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Research Article

The Role of Gamification as an Intervening Variable in the Influence of Digital Competence and Work Flexibility on the Performance of Gig Logistics Workers in Semarang City

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Abstract: The development of the digital economy has led to an increase in the number of gig workers in the logistics sector, including in the city of Semarang. However, work flexibility, as a key feature of the gig system, has not been fully able to optimize worker performance. The phenomena of long working hours, fatigue, and performance differences between workers indicate that digital competence and work flexibility require supporting mechanisms that can increase work engagement. In this context, gamification on digital logistics platforms is seen as a strategic approach to increase the motivation and performance of gig workers. This study aims to analyze the effect of digital competence and work flexibility on the performance of logistics gig workers in Semarang City with gamification as an intervening variable. The study uses a quantitative approach through a survey method of logistics gig workers, with data analysis using Partial Least Squares–Structural Equation Modeling (PLS-SEM). The population consists of 128 online driver workers operating in the city of Semarang. The sampling technique used is purposive random sampling. The results of the study indicate that digital competence has a positive and significant effect on the performance of gig logistics workers, while work flexibility has a positive and significant direct effect on the performance of gig logistics workers. Gamification has been proven to have a positive effect on performance and is able to mediate the influence of digital competence and work flexibility on the performance of logistics gig workers. These findings emphasize the importance of continuous gamification implementation in order to optimize the performance of logistics gig workers in the digital economy era.

Keywords: Digital Competence; Gamification; Logistics Gig Workers; Work Flexibility; Worker Performance.

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1. Introduction

The development of the digital economy has led to a significant increase in the number of gig workers in Indonesia, particularly in the online transportation and logistics sectors, which are now the backbone of urban economic distribution. With the number of gig workers reaching around 41.6 million people, this phenomenon is growing rapidly but has not been matched by adequate welfare and job security (Investor.id, 2025). The flexibility offered by digital platforms is often accompanied by long working hours, income uncertainty, and low social security, as reflected in the low participation of informal workers in the Employment Social Security Program (Social Security Administration Agency of Employment)(Bisnis.com, 2025). This situation makes the performance of gig workers an urgent and crucial issue, as it concerns the sustainability of the digital logistics system and the quality of public services, especially in cities with rapid gig economy growth such as Semarang (Ratnawati, 2025).

The literature shows that digital competence plays an important role in improving work effectiveness, technological adaptation, and collaboration in platform-based work environments. On the other hand, work flexibility is often assumed to increase motivation and productivity (Chauhan, 2023). However, empirical findings on gig workers show inconsistent

results, where flexibility actually triggers excessive workloads due to algorithmic pressure from platforms(Arahbanua, 2023). In addition, gamification is widely applied as a strategy to increase worker motivation and engagement through point systems, rankings, and incentives(Marisa et al., 2020). Nevertheless, most studies still examine digital competence, work flexibility, and gamification separately, and have not adequately considered the role of gamification as a connecting mechanism that explains how digital competence and work flexibility can be optimized to improve the performance of logistics gig workers, particularly in the Indonesian context.

Based on this research gap, this article aims to answer fundamental questions about how digital competence and work flexibility affect the performance of gig logistics workers, and to what extent gamification engagement plays a role in this relationship. Specifically, this study examines the influence of digital competence on performance, the influence of work flexibility on performance, the influence of gamification on performance, and the influence of digital competence and work flexibility on gamification engagement. These questions are important because they have not been answered systematically and simultaneously in studies of logistics gig workers.

This research is necessary because it makes a distinctive contribution compared to previous studies by placing gamification as an intervening variable in the model of the relationship between digital competence, work flexibility, and the performance of gig workers in logistics. Theoretically, this research enriches the study of the gig economy by integrating the perspectives of digital competence, flexible work design, and gamification-based motivation theory. Practically, the research findings are expected to serve as a basis for digital platform managers and policymakers in designing more adaptive, equitable, and sustainable work systems, particularly in improving the performance of gig workers in the urban logistics sector, such as in the city of Semarang.

2. Literature Review

SDT Theory

Self-Determination Theory (SDT), proposed by Deci and Ryan, explains that individual motivation and performance are determined by the fulfillment of three basic psychological needs, namely autonomy, competence, and relatedness. The fulfillment of these needs encourages more autonomous behavior regulation, increases intrinsic motivation, and has a positive impact on individual well-being and performance (Leavell, 2016)(Gunasekare, 2016) (Wood & Lehdonvirta, 2025).

In the context of gig workers in logistics, digital competence reflects the fulfillment of competence needs, work flexibility represents autonomy needs, while gamification plays a role in fulfilling connectedness needs through engagement mechanisms, social recognition, and feedback. However, previous studies tend to examine each of these psychological needs partially. Therefore, this study adopts SDT as a grand theory to explain the role of gamification as an intervening variable in the relationship between digital competence, work flexibility, and the performance of logistics gig workers.

Digital Competence

Digital competence is defined as an individual's ability to use digital technology effectively, critically, and responsibly, including information and data literacy, digital communication and collaboration, content creation, digital security, and technology-based problem solving. Recent empirical studies show that the level of digital competence among workers and students is still in the intermediate category, with the main weaknesses being in information literacy and digital source evaluation (Silva-Quiroz & Morales-Morgado, 2022)(Basilotta-Gómez-Pablos et al., 2022).

In the context of platform-based work, digital competence is a key prerequisite for gig workers to understand application systems, assignment algorithms, and performance assessment mechanisms. Scheel et al. (2022) and Rodríguez-García et al. (2022) found that digital competence has a positive effect on performance through increased work efficiency and technological adaptability. However, previous studies have not extensively linked digital competence with gamification engagement as a motivational mechanism, particularly in the logistics sector, thus opening up space for more comprehensive empirical testing.

Work Flexibility

Work flexibility is a work arrangement concept that gives workers the freedom to determine their working hours, location, and methods. Recent literature shows that work flexibility contributes positively to work-life balance, psychological well-being, and employee motivation and performance (Chauhan, 2023)(Bostan & Bîrcă, 2024). However, work flexibility in the context of the gig economy has different characteristics compared to conventional organizations..

For gig workers in logistics, work flexibility is often illusory because it is influenced by algorithmic pressure and platform targets. Empirical studies show that flexibility without adequate organizational support and digital competence actually encourages excessive working hours and work fatigue (Wöhrmann et al., 2021) (Arahbanua, 2023). Therefore, this study views work flexibility not only as a direct factor in performance, but also as a determinant of gamification engagement that has the potential to mediate this relationship.

Gamification Engagement

Gamification refers to the application of game elements in non-game contexts to increase individual motivation and engagement. The Octalysis framework developed by Chou emphasizes eight core motivational drivers, which combine intrinsic and extrinsic motivation. Recent research shows that gamification can increase engagement, motivation, and performance through the mechanisms of challenge, reward, immediate feedback, and social interaction (Arahbanua, 2023)(Fathian et al., 2020).

However, most studies still place gamification as an independent variable and have not tested it as an intervening variable. In addition, the effectiveness of gamification is highly dependent on workers' ability to understand and utilize digital systems. A study by Universitas Pahlawan (2022) shows that workers with low digital competence tend to be less engaged in gamification systems(Alfarizi, 2023). Thus, this study positions gamification engagement as a mediating mechanism that bridges the influence of digital competence and work flexibility on the performance of gig logistics workers.

Gig Worker Performance

The performance of gig workers in logistics is defined as the level of individual effectiveness in completing tasks, including work efficiency, service quality, financial well-being, and occupational safety. Recent literature shows that gig worker performance is influenced by complex interactions between platform technology, human resource management design, and psychosocial factors (Hsieh et al., 2023)(Wood & Lehdonvirta, 2025).

Although digital technology can improve the efficiency and accuracy of logistics services, excessive algorithmic control has the potential to reduce worker motivation and performance sustainability. Therefore, this study argues that the performance of gig logistics workers cannot be explained solely by structural factors, but needs to be analyzed through SDT-based motivational mechanisms with gamification as an intervening variable.

3. Materials and Method

Research

This study uses a quantitative design with a causal explanatory approach to examine the predictive relationship between digital competence and work flexibility on the performance of logistics gig workers, with gamification involvement as an intervening variable. The research was conducted in the city of Semarang, which was chosen because it is the center of digital economic growth in Central Java with a competitive and digitized logistics gig worker ecosystem. The research subjects were logistics online motorcycle taxi drivers operating through digital platforms, with a sample size of 128 respondents selected using purposive sampling techniques from the population of logistics online motorcycle taxi drivers in the city of Semarang.

Data collection was conducted using an online questionnaire (Google Form) with a five-point Likert scale, developed based on validated indicators from previous research and adapted to the work context of logistics gig workers. The data used comprised primary data in the form of respondents' perceptions regarding digital competence, work flexibility, gamification engagement, and job performance, as well as secondary data including scientific literature and policy reports related to the gig economy to strengthen the theoretical

foundation. This approach was chosen to ensure that the obtained data are accurate, contextual, and relevant to the dynamics of digital platform-based work..

Data analysis was conducted using Partial Least Squares–Structural Equation Modeling (PLS-SEM), which is prediction-oriented and suitable for complex models with reflective indicators and medium sample sizes. The analysis included an evaluation of the measurement model (outer model) to test the validity and reliability of constructs, as well as an evaluation of the structural model (inner model) to examine causal relationships among latent variables. The significance of the relationships was tested using a bootstrapping procedure, while model quality was assessed using R^2 and Q^2 values. This approach was chosen because PLS-SEM does not require strict normality assumptions and is effective for explaining the predictive mechanisms of gig worker performance in a dynamic digital work environment..

4. Results and Discussion

Descriptive Statistics and Preliminary Data Analysis

Based on the respondent characteristics table, this study involved 128 respondents, predominantly male (84.38%), with the majority aged 18–24 years (50%), followed by those aged 25–30 years (25%). This relatively young age composition indicates that the logistics gig sector is an attractive workspace for the early productive-age workforce, who generally have a high level of adaptability to digital technology. In terms of education, most respondents have completed high school/equivalent (53.13%) and undergraduate/bachelor's degree (28.13%), indicating that logistics gig work is inclusive and accessible to workers with medium to high educational backgrounds, while also reflecting the flexibility of this sector as an alternative or complement to formal employment..

Based on work experience, the majority of respondents have been working for 1–2 years (37.50%) and 3–4 years (25%), indicating that most workers are in the early to mid stable phase of their gig careers. This suggests a fairly good retention rate in platform-based jobs, despite the flexible nature of the work. In terms of platforms, Shopee is the most widely used application (34.38%), followed by Gojek (21.09%), as well as Shopee Food and Grab (17.19% each), reflecting the dominance of e-commerce and on-demand service platforms in absorbing gig logistics labor. The variation in application usage also indicates a platform diversification strategy employed by workers to maximize income opportunities.

Regarding work time dynamics, the quietest day at work is generally experienced on Wednesday (16.41%) as well as on certain weekends like Saturday and Saturday–Sunday (12.50% each), while the busiest days occur from Monday to Friday (29.69%) and Saturday–Sunday (14.06%). This pattern reflects fluctuations in demand for logistics services influenced by the rhythm of economic activity and consumer behavior. In terms of income, on the busiest days, most respondents earn IDR 201,000–IDR 300,000 (47.66%), whereas on the quietest days, the majority earn between IDR 51,000–IDR 100,000 (41.41%), indicating daily income volatility as an inherent characteristic of gig work. In addition, most respondents consider this job as a side job (62.50%) and almost all of them use their own vehicles (93.75%), which confirms the character of logistics gig workers as flexible workers with a high level of independence while bearing operational risks based on personal assets. This explanation can be seen in the following Table 1:

Table 1. Research Respondent Identity.

Characteristics	Description	Frequency	Percentage
Respondent's Gender	Man	108	84,38
	Woman	20	15,63
	Total	128	100
Age of Respondents	18 - 24 years old	64	50
	25 - 30 years old	32	25
	31 - 59 years old	28	21,88
	> 59 years old	4	3,13
	Total	128	100

Characteristics	Description	Frequency	Percentage
Respondent Education	Junior High School / Equivalent	4	3,13
	High School / Equivalent	68	53,13
	Currently Studying at University	16	12,50
	Diploma/Associate Degree	4	3,13
	Bachelor's degree/Bachelor	36	28,13
	Total	128	100
Respondent's Length of Service	< 1 year	21	16,41
	1-2 year	48	37,50
	3-4 year	32	25,00
	5-6 year	11	8,59
	> 6 year	16	12,50
	Total	128	100
Type of Respondent Applicator	Gojek	27	21,09
	Shoppe	44	34,38
	Spx Express	4	3,13
	Shopee Food	22	17,19
	Grab	22	17,19
	Mix apps	9	7,03
	Total	128	100
The quietest day at work for respondents	Every Morning	6	4,69
	Monday	11	8,59
	Wednesday	21	16,41
	Friday	11	8,59
	Saturday	16	12,50
	Sunday	5	3,91
	Friday-Sunday	5	3,91
	Friday-Sunday	16	12,50
	Tuesday-Thursday	5	3,91
	Tuesday-Wednesday	11	8,59
	Monday, Tuesday	5	3,91
	Monday-Wednesday	5	3,91
	Amount	128	100
	Sunday	14	10,94
Busiest day when the respondent is working	Monday	14	10,94
	Kamis	5	3,91
	Saturday	9	7,03
	Friday-Sunday	5	3,91
	Wednesday and Sunday	5	3,91
	Wednesday-Saturday	5	3,91

Characteristics	Description	Frequency	Percentage
	Saturday-Sunday	18	14,06
	Monday - Thursday	5	3,91
	Monday, Saturday	5	3,91
	Monday-Friday	38	29,69
	Every Night	5	3,91
	Amount	128	100
	150.000-200.000	39	30,47
Most Common	201.000-300.000	61	47,66
Respondent	301.000-400.000	10	7,81
Income	401.000-450.000	9	7,03
	> 450.000	9	7,03
	Amount	128	100
	<= 15.000	9	7,03
Respondents with	20.000-50.000	31	24,22
the lowest income	51.000-100.000	53	41,41
	101.000-200.000	22	17,19
	201.000-300.000	9	7,03
	> 300.000	4	3,13
	Amount	128	100
	Main Job	48	37,50
Respondent's	Side Job	80	62,50
Employment	Amount	128	100
Status	Own	120	93,75
Respondent	Parents' Belonging	8	6,25
Vehicle Ownership	Amount	128	100

These findings quantitatively indicate the presence of economic instability that has the potential to create structural conflicts within gig work practices.

Measurement Model Evaluation (Outer Model)

The feasibility of the instrument was tested through outer loading, Average Variance Extracted (AVE), Cronbach's Alpha (α), and Composite Reliability (CR) with the following criteria:

$$\text{AVE} \geq 0{,}50; \alpha, \text{CR} \geq 0{,}70$$

All indicators have outer loadings > 0.70, indicating good convergent validity. The AVE values range from 0.707 to 0.803, while CR ranges from 0.878 to 0.942.

Table 2. Construct Validity and Reliability.

Construction	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Work Flexibility	0,889	0,886	0,925	0,756
Digital Competence	0,826	0,829	0,896	0,741
Gamification Engagement	0,917	0,929	0,942	0,803
Logistics Gig Worker Performance	0,793	0,799	0,878	0,707

These results confirm that the constructs of work flexibility, digital competence, gamification engagement, and gig worker performance are measured reliably and validly, making them suitable for hypothesis testing.

Structural Model Evaluation and Hypothesis Testing (Inner Model)

Hypothesis testing is carried out through path coefficient analysis with the significance criteria of t-statistic > 1.96 and p < 0.05.

Table 3. Path Coefficients and Significance.

Construction	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
X1 Digital Competence -> Y Gig Worker Performance	0,328	4,319	0,000
Z Gamification Engagement -> Y Gig Worker Performance	0,272	3,725	0,000
X2 Work Flexibility -> Y Gig Worker Performance	0,416	7,467	0,000
X2 Work Flexibility -> Z Gamification Engagement	0,487	8,442	0,000
X1 Digital Competence -> Y Gamification Engagement	0,318	4,300	0,000

The results show that:

H1: Digital competence has a positive effect on gig worker performance (β = 0.328; p < 0.001)

H2: Gamification engagement has a positive effect on gig worker performance (β = 0.272; p < 0.001)

H3: Work flexibility has a positive effect on gig worker performance (β = 0.416; p < 0.001)

H4: Work flexibility has a positive effect on gamification engagement (β = 0.487; p < 0.001)

H5: Digital competence has a positive effect on gamification engagement (β = 0.318; p < 0.001)Nilai R^2 kinerja = 0,672, yang berarti 67,2% variasi kinerja pekerja gig dapat dijelaskan oleh fleksibilitas kerja, kompetensi digital, dan keterlibatan gamifikasi.

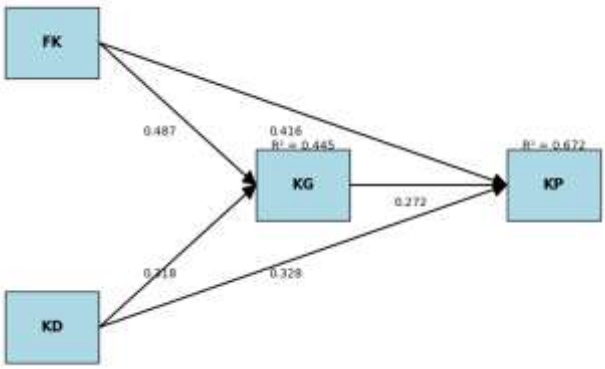

Figure 1. Structural model path diagram.

Mediation Analysis and Effect Size

The mediation effect was analyzed using specific indirect effects and the upsilon (υ) index, with the formula:

$$\boldsymbol{\upsilon} = \frac{(\boldsymbol{a} \times \boldsymbol{b})^2}{\text{total effect}}$$

The results show that:

1. Work flexibility mediation → gamification → performance has υ = 0.032
2. Digital competence mediation → gamification → performance has υ = 0.018

Both are considered low mediation, although statistically significant. This means that gamification engagement acts as an additional enhancer, not the main mechanism in explaining performance improvement.

5. Comparison

This study shows that the performance of gig workers is primarily determined by structural work factors. Job flexibility and digital competence have a greater direct and total effect compared to gamification engagement. These findings reinforce the view that work design in the gig economy plays a central role in shaping worker performance(Samad et al., 2024). With the total effect of job flexibility on performance being the most dominant, the results of this study confirm that gig worker performance relies more on the work system structure than on motivational mechanisms alone.

The findings of this study need to be understood in the context of gig work controlled by digital platform algorithms. Algorithms regulate the distribution of orders, incentives, and work pace dynamically, creating income uncertainty and performance pressure(Samad et al., 2024). Data on income fluctuations between busy and slow days reinforce this context. In such a work environment, work flexibility serves a dual function as both an economic opportunity and a source of structural tension affecting worker well-being.

The relationship between variables indicates that conflict in gig work is latent and structural. Work flexibility and digital competence enhance performance, but they also increase exposure to algorithmic demands. This is reflected in the direct effects of WF and DC being greater than the mediating effects of gamification. This pattern is consistent with findings that performance pressure in digital work is often embedded in system design, rather than in social relationships between individuals(Cheah et al., 2023). Thus, gig work conflict emerges as a logical consequence of the digital work structure.

This study provides the understanding that performance improvement in the gig economy does not always stem from intrinsic motivation or symbolic incentives. Although gamification is significant, its role is complementary. This aligns with the view that gamification is more effective as a supporting mechanism rather than a primary driver of performance (Ramadhan et al., 2023)(Putranti et al., 2024).The key insight from this study is that the sustainability of gig workers' performance requires improvements in work structure and enhancement of digital capacity, not merely optimization of incentives.

The findings of this study are in line with research that emphasizes the role of work flexibility and digital competence in enhancing the performance of platform-based workers (Sindal & Bhate, 2025)(Uddin & Das, 2023). However, this study extends the literature by showing that gamification only acts as a weak mediator. In contrast to studies that position gamification as a primary driver of engagement and performance(Wibisono et al., 2023), these results affirm the dominance of structural factors in gig work.

The practical implications of this study emphasize the need for a shift in digital platform management strategies. Platforms need to prioritize structured and fair work flexibility, as well as strengthen digital competencies through ongoing training. Gamification should be designed to support safety and well-being, not just productivity. This approach aligns with literature recommendations that emphasize sustainable work design in the digital economy (Flora et al., 2025)(Samad et al., 2024).

6. Conclusion

This study shows that the performance of gig workers is largely influenced by structural work factors, particularly work flexibility and digital competence. This is evident from the analysis results, which indicate that the impact of these two variables is greater compared to gamification. Thus, the main contribution of this study is to provide an overview that gig workers' performance is not only influenced by motivation or incentives but is more determined by the systems and work patterns implemented by digital platforms.

Theoretically, this study adds to the understanding that gamification serves as a supporting factor, rather than a primary factor, in improving gig worker performance. The PLS-SEM method used helps to comprehensively explain the relationships between variables. However, this study still has limitations due to the use of cross-sectional data and a limited number of respondents. Therefore, the results of this study should be understood as a depiction of conditions at a certain point in time, rather than as an absolute conclusion.

The results of this study imply that digital platforms need to pay attention to clearer and fairer work arrangements, as well as improve the digital skills of gig workers. Gamification can still be used, but it should not be the main focus in performance improvement. For future research, it is recommended to use a larger dataset, a longer time period, and to include other variables such as well-being and job satisfaction to gain a more comprehensive understanding of gig work.

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