



# The Influence of Working in Non-working Time Through Information and Communication Technologies on Job Engagement

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**Abstract.** In recent years, information and communication technologies (ICTs) during non-work time has been widely used. However, the existing research on WN\_ICT is not in-depth. Based on web crawler technology, this paper explores the mechanism of the influence of WN\_ICT on job engagement. At the same time, work-related rumination and psychological detachment are introduced as mediating variable and moderating variable respectively. This paper's hypotheses were tested using a sample of 253 employees in China's high-tech enterprise. The results showed that the WN\_ICT had a positive impact on job engagement, and work-related rumination played an intermediary role between WN\_ICT and job engagement. Psychological detachment moderated the relationship between work-related rumination and job engagement.

**Keywords:** Working in non-working time through information communication technologies · Affective rumination · Problem-solving pondering · Work-related rumination · Psychological detachment · Job engagement · techno-invasion

## 1 Introduction

Information and communication technology (ICTs) offers organizations solid support for streamlining business operations, achieving operational flexibility, and enhancing new product development performance, all of which boost competition. However, ICTs, especially for information technology and information systems experts, can potentially have adverse effects and implications for people. Technological convenience often compels employees to carry out work in non-working hours, and the boundary between work and family becomes blurred, and working in non-working time through information and communication technologies (WN\_ICT) has emerged.

WN\_ICT can have an influence on the job performance of individuals, especially information technology and information systems professionals. Recently literature lacked the explanation of the influence of job engagement from the perspective of WN\_ICT. This paper puts forward the relationship hypothesis from the perspective of WN\_ICT, and studies the influencing factors of employee job engagement from a new perspective. Besides, the existing research on WN\_ICT is not in-depth. Therefore, this study enriches the related research on WN\_ICT from individual psychological level.

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through geographical restrictions and transmitting work information more efficiently by using new mobile communication devices with rich functions and portability [1]. Job engagement refers to employees' psychological recognition of their work, and take work output results and personal values as a matching link [2]. WN\_ICT can make use of fragmented time to break through the limitations of the original working hours and places, thus improving employees' work output. Higher work output can enhance employees' self-confidence and sense of responsibility, thus promoting the improvement of job engagement. Therefore, we propose hypothesis 1:

H1: WN\_ICT has a negative association with job engagement.

Rumination in non-working time refers to repeatedly thinking about the unfinished tasks of the current day during the free time [3]. Regarding the dimensions of work-related rumination, the most common view divides work-related rumination into affective rumination and problem-solving pondering.

Affective rumination reflects a negative emotional state. WN\_ICT will result in technostress, including techno-overload, techno-uncertainty and techno-complexity, which will enhance the negative emotions of employees. The increasing psychological stress will lead to the intensification of role conflicts, thus reducing job engagement. Based on this, this paper puts forward hypothesis 2a:

H2a: Affective rumination mediates between WN\_ICT and job engagement.

Problem-solving pondering reflects a positive emotional state. Nowadays, the application of information technology encourages employees to work flexibly. WN\_ICT can inspire employees to look for solutions when facing problems. WN\_ICT therefore promotes employees' ability of problem-solving pondering, and further improve employees' work performance and job engagement [4]. Therefore, this paper puts forward hypothesis 2b:

H2b: Problem-solving pondering mediates between WN\_ICT and job engagement.

Psychological detachment refers to the state that employees are out of work in the mental and physical state level. On the one hand, under the action of high-intensity affective rumination, employees' psychological resources will be rapidly consumed. Psychological detachment can help offset the psychological burden caused by affective rumination, so that employees can better devote themselves to the next stage of work. On the other hand, when thinking deeply about problem-solving, psychological detachment will reduce the level of emotional exhaustion, and make employees devote more energy to work. To this end, we put forward hypothesis 3:

H3a: Psychological detachment moderates the relationship between affective rumination and job engagement. The higher the degree of psychological detachment, the weaker negative impact between affective rumination and job engagement.

H3b: Psychological detachment moderates the relationship between problem-solving pondering and job engagement. The higher the degree of psychological detachment, the stronger positive impact between problem-solving pondering on job engagement.

## 3 Research Methods

### 3.1 Sample and Procedure

Based on the background of information technology application, questionnaires were distributed to the information technology experts of high-tech enterprises. A total of 280 questionnaires were distributed through We Chat, paper questionnaires and interviews, and 253 valid questionnaires were collected, with an effective recovery rate of 90%. Of the 253 valid samples collected, 41.5% were males and 58.5% were females, and the average age of the samples was 31.36 years old.

### 3.2 Measures

All the scales in our study were originally written in English. We translated these English measures into Chinese and used back-translation procedures. All measures were rated on a 5-point Likert-type scale (1 point is very inconsistent, and 5 points are very consistent). The representative title of the WN\_ICT measurement scale compiled by Hoover (2016) [5] is: "I am also required by my superiors to keep in touch at leisure time". Based on previous scholars' measurement of WN\_ICT, this paper designs a survey scale, which contains three items. Britt (1999) [6] designed three dimensions of job responsibility: vitality, dedication and concentration, based on Schlenker's (1994) three-responsibility model. This questionnaire selects six questions from two scales. In addition, the three questions of cognitive pattern in Rich (2010) [7] are also used to form the survey scale of this survey. We used the scale developed by Querrstret (2015), which divides the measurement of working rumination into two parts: affective rumination and problem-solving pondering. We chose Likert's five-level scale with 10 items. This study adopts Sonnentag (2007) [8] scale, which consists of four questions. Likert's 5-level scale is used to measure the degree of employees' detachment during work and non-work hours, which tends to the direction of psychological investigation.

## 4 Data Analysis

### 4.1 Confirmatory Factor Analysis and Descriptive Statistics

After preliminary analysis, we find that five-factor structure produces a good model fitting ( $\chi^2(253) = 704.278$ ;  $p < 0.001$ ; RMSEA = 0.06; GFI = 0.941; CFI = 0.963), and it is superior to the four-factor model which combines affective rumination with problem-solving pondering ( $\chi^2(253) = 1034.105$ ;  $p < 0.001$ ; RMR = 0.062; GFI = 0.857; CFI = 0.879).

### 4.2 Hypothesis Testing

In this paper, SPSS 26.0 is used for regression analysis. As shown in Table 1, hypothesis 1 is supported. In model 1, there is a positive correlation between WN\_ICT and job engagement ( $B = 0.444$ ,  $P < 0.001$ ). The second model adds the affective rumination on the

basis of the first model. We find that there is a positive correlation between affective rumination and job engagement ( $B = 0.112, P < 0.001$ ). After adding affective rumination, the influence of WN ICT on job engagement begins to shrink ( $B = 0.386, P < 0.001$ ), which support 2a. Hypothesis 2b discusses the mediating effect of problem-solving pondering. In model 3, there is a significant positive correlation between problem-solving pondering and job engagement ( $B = 0.573, P < 0.001$ ). The influence of WN ICT on job engagement becomes smaller ( $B = 0.161, P < 0.001$ ) after adding the variable of problem-solving pondering into the model, which supports hypothesis 2b. Model 4 introduces the interaction between affective rumination and psychological detachment. The results show that the interaction between affective rumination and psychological detachment is positively correlated with job engagement ( $B = 0.151, P < 0.001$ ). Hypothesis 3a is supported. The fifth model introduces the interaction between problem-solving pondering and psychological detachment. The results show that the interaction between problem-solving pondering and psychological detachment is positively related to job engagement ( $B = 0.04, P < 0.01$ ). Hypothesis 3b is supported.

**Table 1.** Results of regression analysis for mediation and moderation [Self-drawn by the author]

Variable	Job engagement					Affective rumination	Problem-solving pondering
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	1.595**	1.456**	0.528**	3.069***	3.155***	1.240**	1.861**
WN ICT	0.444**	0.386**	0.161**			0.518**	0.494**
Affective rumination		-0.112**			0.674***		
Problem-solving meditation			0.573**	0.219***			
Psychological detachment				0.046	0.022		
Affective rumination* Psychological detachment				0.151***			
Problem-solving pondering* Psychological detachment					0.04**		
R <sup>2</sup>	0.322	0.348	0.557	0.247	0.538	0.174	0.357
R adjustment	0.319	0.343	0.553	0.238	0.532	0.171	0.355
variance ratio	F(1,251) = 119.052,p = 0.000	F(2,250) = 66.673,p = 0.000	F(2,250) = 157.124,p = 0.000	F(3,249) = 27.177,p = 0.000	F(3,249) = 96.540,p = 0.000	F(1,251) = 53.005,p = 0.000	F(1,251) = 139.410,p = 0.000

## 5 Conclusion

Information technology is becoming more and more important to organizations. Employees must constantly adapt to new systems and technology. This paper has proved through empirical research that WN\_ICT can improve employees' job engagement. At the same time, we also prove the mediating effect of work rumination, and the introduction of psychological detachment plays a moderating role between work rumination and job engagement.

Firstly, by investigating the influence of information technological innovation on employees' mental health, this study deepens our understanding of the relationship between information technological innovation and employees' mental health. Secondly, this study shows that with the continuous development of information technology, more research is needed to explore how organizations can help individuals reduce the adverse consequences of using information and communication technology in non-work time, which is in line with the current research direction. Thirdly, managers, especially in knowledge-based organizations with high-level information technology, should pay more attention to the loss of non-working hours caused by information technological innovation. For example, using communication tools with low emotional rumination, such as We Chat, can well relieve employees' emotional stress. Finally, with the application of information technology in non-working hours, managers can improve employees' ability and confidence to complete tasks by training their computer or information technology.

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