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The Curvilinear Relationship between Telecommuting and Work Engagement: The Roles of Autonomous Motivation and Work Boundary Strength

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Abstract: This study explores the curvilinear relationship between telecommuting and work engagement based on self-determination theory, while examining the mediating role of autonomy motivation and the moderating effect of work boundary strength. Data were collected from 358 members of knowledge enterprises over three waves, each 10 days apart. Hierarchical regression analysis and PROCESS macros were employed to test the conceptual model. The findings reveal an inverted U-shaped relationship between telecommuting intensity and both work engagement and autonomy motivation. Autonomy motivation mediates the relationship between telecommuting intensity and work engagement. Work boundary strength moderates the inverted U-shaped relationship between telecommuting intensity and autonomy motivation. By investigating the inverted U-shaped relationship between telecommuting intensity and work engagement, this paper offers a new explanation for understanding the differences between telecommuting and work engagement. It also extends the interpretation of the “too much of a good thing” effect in the workplace and enriches research in the field of telecommuting.

Keywords: Telecommuting; Autonomy Motivation; Work Engagement; Work Boundary Strength; Self-determination Theory

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1.Introduction

The digital economy era has brought significant changes to the daily work and lifestyle of organizational members [1]. Telecommuting is gradually becoming the new norm, and many companies are adopting telecommuting and remote communication and collaboration to replace traditional on-site work patterns [2]. According to a 2020 global telecommuting survey conducted by YouGov in the UK, more than one-third of respondents are already using telecommuting, while another one-third expressed their willingness to adopt this work mode in the future. These findings highlight the increasingly normalized trend of telecommuting [3]. Therefore, it is important to address the impact of telecommuting on employees and businesses in the digital economy era in current management practices [4].

Telecommuting, a flexible work mode enabled by modern communication technologies, allows employees to work outside of traditional workspaces and is characterized by digitization, separation, and flexibility [5]. As telecommuting becomes increasingly prevalent, scholars have conducted numerous studies exploring its effectiveness [6-7]. Work engagement is one of the many effects of telecommuting and has been a controversial topic, with debates on whether employees engaged in telecommuting have higher work engagement [8]. While some studies have found that telecommuting improves work

engagement [9], others have shown that it has a negative impact [10]. The inconsistency of these research findings suggests that the relationship between telecommuting and work engagement is likely to be complex and nonlinear, rather than a simple linear one [11].

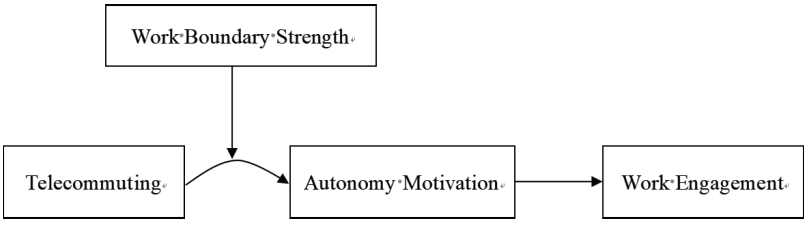
Moreover, as telecommuting has become a defining feature of contemporary work patterns, the knowledge about the impact of telecommuting accumulated by the academic community may lack relevance to the current work situation [12]. This suggests that further exploration of whether and how telecommuting affects employees' work engagement in the context of the digital economy has significant theoretical and practical value [13]. Therefore, this study aims to unveil the possible U-shaped curve relationship between telecommuting and employees' work engagement by integrating previous research findings. This approach overcomes the limitations of solely discussing simple linear relationships and offers a more comprehensive and precise explanation of the relationship between the two.

According to self-determination theory, creating a work environment that meets employees' psychological need for autonomy can promote their sense of autonomy in their work, enhance their autonomy motivation, and generate positive behavioral outcomes [14]. Conversely, if employees' need for autonomy is suppressed, their sense of control in their work increases, and their autonomy motivation weakens, negatively affecting their work engagement [15]. While telecommuting can provide employees with greater autonomy, allowing for better self-directed choices and enhancing their autonomy motivation [8] , an increase in the intensity of telecommuting may present significant work challenges, leading to weakened autonomy and self-control, suppressing their motivation for autonomy [16]. Therefore, a nonlinear relationship may exist between telecommuting and employees' autonomy motivation. As a critical driver of employee engagement, high autonomy motivation makes employees more proactive and engaged in their work [15]. Thus, analyzing the transmission of autonomy motivation through the lens of self-determination theory could be crucial in further uncovering the nonlinear impact of telecommuting on employee work engagement.

Additionally, the impact of telecommuting is often influenced by external environmental factors, such as work boundary intensity, which is an essential work environment factor that is rarely associated with telecommuting [17]. Work boundary strength refers to the measures that organizations use to regulate the mutual penetration of employees' work and non-work areas [18]. According to self-determination theory, supportive and controlling factors in the work environment can significantly affect employees' autonomy motivation [19]. With telecommuting, there is a high degree of mutual penetration between employees' work and personal life. Thus, work boundary strength implemented by organizations can affect employees' perception of work autonomy and control [20], ultimately having varying impacts on their autonomy motivation. Therefore, it is crucial to consider work boundary intensity as a contextual variable when studying the relationship between telecommuting and employees' autonomy motivation.

This study utilizes self-determination theory to develop a theoretical model (Figure1) aimed at exploring the impact of telecommuting on employee work engagement. Autonomy motivation serves as the mediator and work boundary strength as the moderator in the model. The study seeks to deepen our understanding of how telecommuting intensity affects employee work engagement in the digital economy context. Ultimately, the findings will offer scientifically sound recommendations on how enterprises can enhance employee work engagement through effective job design.

Figure1: Conceptual Model.



2.Theories and Hypotheses

2.1 Telecommuting and Work Engagement

Telecommuting is a flexible work arrangement that enables employees to work outside of a fixed office location using modern

information and communication technologies [21]. The concept of telecommuting was first introduced by Nilles in the 1970s during the oil crisis, with the aim of demonstrating that telecommuting could help save oil by reducing commuting time [22]. In the post-pandemic era, telecommuting has become a revolutionary and innovative work mode for enterprises to avoid major crises and market risks, and has thus attracted the attention of scholars [23]. In comparison to telecommuting research, the concept of work engagement was proposed relatively later. It was first introduced by Kahn in 1990 and defined as a positive state where employees are fully invested in their work in terms of physical, cognitive, and emotional aspects [24]. As work engagement is closely related to better performance and well-being, theoretical and practical circles have been devoted to exploring factors that can enhance work engagement [25]. Against the backdrop of the rapid growth of telecommuting, there has been much discussion on the impact of telecommuting on employee work engagement [13-26].

Currently, there are two different views in academia regarding the impact of telecommuting on employee work engagement. On one hand, some researchers suggest that telecommuting is a family-friendly work design and arrangement that is likely to enhance employee work engagement through social exchange [27]. If employees feel that the organization cares about them and trusts that they can maintain work efficiency while telecommuting, they may reciprocate the organization with a positive work attitude and behavior. On the other hand, telecommuting's physical and psychological separation from the workplace may weaken employees' identification with the organization, leading to less social support and feedback and ultimately reducing employee work engagement [13]. Additionally, a recent study suggests that there may be a nonlinear relationship between the intensity of telecommuting and work engagement [28]. This study believes that, from the perspective of the "too much of a good thing" effect, as the intensity of telecommuting increases, employee work engagement will also increase. When the optimal intensity is reached, work engagement will be highest; however, after exceeding this threshold, telecommuting will have a negative impact on work engagement. In other words, as the intensity of telecommuting increases from low to high, it will have significantly different effects on employee work engagement.

Specifically, the impact of telecommuting on employee work engagement is determined by the varying levels of activation experienced by employees during telecommuting interactions. When the intensity of telecommuting is low, employees' activation level is also low, and they may feel bored and shift their attention from work activities to other activities, leading to a depletion of work emotional resources and lower work engagement [29]. However, as the intensity of telecommuting increases, the activation level of employees also increases, enhancing their work engagement. At a moderate activation level, employees can obtain the best resources to maintain their vitality during telecommuting and have higher work engagement [29]. Furthermore, when the optimal activation level is reached, employees are more confident in dealing with the pressure brought by telecommuting, can achieve personal valued work achievements, and experience the meaning of work during telecommuting [30], resulting in higher work engagement.

However, excessive intensity of telecommuting has a negative impact on employee work engagement beyond a critical point due to the "too much of a good thing" effect. High-intensity telecommuting can lead to excessive activation levels, interfering with employees' emotions and cognition, causing higher role stress, resource depletion, and lower work engagement [29-31]. Furthermore, studies indicate an inverted U-shaped relationship between the intensity of telecommuting and employee task performance and satisfaction, suggesting that moderate intensity telecommuting can enhance employee satisfaction and task performance [32]. Based on this, we propose the following hypothesis:

H1: There is an inverted U-shaped curve relationship between telecommuting and work engagement.

2.2 Telecommuting and Autonomous Motivation

Autonomous motivation refers to the behavioral drive that employees generate from their genuine interest in an activity or personal recognition and value, which is a combination of highly internalized external and internal motivation [33]. According to the self-determination theory, autonomous motivation can only be triggered when the support provided by the external environment satisfies the individual's three psychological needs of autonomy, relatedness, and competence, thus having a positive impact on employees' work attitudes and behavior [14].

Telecommuting is an extremely flexible working mode that can meet the needs of both organizations and individual employees. It gives employees the power of self-management and stimulates work autonomy [34]. Telecommuting allows

employees to choose their work location freely, enhancing their sense of control and flexibility in scheduling [8]. This work mode also provides autonomous support, enabling employees' basic psychological needs to be met, which is conducive to the formation of autonomous motivation [35]. However, the impact of telecommuting on employees' autonomous motivation may change as the intensity of telecommuting increases.

Firstly, when telecommuting intensity is low, employees can complete tasks without expending too much time and energy on their work [29]. Although telecommuting can satisfy employees' autonomy needs at this stage, it may not meet the needs of relatedness and competence, thus not effectively activating employees' autonomous motivation.

Secondly, under moderate telecommuting intensity, employees can control the pace of work arrangements and maintain communication and interaction with colleagues in the workplace, effectively dealing with work challenges to gain a sense of achievement [11]. Therefore, they are more likely to meet their basic psychological needs and show higher autonomous motivation.

Finally, as most employees choose to work from home in telecommuting, high telecommuting intensity can easily lead to employees facing higher role conflicts and work pressure, making it difficult for employees to balance their work and family life. It can also breed more negative emotions during telecommuting [21], , thus weakening employees' sense of control over work and making it difficult for their basic psychological needs to be met, which is also not conducive to the formation of autonomous motivation. Based on the above, we propose the following hypothesis:

H2: There is an inverted U-shaped relationship between telecommuting and autonomous motivation.

2.3 The Mediating Role of Autonomous Motivation

According to the self-determination theory, employees with high levels of autonomy and competence are more likely to exhibit high levels of autonomous motivation towards their work [14]. This autonomous motivation can increase their work engagement through a sense of control and competence over the task at hand, as well as the enjoyment of challenging work experiences [29-35]. Empirical studies have also shown that autonomous motivation positively affects employees' work engagement [36]. Therefore, autonomous motivation can promote higher levels of work engagement by increasing employees' willingness and autonomy to engage in their work.

In essence, different levels of telecommuting intensity can impact employees' basic psychological needs in various ways, resulting in varying levels of autonomous motivation in telecommuting. Autonomous motivation is a crucial factor that promotes employees' proactive engagement in work and positively affects their work engagement. Therefore, we propose the following hypothesis:

H3: Autonomous motivation plays a mediating role in the inverted U-shaped relationship between telecommuting and work engagement.

2.4 The Moderating Role of Work Boundary Strength

The increasing popularity of telecommuting and telecommuting has resulted in more complex daily role relationships for employees, blurring the boundaries between work and non-work areas [37]. To regulate employee behavior and prevent excessive overlap between work and non-work activities, companies often establish work boundary policy [38]. Research has demonstrated that strong work boundary strength can make employees feel controlled since it prohibits any non-work behavior, while weak boundary strength allows more autonomy and flexibility in roles [39]. Therefore, work boundary strength could potentially moderate the inverted U-shaped relationship between telecommuting intensity and autonomous motivation.

On the one hand, as the intensity of telecommuting increases, employees with weak work boundary strength have more autonomy and flexibility in their work than those with strong work boundary strength, leading to an increase in autonomous motivation [40]. This flexible work boundary strength creates a supportive work environment in telecommuting, reflecting the organization's trust and support in employees, and largely satisfying employees' psychological needs [41]. Thus, weak work boundary strength can better enhance the positive effect of telecommuting on employees' autonomous motivation than strong work boundary strength.

On the other hand, strong work boundary strength may impose more restrictions on employees during telecommuting compared to weak work boundary strength, creating a controlled work environment that makes employees feel controlled

rather than supported by the organization [39]. This control-type work boundary strength exacerbates employee resource depletion and role pressure, leading to emotional exhaustion and weakening employees' autonomous motivation [42]. Therefore, in the stage of excessive telecommuting intensity, strong work boundary strength adopted by companies can exacerbate the negative effects of telecommuting intensity and be less conducive to the formation of employees' autonomous motivation.

To sum up, under the weak work boundary strength, the inverted U-shaped relationship between telecommuting and autonomous motivation may not be very obvious, while under the strong work boundary strength, the inverted U-shaped relationship between telecommuting and autonomous motivation will be more obvious. Therefore, we propose the following hypothesis:

H4: Work boundary strength moderates the inverted U-shaped relationship between telecommuting and autonomous motivation.

3.Method

3.1 Study Design and Procedure

The study utilized convenience sampling to collect data from knowledge workers in a large state-owned enterprise in Shenzhen. To minimize common method bias, the questionnaire was administered at three distinct time points. Participants were informed of the survey's anonymity and confidential nature for academic research purposes only. The first stage of the questionnaire focused on telecommuting intensity and demographic characteristics, the second stage assessed autonomous motivation and work boundary strength, and the third stage measured work engagement.

Out of 450 questionnaires distributed, 358 valid responses were obtained after eliminating invalid data with excessive missing information or regular response patterns, yielding an effective recovery rate of 79.56%. The majority of participants were male (57.82%), aged between 25-35 years (77.37%), with a bachelor's degree as their primary educational background (43.58%), unmarried (48.88%), and 70.11% working as ordinary employees.

3.2 Measures

Telecommuting intensity. The study assessed the level of telecommuting intensity among participants by asking them to report the number of hours they spent telecommuting in the past week due to the epidemic, following the approach of Golden and Veiga [26]. To ensure measurement reliability, participants also indicated the proportion of their weekly working hours spent telecommuting. Results showed no significant difference between the reported proportion of telecommuting time and actual hours. The study presented the average weekly telecommuting time of the employees to clearly depict telecommuting intensity.

Autonomous motivation. Autonomous motivation was assessed using a 6-item scale developed by Gagné et al. [33], with example items such as "My current work matches my values." The Cronbach's α value was 0.91.

Work engagement. Work engagement was measured using a 9-item scale developed by Schaufeli et al. [24], with example items such as "I can feel myself bursting with energy at work." The Cronbach's α value was 0.91.

Work boundary strength. A 4-item scale developed by Hecht and Allen [18] was used, with example items such as "The company requires complete focus on work-related issues during working hours." The Cronbach's α value was 0.89.

The study controlled for variables such as gender, age, education level, marital status, and job level based on prior research [8-9]. Gender was coded as 1 for male and 2 for female. Age was coded as 1 for "21 years old and below," 2 for "22-30 years old," 3 for "31-40 years old," 4 for "41-50 years old," and 5 for "51 years old and above." Education was coded as 1 for high school (technical school) and below, 2 for junior college degree, 3 for bachelor's degree, and 4 for master's degree and above. Marital status was coded as 1 for married, 2 for unmarried, and 3 for other. Job level was coded as 1 for ordinary employees, 2 for grassroots managers, 3 for middle-level managers, and 4 for senior managers.

4.Results

4.1 Common Method Bias and Confirmatory Factor Analysis

The study employed programmatic control to mitigate the common method bias issue by collecting data at three different

time points. However, to further address the issue, post-hoc statistical control was carried out. Harman's single-factor analysis resulted in three factors, with the first factor accounting for less than 40% of the variance. Confirmatory factor analysis revealed that the single-factor model had poorer fit indices compared to other factor models (Table1). The method factor test was used, but adding a common method bias latent factor did not significantly improve the fit indices of the three-factor model. Based on the analysis, it can be concluded that common method bias has been somewhat effectively controlled.

Table1: Confirmatory Factor Analysis

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$
Model 1 (AM+WE+WBE)	1819.72	152	11.97	0.56	0.50	0.18	0.15	1612.64***
Model 2 (AM, WE+WBE)	982.47	151	6.51	0.78	0.75	0.12	0.12	775.39***
Model 3 (AM, WE, WBE)	207.08	149	1.40	0.98	0.98	0.03	0.04	-
Model 4 (AM, WE, WBE, CMV)	229.86	148	1.55	0.98	0.97	0.04	0.05	-

Note(s): Autonomy motivation = AM; Work engagement = WE; Work boundary strength = WBE; CMV = Common Method Variance; + means to combine factors; $^{***}p < 0.001$.

4.2 Descriptive Statistics and Correlation Analysis

The means, standard deviations, and correlations between variables are shown in Table2. There is a significant positive correlation between telecommuting intensity and autonomy motivation ($r = 0.14$, $p < 0.01$); there is also a significant positive correlation between autonomy motivation and work engagement ($r = 0.49$, $p < 0.01$).

Table2: Descriptive Statistics and Inter-correlations of Variables

Variable	1	2	3	4	5	6	7	8	9
1.Gender	1								
2.Age	0.02	1							
3.Education	0.05	-0.07	1						
4. Marital status	-0.01	-0.10	0.01	1					
5. Occupational level	0.05	0.07	-0.04	-0.03	1				
6. Telecommuting intensity	-0.00	0.04	-0.01	-0.04	-0.01	1			
7. Autonomy motivation	0.08	-0.07	-0.03	0.03	-0.03	0.11*	1		
8. Work engagement	-0.02	-0.04	-0.01	0.03	0.05	0.03	0.49**	1	
9. Work boundary strength	0.03	-0.05	0.03	0.06	0.05	-0.08	-0.10	0.01	1
M	1.59	2.71	2.60	1.51	1.39	24.90	2.98	3.11	3.19
SD	0.49	0.89	0.75	0.50	0.64	9.11	0.84	0.73	0.94

Note(s): N = 358; $^{*}p < 0.05$, $^{**}p < 0.01$ (two-tailed).

4.3 Hypothesis Testing

Prior to hypothesis testing, the variables of telecommuting intensity and work boundary strength were standardized. Table3 displays the results of the hierarchical regression analysis.

Table3: The Results of Hypotheses Testing

Variable	Work engagement			Autonomy motivation		
	M1	M2	M3	M4	M5	M6
Constant	3.28	3.39	2.15	3.10	3.07	3.08
Gender	-0.02	-0.04	-0.09	0.13	0.13	0.14
Age	-0.05	-0.05	-0.02	-0.07	-0.07	-0.07
Education	-0.03	-0.03	-0.02	-0.04	-0.03	-0.02
Marital status	0.02	0.04	0.02	0.06	0.07	0.03
Occupational level	0.05	0.07	0.07	-0.01	-0.00	-0.01
Telecommuting intensity	0.04	-0.08	-0.08^{+}	-0.01	-0.02	-0.04
Telecommuting intensity squared		-0.12***	-0.08**	-0.11**	-0.12**	-0.13***
Autonomy motivation			0.40***			
Work boundary strength					-0.09^{+}	0.02
Work boundary x Work boundary strength						-0.24***
Telecommuting intensity squared x Work boundary strength						-0.10**
R^2	0.01	0.05	0.26	0.05	0.06	0.11
ΔR^2		0.04***	0.21***		0.01	0.05***
F	0.53	2.59*	15.12***	2.74**	2.90**	4.51***

Note(s): $^{+}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Hypothesis 1 stated that work engagement improves with increasing telecommuting intensity, but only up to a certain point after which it decreases. The results presented in Model 2 of Table3 supported this hypothesis, showing a significant negative effect of the telecommuting intensity squared term on work engagement ($b = -0.12$, $p < 0.001$), indicating an inverted U-shaped relationship between telecommuting intensity and work engagement. Thus, H1 was confirmed.

Hypothesis 2 proposed that as telecommuting intensity increased and reached a certain level, employees' autonomy motivation would start to decline. The results were presented in Model 4 of Table3, where the telecommuting intensity squared term had a significant negative impact on autonomy motivation ($b = -0.11$, $p < 0.01$), indicating an inverted U-shaped relationship between telecommuting intensity and autonomy motivation. Therefore, H2 was supported.

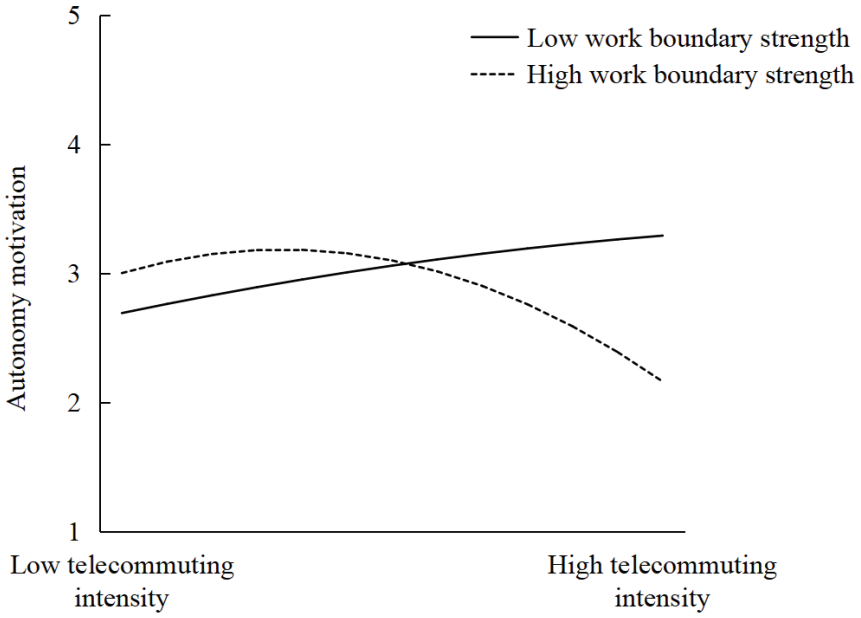
Hypothesis 3 suggested that as telecommuting intensity gradually increased, fluctuations in employees' autonomy motivation would correspondingly affect their work engagement. The results are presented in Model 3 of Table3. After adding autonomy motivation, the impact coefficient ($b = -0.08$, $p < 0.01$) of the telecommuting intensity squared term on work engagement decreased but remained significant, indicating that autonomy motivation partially mediated the nonlinear effect of telecommuting intensity on work engagement. Therefore, H3 was preliminarily validated.

To test the robustness of the curvilinear mediation effect of autonomy motivation, we used the MEDCURVE macro program in SPSS. The results showed that when telecommuting intensity was moderate, the instantaneous effect of autonomy motivation was 0.12 with a confidence interval of [0.06, 0.19]. However, when telecommuting intensity was low or high, the confidence intervals of the instantaneous effect of autonomy motivation included 0. This indicates that when telecommuting intensity was moderate, autonomy motivation played a significant mediating role in the curvilinear relationship between telecommuting intensity and work engagement, thus supporting H3.

Hypothesis 4 suggested that work boundary strength could moderate the nonlinear relationship between telecommuting intensity and autonomy motivation. The results were presented in Model 6 of Table3, which showed that the interaction term between the squared term of telecommuting intensity and work boundary strength had a significant negative effect on employees' autonomy motivation ($b = -0.10$, $p < 0.01$). This indicated that work boundary strength negatively moderated the inverted U-shaped relationship between telecommuting intensity and autonomy motivation, providing support for H4.

Additionally, to better illustrate the inverted U-shaped moderating effect of work boundary strength on telecommuting intensity and autonomy motivation, a moderation effect plot of job boundary strength was generated, as shown in Figure2. It can be observed that the inverted U-shaped relationship between telecommuting intensity and autonomy motivation is not significant when work boundary strength is weak. In contrast, when work boundary strength is strong, the inverted U-shaped relationship between telecommuting intensity and autonomy motivation is significant, further validating H4.

Figure2: Moderating effect of work boundary strength between telecommuting intensity and autonomy motivation



5.Discussion

This study aimed to investigate the impact of telecommuting on employee work engagement, focusing on the mediating role of autonomy motivation and the moderating role of work boundary strength. Drawing on self-determination theory, the study found that telecommuting intensity had an inverted U-shaped effect on work engagement, with moderate levels having a positive impact, and excessive levels having a negative impact. Additionally, there was an inverted U-shaped relationship between telecommuting intensity and autonomy motivation, with autonomy motivation mediating the effect of telecommuting intensity on work engagement. Finally, work boundary strength moderated the relationship between telecommuting intensity and work engagement, with strong work boundary strength amplifying the inverted U-shaped impact of telecommuting intensity on autonomy motivation compared to weak work boundary strength.

5.1 Theoretical Contribution

The main contribution of this study is to provide further clarification on the relationship between telecommuting and work engagement. With the prevalence of telecommuting in the digital economy, scholars have paid attention to its impact on

employee work engagement [12-13]. By examining the dual attributes of telecommuting intensity, this study reveals that moderate telecommuting intensity can promote employee work engagement, while excessive telecommuting intensity has a negative impact beyond a certain threshold. These findings offer a new perspective on explaining the divergent relationship between telecommuting and work engagement, and enrich research in the field of telecommuting.

Moreover, this study emphasizes the significance of autonomy motivation as a crucial factor in comprehending the relationship between telecommuting intensity and work engagement, which has been neglected in prior research [8-26]. Drawing on self-determination theory, this study incorporates autonomy motivation as a mediating variable in the association between telecommuting intensity and work engagement. These findings build upon the conclusion by Kuruzovich et al. [7] on the nonlinear relationship between telecommuting intensity and work outcomes and illuminate the "black box" mechanism of how telecommuting intensity impacts employee work engagement.

Finally, this study sheds light on the moderating effect of work boundary strength on the relationship between telecommuting intensity and employee motivation, providing new insights into the boundary conditions of telecommuting intensity research. While previous research on telecommuting intensity has mainly focused on individual and external environmental factors [26], this study addresses a gap in the literature by examining the moderating factors. The findings contribute to a deeper understanding of the mechanisms through which telecommuting intensity affects employee motivation [4], and identifying the conditions under which telecommuting can be either beneficial or detrimental to employee outcomes.

5.2 Practical Implications

In today's digital economy, telecommuting and on-site work are two primary working modes, and managing telecommuting has become a pressing concern in the industry. This study explores the relationship between telecommuting intensity and employee work engagement, providing valuable insights for relevant practices.

First, organizations should assess the degree of telecommuting. While telecommuting is a flexible work design, organizations should use it judiciously and be mindful of the potential risks of excessive telecommuting intensity. Moderate telecommuting intensity can enhance employees' autonomy motivation and work engagement, but excessive telecommuting intensity can have adverse effects. Therefore, organizations should keep telecommuting intensity within a moderate range to avoid negative impacts on employees' motivation, attitudes, and behavior.

Second, organizational managers should prioritize the positive effect of autonomy motivation in enhancing employees' work engagement. Autonomy motivation is a crucial intrinsic factor for improving work engagement. Under telecommuting, organizational managers should reasonably set the difficulty and risk of tasks, create flexible work conditions, and provide a supportive work environment that meets employees' basic psychological needs to stimulate autonomy motivation.

Third, when implementing telecommuting, organizational managers should set appropriate work boundary strength. While strong work boundary strength can play a supervisory role, it can also exacerbate the weakening effect of telecommuting intensity on autonomy motivation. Therefore, companies should flexibly formulate work boundary strength to maximize the effectiveness of telecommuting.

5.3 Limitations and Future Directions

First, this study used a sampling method that involved taking three measurements at 10-day intervals to establish the causal relationship between research variables. However, the short interval may have resulted in a memory effect among respondents. It is unclear whether the interval time effectively controlled for interference from other irrelevant factors or completely eliminated the memory effect of respondents. Future research could consider using multiple repeated measurements to further validate the relationship between variables.

Second, since all variables in this study were self-reported by enterprise employees, there may be a potential for common method bias to affect the relationship between variables. Although we have controlled and tested for this before, during, and after the study, future research can address this concern by using multi-source questionnaire surveys or experimental designs to further validate the findings.

Third, this study focused on the influence mechanism of telecommuting intensity on employees' job engagement based on self-determination theory. Future studies could explore this influence mechanism more comprehensively by integrating other

perspectives and examining additional mediating and moderating variables.

6.Conclusion

Telecommuting has become an essential part of modern work and is considered a new paradigm of work in the 21st century. Although telecommuting can promote employees' autonomy motivation and work engagement to some extent, increased telecommuting intensity may negatively impact employees. Moreover, the effectiveness of telecommuting is also influenced by the boundary management strategy implemented by the organization.

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Conflict of Interests

The author(s)declare(s) that there is no conflict of interest regarding the publication of this paper.

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