that the contribution of mediation to this pathway is relatively small, but still statistically significant. Thus, H8 stating that Work Fatigue mediates the influence of Empowering Leadership on Work Engagement is accepted.

Based on the researcher's analysis, in a construction project environment, empowering leadership can reduce employee burnout through several mechanisms. First, clear directions reduce confusion in the execution of work. Second, employee involvement in technical decisions makes employees feel they have control over the work. Third, the support of the employer helps employees face field obstacles without feeling burdened individually. When the psychological pressure is reduced, employees are better able to maintain energy, dedication, and focus on work.

Thus, the results of this study show that Work Fatigue acts as a mediation mechanism in the relationship between Empowering Leadership and Work Engagement. Therefore, the eighth hypothesis that Work Fatigue mediates the influence of Empowering Leadership on Work Engagement is accepted.

Work Fatigue Mediates the Influence of Perceived Organizational Support on Work Engagement

The results of the specific indirect effect test showed that Work Fatigue mediated the influence of Perceived Organizational Support on Work Engagement with an original sample value of 0.100, a T-statistics value of 4.069, and a p-value of < 0.001 . The VAF value of 26.2% indicates the existence of partial mediation. Thus, H9 stating that Work Fatigue

mediates the influence of Perceived Organizational Support on Work Engagement is accepted.

Based on the researcher's analysis, organizational support in the construction project environment plays an important role as an important resource that helps employees maintain work energy. Such support can be in the form of work facilities, safety systems, attention to health, appreciation for contributions, fair work policies, and development opportunities. When the support is real, employees are better able to deal with project pressure without experiencing excessive fatigue. The reduction in fatigue then helps employees maintain enthusiasm, dedication, and focus on work.

Thus, the results of this study show that Work Fatigue mediates the relationship between Perceived Organizational Support and Work Engagement. Therefore, the ninth hypothesis that Work Fatigue mediates the influence of Perceived Organizational Support on Work Engagement is accepted.

Work Fatigue Mediates the Influence of Job Demands on Work Engagement

The results of the specific indirect effect test showed that Work Fatigue mediated the influence of Job Demands on Work Engagement with an original sample value of -0.109, a T-statistics value of 3.823, and a p-value of < 0.001 . The VAF value of 25.4% indicates the existence of partial mediation. Thus, H10 which states that Work Fatigue mediates the influence of Job Demands on Work Engagement is accepted.

Based on the researcher's analysis, the work demands on the construction project of PT Hutama Karya (Persero) Infrastructure Division I have a multidimensional character. Employees face not only a high volume of tasks, but also time pressures, coordination demands, safety risks, changing field conditions, and the need for quick decision-making. When these demands increase, employees are vulnerable to physical, mental, and emotional exhaustion. This fatigue then decreases the ability of employees to remain enthusiastic, dedicated, and positively engaged at work. This explains why Work Fatigue has been shown to mediate the influence of Job Demands on Work Engagement.

Thus, the results of this study show that the negative influence of Job Demands on Work Engagement does not only occur directly, but also through an increase in Work Fatigue. Therefore, the tenth hypothesis that Work Fatigue mediates the influence of Job Demands on Work Engagement is accepted.

Overall, the results of the discussion showed that the Work Engagement of employees of PT Hutama Karya (Persero) Infrastructure Division I was influenced by the balance between work resources and work demands. Empowering Leadership and Perceived Organizational Support have been proven to play a role as work resources that can increase work engagement and reduce work burnout. On the contrary, Job Demands have proven to be job demands that can increase Work Fatigue and decrease Work Engagement. These findings confirm that human resource management in the construction project environment needs to pay attention to two sides simultaneously, namely strengthening work resources and controlling work demands so that work fatigue does not develop into a factor that weakens employee involvement

CONCLUSION

Based on the research findings among employees of PT Hutama Karya (Persero) Infrastructure Division I involved in Greater Jakarta projects, it can be concluded that empowering leadership and perceived organizational support have positive and significant effects on work engagement, whereas job demands have a negative and significant effect on work engagement. In addition, empowering leadership and perceived organizational support have been shown to reduce work fatigue, while job demands increase work fatigue. Furthermore, work fatigue has a negative and significant effect on work engagement, indicating that higher levels of work fatigue are associated with lower employee engagement with their work. The results also demonstrate that work fatigue functions as a mediating variable in the relationships between empowering leadership, perceived organizational support, and job demands and work engagement. Based on these findings, PT Hutama Karya is recommended to strengthen empowering leadership practices through leadership development programs for project supervisors, enhance organizational support by improving work facilities and employee welfare programs, and manage job demands through workload optimization and structured rest periods. Future researchers are encouraged to expand the research model by incorporating additional variables, such as organizational culture, peer support, and work-life balance, as well as extending the research scope to other construction projects in different regions to improve the generalizability of the findings.

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