

The Role of Job Flourishing in the Relationship Between Resilience and Burnout Among Manufacturing Workers at PT Apollo Solar Batam

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Abstract

Burnout is a significant concern among manufacturing workers who are exposed to demanding working conditions, including extended shifts, high production targets, and repetitive tasks. This study examined the associations among resilience, job flourishing, and burnout and tested whether job flourishing mediated the association between resilience and burnout among operator-level employees at PT Apollo Solar Batam. A quantitative explanatory design was employed with 119 respondents. Data were collected using the Connor–Davidson Resilience Scale, the Indonesian Maslach Burnout Inventory, and the Flourishing-at-Work Scale–Short Form. Mediation was tested using regression-based path analysis and PROCESS Model 4 with 10,000 bootstrap resamples and a 95% confidence interval. Resilience was negatively associated with burnout and positively associated with job flourishing, while job flourishing was negatively associated with burnout. The indirect association between resilience and burnout through job flourishing was statistically significant (effect = -0.3263 , BootSE = 0.0973 , 95% bootstrap CI [-0.5197 , -0.1361]), whereas the direct association was not statistically significant ($B = -0.0142$, $p = .8942$). These findings are consistent with an indirect-only mediation pattern, suggesting that job flourishing may represent an important psychological pathway linking resilience with burnout. However, the cross-sectional design does not establish temporal ordering or causal mediation.

Keywords: Resilience; Burnout; Flourishing; Manufacturing Industry.

INTRODUCTION

In the modern era, work is no longer just a means to meet economic needs, but also to fulfill individual psychological needs such as self-actualization, a sense of purpose, social identity, and opportunities to contribute to society. Healthy and meaningful work can enhance psychological well-being, provide a sense of competence, and build positive social relationships (Annison & Davidson, 2023). However, work can also be a source of psychological pressure when high job demands are not balanced with life balance and exceed an individual's personal capacity. This condition is commonly found in the manufacturing sector, which is characterized by long working hours, tight production targets, shift work systems, as well as monotonous jobs that require high concentration, thus increasing the risk of

prolonged emotional and physical exhaustion burnout.

As a psychological syndrome, burnout emerges when work-related stress is not adequately addressed, and is typically marked by three key features: feelings of emotional depletion, the development of depersonalisation or cynical attitudes toward work, and a decline in perceived personal achievement (Maslach & Leiter, 2016). Lu et al. (2020) reported that, in a sample of 6,130 factory workers and miners in Wulumuqi, China, 85.98% of respondents experienced occupational burnout to varying degrees, as measured by the Chinese Maslach Burnout Inventory (CMBI). These findings indicate that burnout is a significant issue that warrants attention among this group of workers. However, this figure cannot be directly generalized as the prevalence of burnout among all manufacturing workers across various

countries and companies, as the study specifically included factory workers and miners exposed to various occupational hazards, such as coal dust, silica, asbestos, benzene, lead, and noise. Other studies in the manufacturing context, such as Zhou et al. (2022) have also found that work stress, production demands, and shift work patterns are associated with an increased risk of burnout among female workers in the electronics manufacturing sector in Guangdong, China.

In the context of PT Apollo Solar Batam, exploratory interviews were conducted with five operator-level employees to gain an initial understanding of their work experiences and working conditions. The interviews were brief and conducted during lunch breaks, using open-ended questions addressing working hours, shift schedules, production demands, and perceived fatigue. The interview findings revealed variation in experiences among the respondents. Some respondents reported physical fatigue, whereas others highlighted decreased work motivation, production demands, monotonous tasks, or reduced time with family. All respondents worked under a 12-hour shift system, while pressure to meet production targets was a characteristic of the operators' work context at the company. These initial interviews were exploratory in nature and were not intended to estimate the prevalence of burnout, but rather to provide contextual insight into working conditions and identify sources of work-related pressure that warrant further investigation.

The Job Demands–Resources (JD-R) theory provides a useful framework for understanding burnout among manufacturing workers. The theory proposes that employee well-being is shaped by the interaction between job demands and available resources. Job demands refer to physical, psychological, social, or organisational aspects of work that require sustained effort, whereas job resources refer to aspects of work that help employees achieve work goals, reduce job demands, and support psychological functioning. In manufacturing settings, job demands may

include extended shifts, long working hours, high production targets, and repetitive tasks (Bakker & de Vries, 2021). Within this framework, personal resources are individual characteristics that help employees cope with demanding work conditions and maintain psychological functioning. Resilience can be conceptualised as a personal resource because it reflects an individual's capacity to adapt to adversity, recover from difficulties, and maintain functioning when facing challenging circumstances. Thus, resilience may be particularly relevant to understanding burnout in demanding occupational contexts such as manufacturing. In addition to personal resources such as resilience, positive psychological states such as job flourishing may also be relevant to the JD-R process,

Particularly in understanding the relationship between job demands and burnout (Nicolls et al., 2024).

Resilience refers to an individual's capacity to recover or endure difficulties, traumatic events, and adapt positively to changes that occur (Bonanno et al., 2024). Resilience is not only reactive (bouncing back from difficulties) but also proactive (anticipating and learning from challenges), thus opening up the possibility not only to prevent burnout but also to encourage personal development and sustainable adjustment (Labrague, 2021). Individuals with high levels of resilience tend to manage work pressure more effectively, resulting in a lower risk of burnout. This finding is supported by the research conducted by Guo et al., (2018) involving 1,061 nurses in Chinese hospitals, which showed that individuals with high resilience levels have significantly lower levels of burnout. Similar findings were reinforced by Lee et al. (2019) which indicated that resilience is negatively associated with burnout and can mediate the relationship between stress and burnout. Thus, resilience is seen as a protective factor that helps workers maintain their psychological functioning even when facing high job demands.

As well as reducing burnout levels, resilience has the potential to foster positive states such as flourishing (Berend, B., Vogt, D., & Brohm-Badry, M. (2020). Flourishing describes an individual's optimal state of a person, in which they are not only free from psychological distress but also experience meaning, happiness and a deep sense of engagement in their life and work (Keyes, 2002; Seligman, 2018). In the work context, flourishing at work refers to a state in which employees experience emotional well-being and function effectively psychologically and socially. The Flourishing-at-Work Scale–Short Form (FWS-SF) conceptualises workplace flourishing as a multidimensional construct comprising emotional, psychological, and social well-being (Rautenbach & Rothmann, 2017). In the present study, job flourishing is understood as a work-specific form of positive psychological functioning that may be relevant to employees' experiences of burnout.

In an organisational context, flourishing has increasingly been examined as a positive psychological state associated with employee well-being. Freire et al. (2020) for example, found that flourishing mediated the relationship between psychological capital and burnout among teachers. However, psychological capital was examined as a composite construct involving resilience, self-efficacy, optimism, and hope. Therefore, the specific mediating role of flourishing in the relationship between resilience and burnout remained unclear. Similarly, Vetter et al. (2018) reported that resilience and flourishing were negatively associated with burnout among gynecologic oncologists, but their study did not test whether flourishing mediated the relationship between resilience and burnout. Thus, previous studies provide evidence that positive psychological resources and flourishing are related to burnout, but they have not adequately established the specific mechanism linking resilience, flourishing, and burnout.

This gap is particularly important in manufacturing settings, where employees commonly face extended shifts, long working

hours, high production targets, repetitive tasks, and potentially hazardous working conditions. These characteristics represent a distinct occupational context from those examined in previous studies of teachers, healthcare professionals, and academics and may shape the relationship between personal resources and positive psychological functioning. Nevertheless, empirical evidence regarding the mediating role of flourishing in the relationship between resilience and burnout among manufacturing workers remains limited. The present study therefore examines whether flourishing mediates the association between resilience and burnout among operator-level employees at PT Apollo Solar Batam. By focusing on this occupational context, the study extends previous research beyond service and education professions and provides a more specific examination of the potential mediating pathway linking resilience and burnout in manufacturing work. Based on these research objectives, the research hypotheses are formulated as follows:

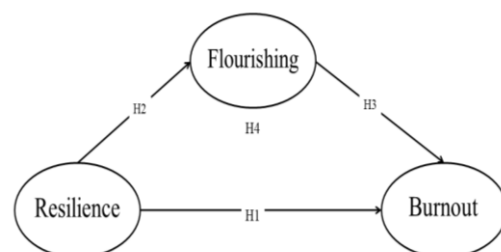
H₁: Resilience is negatively associated with burnout.

H₂: Resilience is positively associated with flourishing.

H₃: Flourishing is negatively associated with burnout.

H₄: Flourishing mediates the association between resilience and burnout.

To facilitate an understanding of the relationship flow between variables, the following research model is proposed:



Picture 1. Conceptual Research Model

METHODS

This study used a quantitative explanatory design. The target population comprised 160 operational employees serving

as production-line operators at PT Apollo Solar Batam. Data collection was conducted between February and April 2026. Participants were eligible if they had worked as operators for at least six months, were assigned to a shift-based work schedule, and voluntarily agreed to participate by providing informed consent. Employees who did not hold operational positions or who were on extended leave were excluded.

Before the main survey, the research instruments were pilot-tested with 41 employees drawn from the same target population. Pilot participants were excluded from the main study, and their data were used solely to assess the validity and reliability of the instruments. They were not invited to complete the main questionnaire again to prevent repeated participation. Following the pilot phase, all 119 eligible employees who had not participated in the pilot study were invited to complete the main questionnaire. Because the questionnaire was administered to the entire remaining eligible group rather than to a selected subset, the main study adopted a census-based sampling approach. The final analytical sample consisted of 119 respondents who provided informed consent and returned complete questionnaires.

Data were collected using an online questionnaire administered through Google Forms. The questionnaire link was distributed with the assistance of the Human Resources (HR) department through an internal communication group. Before completing the questionnaire, respondents received written information about the study objectives, data confidentiality, the voluntary nature of participation, and their right to withdraw at any time without consequences. Participants provided informed consent by checking a consent box at the beginning of the questionnaire. To protect confidentiality, the HR department assisted only in distributing the questionnaire link and had no access to individual responses. The researchers did not collect personally identifiable information, including respondents' names or employee

identification numbers. The study received ethical approval from the Health Research Ethics Committee of Universitas Batam under approval number 062/LPPM-UNIBA/PI-EC/IV/2026.

Three self-report instruments were used to assess resilience, burnout, and flourishing. Resilience was measured using the Indonesian-language version of the 25-item Connor–Davidson Resilience Scale (CD-RISC 25), originally developed by Connor and Davidson (2003) and examined for construct validity and internal consistency by Prawita and Heryadi (2023). The scale comprises five dimensions: personal competence, high standards, and tenacity; trust in one's instincts, tolerance of negative affect, and the strengthening effects of stress; positive acceptance of change and secure relationships; control; and spiritual influences. Burnout was assessed using the 22-item Indonesian adaptation of the Maslach Burnout Inventory, known as the Maslach–Trisni Burnout Inventory (M-TBI), which consists of three dimensions: exhaustion, cynicism, and personal accomplishment. Flourishing was measured using the 17-item Flourishing-at-Work Scale–Short Form (FWS-SF), comprising emotional, psychological, and social well-being. In the present study, all items were administered using a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores on the resilience and flourishing measures indicated higher levels of the respective constructs, while burnout scores were interpreted according to the scoring direction of its three dimension.

Statistical analyses were performed using IBM SPSS Statistics version 27. The analytical procedure began with an evaluation of instrument quality, including validity and reliability tests, followed by assumption checks for parametric analysis. Normality of the data was examined using the One-Sample Kolmogorov–Smirnov Test, while multicollinearity was assessed based on Tolerance and Variance Inflation Factor (VIF) values. The hypothesised relationships among resilience, flourishing, and burnout were examined using

regression-based path analysis. The mediating role of flourishing was tested using the PROCESS macro for SPSS, Model 4, with 10,000 bootstrap resamples and a 95% confidence interval. The indirect effect was considered statistically significant when its bootstrap confidence interval did not include zero.

RESULTS and DISCUSSION

Results

Validity and Reliability Test Results

The research instrument consists of the CD-RISC with 25 items to measure resilience, the MBI with 22 items to measure burnout, and the FWS-SF with 17 items to measure flourishing. The validity test results showed that the table *r* value was 0.304. In the resilience scale, the calculated *r* values ranged from 0.431 to 0.877, indicating that 24 out of 25 items were valid, while one item was eliminated due to not meeting the validity criteria. All items on the burnout and flourishing scales met the validity criteria with calculated *r* values ranging from 0.379 to 0.842 and 0.504 to 0.865, respectively. Furthermore, the reliability test results showed a Cronbach's Alpha value of 0.960 for the resilience scale, 0.932 for the burnout scale, and 0.946 for the flourishing scale, indicating that all instruments had very good reliability.

Classical Assumption Test

The purpose of the normalcy test is to ascertain whether a set of data follows a normal distribution. When deciding whether or not to use parametric statistics, this test is crucial. Using SPSS's One Sample Kolmogorov-Smirnov test, we checked for normalcy in this study:

**Table 1. Normality Test
One-Sample Kolmogorov-Smirnov Test**

Unstandardised Residual		
N		119
Normal	Mean	.0000000
Parameters	Standard	
a, b	Deviation	1.03005783
Test Statistic		.050
Asymptotic Significance		.200 ^d
(2-tailed) ^c		

The Kolmogorov-Smirnov statistic came out to be 0.050 with an Asymp. Sig. (2-tailed) value of 0.200, according to the findings of the normality test using the One-Sample Kolmogorov-Smirnov Test. This study's data follows a normal distribution as the *p*-values for the two tests were higher than 0.05. We may go on to the multicollinearity test now that we know the normalcy assumption is true.

One goal of the multicollinearity test is to find out if the regression model's independent variables are correlated or not. Values of the Tolerance and VIF were used to perform the test. With a Tolerance greater than 0.10 and a VIF less than 10, multicollinearity is not present. The findings of the tests that were run using SPSS are as follows:

**Table 2. Multicollinearity Test
Coefficients^a**

Model	Collinearity Statistics	
	Tolerance	VIF
1		
Resilience	.339	2.954
Flourishing	.339	2.954

a. Dependent Variable: *Burnout*

A tolerance value of 0.339 and a VIF of 2.954 were both produced by the multicollinearity test. If the VIF is less than 10 and the tolerance value is larger than 0.10, then the regression model does not have a multicollinearity issue. Thus, the resilience and flourishing variables can be used together as predictors of burnout without causing bias due to multicollinearity.

Mediation Analysis Using Bootstrapping

Mediation analysis with bootstrapping was conducted using the PROCESS macro (Model 4) with 10,000 bootstrap resamples and 95% percentile confidence intervals, specifying flourishing as a mediator of the relationship between resilience and burnout.

Table 3. Regression paths in the mediation model

Path	Outcome	Predictor	b	SE	T	p	95% CI (LLCI, ULCI)	R ²
X → M (a)	Flourishing (M)	Resilience (X)	0.6152	0.0407	15.1197	< 0.001	0.5346, 0.6957	0.6615
M → Y (b)	Burnout (Y)	Flourishing (M)	-0.5304	0.1413	-3.7527	0.0003	-0.8103, -0.2505	0.2752
X → Y (c)	Burnout (Y)	Resilience (X)	-0.3405	0.0656	-5.1920	< 0.001	-0.4704, -0.2106	0.1873
X → Y (c')	Burnout (Y)	Resilience (X) (controlling for M)	-0.0142	0.1069	-0.1333	0.8942	-0.2260, 0.1975	0.2752

Table 4. Bootstrap indirect effect of resilience on burnout through flourishing

Indirect Path	Effect (ab)	BootSE	95% Bootstrap CI (BootLLCI, BootULCI)	Interpretation
X → M → Y	-0.3263	0.0973	-0.5197, -0.1361	Significant

As shown in Tables 3 and 4, resilience was positively associated with flourishing, whereas flourishing was negatively associated with burnout. The indirect effect of resilience on burnout through flourishing was statistically significant ($B = -0.3263$, $\text{BootSE} = 0.0973$, 95% bootstrap CI $[-0.5197, -0.1361]$), as the confidence interval did not include zero. In contrast, the direct effect of resilience on burnout was not significant after flourishing was included in the model ($B = -0.0142$, $p = .8942$). This pattern is consistent with an indirect-only mediation, suggesting that flourishing plays an important mediating role in the relationship between resilience and burnout.

Discussion

The findings showed that resilience was negatively associated with burnout among operator-level employees at PT Apollo Solar Batam. This finding indicates that employees with higher levels of resilience tended to report lower levels of burnout. The result is consistent with previous research showing that resilience is negatively associated with burnout. This result is consistent with Guo et al. (2018), who reported a negative association between resilience and burnout among nurses, and with Lee et al. (2019), who found that emotional workers with higher resilience tended to experience lower burnout and stress. More recent evidence also supports the relevance of resilience as a personal resource in occupational well-being. Archer et al. (2024), in a field study involving employees of an innovation and manufacturing organisation, found that increases in work-related psychological flexibility were associated with greater stress resilience and lower exhaustion. Similarly, a

2026 study of blue-collar employees in manufacturing organisations found that resilience was associated with lower burnout under conditions of poorer work-life fit (Güner Kibaroglu, 2026).

From a Job Demands-Resources (JD-R) perspective, this association can be understood in terms of resilience as a personal resource. Employees with greater personal resources may be better positioned to regulate their responses to demanding work conditions and maintain psychological functioning when facing prolonged demands (Cantante-Rodrigues et al., 2021). This interpretation is particularly relevant to the present manufacturing context, where operators work under shift schedules and production demands. Recent manufacturing research has likewise shown that occupational stress is positively associated with burnout, whereas psychological capital is negatively associated with burnout among manufacturing employees. However, because the present study used a cross-sectional design, this finding should be interpreted as an association rather than evidence that resilience directly causes lower burnout.

Resilience was also positively associated with flourishing. This finding indicates that employees who reported higher resilience also tended to report higher levels of work-related flourishing. This finding is consistent with Mariana et al. (2023), who found a positive relationship between resilience and flourishing among elementary school teachers. It also corresponds with Shellman & Hill (2017), who described resilience as a capacity related not only to coping with adversity but also to positive development and well-being. In addition, Chen (2024) emphasised that

resilience is relevant to teachers' capacity to maintain positive functioning and flourish under demanding conditions. Evidence from other working populations also supports this relationship. In a one-year prospective study of working adults in Hong Kong, Ho et al. (2022) found that psychological capital, which includes resilience, hope, efficacy, and optimism, was associated with subsequent employee flourishing and positive functioning at work. These findings suggest that resilience may be associated with flourishing through employees' ability to maintain meaning, engagement, competence, and positive relationships in their work.

The present finding can also be interpreted through the motivational pathway of JD-R theory. Personal resources such as resilience may help employees recognise and use available job resources, maintain confidence in performing their tasks, and remain psychologically engaged. In this sense, resilience may be related not only to the reduction of negative outcomes such as burnout but also to the development of positive work-related functioning. This interpretation is supported by recent research on job flourishing, which indicates that personal resources and positive work experiences are important correlates of flourishing, while demanding work conditions such as workload pressure are generally negatively related to flourishing (A'yuninnisa et al., 2024). The present finding extends this literature by examining the resilience–flourishing association among manufacturing operators, a population that has received less attention in flourishing research.

Flourishing was significantly and negatively associated with burnout after controlling for resilience. This finding indicates that employees who reported greater emotional, psychological, and social well-being at work tended to report lower levels of burnout. Flourishing may be relevant to burnout because it reflects more than the absence of psychological distress. It includes employees' experiences of positive affect, meaning, competence, engagement, and social functioning in the workplace. These positive experiences may provide psychological energy and help employees maintain a sense of purpose despite demanding work conditions (Verma et al. 2025). In contrast, employees who experience low levels of flourishing may have fewer positive psychological resources

available to counteract emotional exhaustion, psychological distancing, and reduced occupational functioning.

This result is consistent with Vetter et al. (2018), who reported that flourishing and resilience were inversely associated with burnout among gynecologic oncologists. It is also consistent with Freire et al. (2020), who found that flourishing mediated the relationship between psychological capital and burnout among teachers. Similarly, Chaylaurent et al. (2024) found that supportive resources were positively associated with subjective well-being among healthcare workers in Batam, highlighting the relevance of positive psychological functioning in demanding occupational contexts. Evidence from manufacturing research further indicates that positive psychological resources are relevant to employee well-being. For example, psychological capital and self-esteem have been shown to mediate associations between occupational stress, burnout, and well-being among manufacturing workers. Similarly, Zhou et al. (2022) found that occupational stress was significantly associated with burnout among female manufacturing workers and that social support was relevant to lower burnout.

The mediation analysis provided evidence that flourishing was associated with the indirect pathway linking resilience and burnout. The indirect effect of resilience on burnout through flourishing was $b = -0.3263$, with a bootstrap standard error of 0.0973 and a 95% bootstrap confidence interval ranging from -0.5197 to -0.1361 . Because the confidence interval did not include zero, the indirect effect was statistically significant. The indirect effect indicates that higher resilience was associated with higher flourishing, which in turn was associated with lower burnout. This pattern provides support for the proposed resilience, flourishing, and burnout pathway. It is also theoretically consistent with JD-R theory: resilience may function as a personal resource, while flourishing represents a positive state of psychological functioning through which personal resources are related to employee well-being.

Importantly, the direct association between resilience and burnout became non-significant after flourishing was included in the model ($b = -0.0142$, $SE = 0.1069$, $t = -0.1333$, $p = 0.8942$, 95% CI $[-0.2260, 0.1975]$). Therefore, the results are more consistent with

an indirect-only mediation pattern than with partial mediation. In other words, after accounting for flourishing, the data did not show a statistically significant residual direct association between resilience and burnout. This finding suggests that flourishing may represent an important statistical pathway linking resilience with burnout in this sample. The findings are broadly consistent with Freire et al. (2020), who reported that flourishing mediated the relationship between psychological capital and burnout among teachers. However, the present study extends that evidence in two ways. First, it examines resilience separately rather than treating it only as one component of the broader psychological capital construct. Second, it applies the model to operator-level manufacturing workers, a group exposed to distinctive demands such as shift work, production targets, repetitive tasks, and limited recovery opportunities. Thus, the study provides preliminary evidence that the relationship between resilience and burnout in manufacturing may be statistically transmitted through work-related flourishing.

Thus, the observed association between resilience and burnout in the present sample was primarily represented by an indirect pathway through flourishing rather than by a remaining direct association. From a JD-R perspective, this finding extends the framework by suggesting that personal resources such as resilience may be linked to burnout not only through the reduction of strain but also through the promotion of positive psychological functioning at work. However, because the data were cross-sectional, the findings indicate statistical association rather than temporal or causal mediation; longitudinal and multi-source studies are needed to establish the direction of the relationships among resilience, flourishing, and burnout.

CONCLUSION

This study found that resilience was negatively associated with burnout and positively associated with flourishing among operator-level employees at PT Apollo Solar Batam. Flourishing was also negatively associated with burnout. The bootstrapping analysis indicated a statistically significant indirect association between resilience and burnout through flourishing (indirect effect = -0.3263 , BootSE = 0.0973 , 95% bootstrap CI [-0.5197 , -0.1361]), whereas the direct

association between resilience and burnout was not statistically significant after flourishing was included in the model ($b = -0.0142$, $p = 0.8942$, 95% CI [-0.2260 , 0.1975]). This pattern is consistent with an indirect-only mediation, although the cross-sectional design does not establish temporal ordering or causal mediation. Theoretically, these findings extend the application of the JD-R framework by suggesting that personal resources such as resilience may be associated with burnout not only through reduced strain but also through positive psychological functioning represented by flourishing.

Practical Implication (Suggestions)

Human Resources Development: The company, through Human Resource Development (HRD) and management, may consider developing programs that support employee resilience and job flourishing as part of broader efforts to promote psychological well-being and address burnout risk. Such initiatives may include activities that strengthen employees' coping resources, positive work experiences, and supportive workplace conditions. However, the effectiveness of specific interventions in reducing burnout should be evaluated in future research.

For Future Researchers: Future researchers may consider using longitudinal or mixed-methods designs to provide a more comprehensive understanding of the relationships among resilience, flourishing, and burnout. Future studies may also incorporate additional variables, such as perceived organisational support, work engagement, and job satisfaction, to further develop the research model and examine other factors that may be associated with burnout among manufacturing workers.

Research Limitations

1. Personnel working in the industrial sector were the only subjects of this study. Hence, due to differences in personality traits, company culture, and job requirements, the study's findings cannot be applied to other industries just yet.
2. This research has limitations in the data collection process because the distribution of

the questionnaire through Google Form was done with the assistance of the company's Human Resource (HR) department according to the mechanisms in place in the research environment. This condition caused the researcher to be unable to accompany or directly observe the process of respondents filling out the questionnaire.

3. Research on flourishing among manufacturing workers is still relatively limited. As a result, the interpretation of this research's findings cannot yet be comprehensively compared with empirical findings in the manufacturing industry context, especially regarding the role of flourishing as a mediating variable.

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