Decoding the Digital Dilemma: Unraveling the Relationship Between Algorithmic Management and Employee Turnover Intentions in Online Work Platforms

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Abstract. With the continuous development of big data, artificial intelligence, and cloud computing, the platform economy is steadily rising, giving rise to diverse forms of employment. Online platform algorithm management, facilitated by network information technology, utilizes online platforms as carriers and employs data-driven algorithms to achieve highly efficient and precise matching services, as well as intelligent labor process management. To comprehensively understand the underlying influence mechanism of online platform algorithm management on employees, this paper focuses on studying the impact of algorithm management on employee turnover intention at the individual level. Through an extensive review of literature, questionnaire surveys, and analysis, this study aims to investigate the mechanism by which algorithm management affects turnover intention, as well as the mediating role of employee engagement in the relationship between turnover intention. By conducting a detailed analysis of the questionnaire data, this study provides a fresh perspective and theoretical foundation for human resource management in the context of online labor platforms. To explore the application of online algorithm management in the food delivery platform and its impact on employee turnover intentions, this study received 224 valid responses from rider employees in the food delivery industry. The research findings indicate that the application of algorithms significantly predicts turnover intention in a positive manner and employee engagement mediates the relationship between algorithm management application and turnover propensity. These research conclusions offer a fresh perspective and theoretical basis for understanding rider departure behavior on effective food delivery platforms and the application of online algorithm management in the food delivery industry.

Keywords: online labor platform; algorithm management application; employee engagement; turnover intention

1 Introduction

In recent years, digital labor platforms in China have experienced rapid development and attracted a large number of platform workers. Unlike traditional management approaches, these digital labor platforms employ algorithmic labor control methods, which involve real-time data acquisition and analysis through algorithms to establish objective functions for supervising and optimizing the labor process of each worker. As a new management tool in the digital era,

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algorithmic management not only brings about a novel working experience for workers but also profoundly impacts their psychology and behavior [1].

Based on the current situation, research on the impact of online platform algorithm management on employee turnover intention by domestic and international scholars is scattered and has not yet formed a comprehensive theory. Existing studies mostly focus on the overall impact of online labor mechanisms on employee autonomy, while there is insufficient research on the potential negative effects of algorithm management on employee engagement and subsequent turnover intention. Previous research has confirmed that algorithmic management can reduce employee autonomy, alter their career development, and create a sense of technological dependency, which in the long run can affect employee engagement and lead to a tendency to leave the job. However, further research is needed to deepen our understanding of this phenomenon.

Indeed, online platform algorithm management is a future trend in employment management, and it is crucial to explore its impact on employee intentions. This study aims to examine the relationship between online platform algorithm management and employee turnover intention. On one hand, it can fill the theoretical gap in the academic community regarding the study of online platform algorithms and employee behavior. On the other hand, it can provide valuable insights and guidance for organizational leaders to better mitigate employee turnover rates. Understanding the effects of algorithm management on employee intentions is of utmost importance in shaping future employment practices and optimizing employee retention strategies.

For online labor platforms, job flexibility is accompanied by high employee mobility. Currently, the largest online labor platform is the food delivery platform. Moreover, there is significant public discourse surrounding the large group of delivery riders, making them the most representative subject of this study. However, the issue of reducing turnover among delivery riders has encountered obstacles when considering the practical circumstances of the companies. Therefore, this paper takes a perspective from platform algorithm management to analyze in-depth the mobility and high turnover rate of delivery riders.

2 Literature Background & Theory Development

2.1 The application of algorithm management in online platforms

Online platforms have emerged as a new form of industrial organization in the platform economy, developed through internet technology. The advancement of digital technology has given rise to new forms of flexible employment. Online labor platforms utilize algorithm technology and data information to achieve rapid and accurate matching of labor supply and demand. For example, all food delivery platforms use algorithm management to allocate and evaluate work. However, this management model also reflects a tendency towards "algorithmic authoritarianism," where platform companies exert control and dominance through technology. Research by Zhan and Zhao points out the dual-edged effect of algorithm management, as it empowers but also burdens individuals [1].

2.2 Employee engagement

Saks (2006) referred to employee engagement as the degree to which an individual takes responsibility for and is involved in their work role [2] . Furthermore, employee engagement is considered a positive and satisfying behavior related to work, characterized by three elements: vigor, interest, and dedication. Employee engagement is crucial for organizations to achieve valuable market success outcomes across various contexts [3].

2.3 Turnover intention

Turnover intention refers to the employee's awareness or idea of resignation, which is considered to be a key premise of actual voluntary resignation [4]. High employee turnover leads to direct and indirect costs such as costs associated with recruiting and training new employees, as well as loss of organizational knowledge and cohesion culture, which in turn affects the normal operation of the organization [5]. Therefore, the academic community has paid a lot of attention to employee resignation and resignation intention [4].

2.4 Hypothesis and research model

Research on the negative impact of algorithmic management on employee work in online platforms has mainly focused on employees' negative emotions, with a smaller portion examining employee behaviors such as counterproductive work behavior and turnover. Algorithmic management in food delivery platforms typically manifests in controlling employees' time, order arrangements, and other work-related controls. Prior research pointed out that platform algorithmic management can influence turnover intention by increasing employees' perception of professional stigma [6]. Research by Sun et al. indicated that under the context of platform algorithmic management, perceived control has an impact on employee emotional exhaustion [7].

Based on the interview results of this study, confirmatory factor analysis was conducted on the items of the algorithmic management scale, resulting in the identification of three important dimensions of algorithmic management: platform control, evaluative interactive management, and autonomy control. The interview content also indicated that the application of platform algorithmic management has a negative impact on the work attitudes of delivery riders, leading to a tendency to quit. Based on this, hypothesis H1 was proposed:

H1: The application of algorithmic management in online work platforms has a positive prediction on employee turnover intention, meaning that the higher the application of algorithmic management in online work platforms, the higher the tendency to quit.

According to the Job Demands-Control Theory, job demand is considered as a stressor in the work environment, which will lead to stress. Job control refers to the degree of decision-making autonomy that workers have in the work, while high demand and low control will lead to the worst happiness of employees [8]. An article has compiled relevant studies and concluded that low control or low autonomy affects employees' well-being through stress and burnout, resulting in negative work performance [9]. According to the Conservation of Resources Theory, individuals gain or lose resources through their interaction with environmental elements. Faced with the loss of resources such as control and autonomy, individuals develop negative work attitudes and emotions [10, 11], such as insecurity, stress, and emotional exhaustion [12].

The application of algorithmic management has changed the nature of work, job content, and skill requirements. Faced with the high control exerted by algorithmic management, employees often adopt negative psychological defense strategies to preserve existing resources, exhibiting negative and resistant emotions. Based on this, hypothesis H2 was proposed:

H2: Employee engagement has a negative predictive effect on employee turnover intention, meaning that the higher the employee engagement, the lower the turnover intention, while the lower the employee engagement, the stronger the turnover intention.

In studies related to employee engagement, Saks (2006) first proposed a negative correlation between employee engagement and turnover intention [2]. Lin (2016) summarized in their study on the impact of work-family conflict on turnover intention that organizational engagement and job engagement have a negative influence on turnover intention [13]. Gasic and Berber drew similar conclusion that employees have lower turnover intention when they are more engaged [14]. Based on this, hypothesis H3 was proposed:

H3: Employee engagement is negatively correlated with turnover intention, meaning that the lower the employee engagement, the stronger the inclination to leave the job.

This paper assumes the following equation. The logical model construction is shown in Figure 1.

$$Y = cX + e1 \quad (1)$$

$$M = aX + e2 \quad (2)$$

$$Y = c'X + bM + e3 \quad (3)$$

X is the algorithm management application; Y is the turnover intention; M is employee engagement; C 'is the direct effect of independent variable X on dependent variable Y after controlling the influence of mediating variable M; C is the total effect of X on Y; e1 - e3 are regression residua.

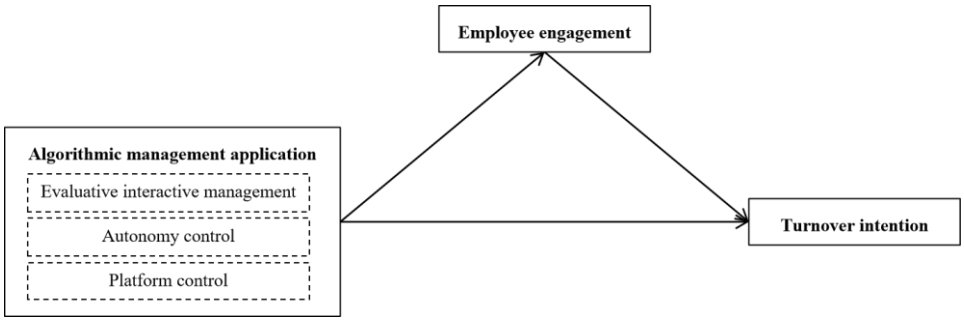

Figure 1: Research Model

3 Research Design

3.1 Sample and data collection

Two hundred and twenty-four participants were enrolled in the experiment. Table 1 lists their demographic information. Among the surveyed riders, 68.3% are from first-tier and second-tier cities, with 122 males and 102 females. 40.2% of the riders are aged between 25-35,

approximately 27.7% are aged between 18-25 and 35-45, while 4.5% are over 45 years old. The education level of the riders is generally low, with 70.1% having a high school or undergraduate degree. The average income level of the riders is also low, with 30.8% having 1-2 years of work experience. 55.3% of the respondents have worked for less than a year, and part-time riders account for 53.4% of the total. This suggests a high turnover rate among delivery riders in the food delivery platform.

Table 1: Participants' demographic information

	Group	N	Proportion (%)
City level	First-tier city	54	24.1
	Second-tier city	99	44.2
	Third-tier cities	56	25.0
	Others	15	6.7
Gender	Male	122	119.6
	Female	102	45.5
Age group	18-25	62	27.7
	25-35	90	40.2
	35-45	62	27.7
	Above 45	10	4.5
Work type	Full-time rider on the delivery platform	49	21.9
	Part-time rider on the delivery platform	120	53.6
	Full-time riders on third-party platforms	48	21.4
	Part-time riders on third-party platforms	7	3.1
Income	Less than 2000	18	8.0
	2000-4000	84	37.5
	4000-6000	81	36.2
	6000-8000	28	12.5
	More than 8000	13	5.8
Working experience	Less than 6 months	46	20.5
	6-12 months	78	34.8
	1-2 years	69	30.8
	2-3 years	26	11.6
	More than 3 years	5	2.2
Education level	Junior high school and below	31	13.8
	High school	126	56.3
	Undergraduate	59	26.3
	Graduate or above	8	3.6

3.2 Measures

Algorithm management application scale. There is currently no comprehensive scale for measuring online algorithmic management. Based on the literature, researchers have developed interview questions as independent variables. Liu et al. (2021) believe that online labor platform algorithmic management controls the labor process of employees and reduces their autonomy [15]. The work is divided into three stages: work preparation, work execution, and work feedback, which are further subdivided into ten variables. Based on this, interviews were conducted with 60 food delivery riders, and the interview content was used to select independent variables for questionnaire development. These variables include platform electronic

monitoring, technological connectivity, behavioral control, digital reputation, compensation system, and task acceptance. After confirmatory factor analysis, 30 items were retained, and three dimensions were extracted: platform control, evaluation and interaction management, and autonomy control.

Employee engagement scale. The Utrecht Work Engagement Scale (UWES) was chosen to assess work engagement [16], it has become the mainstream tool widely used for measuring employee work engagement in relevant empirical research.

Turnover intention scale. In this study, the turnover intention was measured using the turnover intention scale utilized by Weng and Xi, consisting of four items [17].

3.3 Data analysis

3.3.1 Reliability and validity.

We analyzed the reliability and validity by using SPSS 23.0 on two criteria: (1) Cronbach's alpha should be above 0.7; (2) KMO should be above 0.5 with significance is smaller than 0.05. The results are shown in Table 2, indicating the plausibility of the questionnaire.

Table 2: Reliability and convergent validity analysis

Variable	KMO	Bartlett's Test of Sphericity			N	Cronbach's α
		Value	df	sig.		
Algorithm management	0.656	139.619	10	.000	30	0.964
Turnover intention	0.858	306.171	15	.000	4	0.957
Employee engagement	0.816	926.337	136	.000	17	0.962

3.3.2 Algorithmic management and employee turnover intention.

The regression analysis results indicate that algorithmic management application has a significant impact on employee turnover intention, with $F = 123.741$, $p < 0.001$ (See Table 3). Additionally, the algorithmic management application can explain 35.5% of the variance in employee turnover intention, indicating a good fit of the regression equation. The linear relationship of the regression equation is significant, providing support for hypothesis 1. Furthermore, the algorithmic management application has a positive influence on employee turnover intention.

Table 3: Results of linear regression analysis of calculation management application and turnover tendency

	Unstandardized coefficients		Standardization coefficient	t	p	Adjust R^2	F
	β	SE	t				
constant	1.115	0.206	-	5.415	0.000	0.355	123.741***
Algorithm management	0.659	0.059	0.598	11.124	0.000		

Dependent variable: Turnover intention. Note(s): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.3.3 The mediating role of employee engagement.

This study used SPSS 23.0 PROCESS Model 4 to examine the mediating effect of employee engagement on the relationship between algorithmic management application and employee turnover intention. The results showed that algorithmic management application significantly negatively predicted employee engagement, with $\beta = -0.843$, $SE = 0.063$, $p < 0.001$. When both algorithmic management application and employee engagement were included in the regression equation, algorithmic management application significantly positively predicted employee turnover intention, with $\beta = 0.319$, $SE = 0.072$, $p < 0.001$, while employee engagement significantly negatively predicted employee turnover intention, with $\beta = -0.403$, $SE = 0.057$, $p < 0.001$ (See Table 4). This indicates that employee engagement plays a mediating role between algorithmic management application and turnover intention, providing support for hypothesis 2 and hypothesis 3.

The mediation analysis involved three models, which are described as follows:

$$Y = 0.659X + 1.115 \quad (4)$$
$$M = -0.843X + 6.092 \quad (5)$$
$$Y = 0.319X - 0.403M + 3.571 \quad (6)$$

Table 4: Results of the mediation effect analysis

	Turnover intention			Employee engagement			Turnover intention		
	β	SE	t	β	SE	t	β	SE	t
constant	1.115	0.206	5.415***	6.092	0.219	27.793***	3.571	0.394	9.058***
Algorithm management	0.659	0.059	11.124***	-0.843	0.063	-13.351***	0.319	0.072	4.435***
Employee engagement							-0.403	0.057	-7.070***
R-sq		0.355***			0.443***			0.472***	
F		123.741			178.255			100.514	

Note(s): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4 Conclusions

4.1 Summary of findings

The application of algorithmic management on online work platforms positively predicts employee turnover intention. Specifically, a higher degree of algorithmic management application (manifested as platform control, evaluation interactive management, and autonomy control) is associated with a higher turnover intention. Moreover, this study demonstrates that the application of platform algorithmic management influences turnover intention through employee engagement.

4.2 Theoretical significance

This paper provides new theoretical support in the field of organizational behavior and management, revealing the underlying mechanism of algorithmic management's impact on employee turnover intention. Additionally, the study identifies three important features of algorithmic management: platform control, evaluation interactive management, and autonomy control, laying the foundation for future research.

4.3 Practical significance

Organizations should prioritize the reasonable and effective application of algorithmic management on online work platforms, particularly in terms of platform control, evaluation interactive management, and autonomy control, to mitigate employee turnover and attrition. To reduce employee turnover intention, organizations can take measures to enhance employee engagement. By implementing incentives, training programs, and development opportunities, organizations can foster greater commitment and loyalty among employees, thereby reducing the likelihood of employees leaving due to turnover intention. When designing and implementing algorithmic management on online work platforms, organizations should consider the influence mechanism of employee engagement. Setting appropriate indicators and evaluation criteria for algorithmic management ensures that these measures stimulate employee engagement and subsequently reduce turnover intention.

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