# Research on the Influence of Postgraduate's Big Data Capability on Their Innovation Performance

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**Abstract.** In the era of big data, the capability of data acquisition and analysis has become one of the important factors affecting the output of innovative achievements of university scientific research teams. Based on self-determination theory and social learning theory, this study constructs a research model among four variables: big data capability, knowledge transfer, self-efficacy and innovation performance. Taking 392 postgraduate students from different levels of colleges and universities in Shanghai as the survey object, the questionnaire was distributed and data were collected. At the same time, the model was verified by SPSS 26.0 and Amos 24.0 software. The data analysis results show that: big data capability has a positive role in promoting innovation performance; In the process that big data capability affects innovation performance, knowledge transfer plays a partial intermediary role; Self-efficacy positively regulates the relationship between big data capability and innovation performance, and the higher the level of self-efficacy, the stronger the promotion effect of big data capability on innovation performance.

**Keywords:** Postgraduate student · Big data capability · Knowledge transfer · Self-efficacy · Innovation performance

## 1 Introduction

In the era of big data, how to extract information from massive scientific data, discover laws, and then complete knowledge innovation is a new topic faced by university scientific research teams. Therefore, cultivating the capability of big data is of great significance to improve the scientific research level and future development of colleges and universities. As the main scientific research human capital of colleges and universities, postgraduate students are the main source of innovative scientific research achievements in Colleges and universities. However, the research on big data capability is still limited to its impact on enterprise performance, and there is little mention on how it affects the innovation performance of postgraduate students. Therefore, exploring how the capability of big data affects the innovation performance of postgraduate students is of great


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significance to improve the education quality and scientific research output of colleges and universities.

The research shows that knowledge transfer plays an important role in the process of big data capability affecting the innovation performance of postgraduate students. Relevant research shows that knowledge transfer effect can occur between different individuals or groups, and this process can have a significant positive impact on team performance [9]. The capability of big data can help postgraduate students overcome the obstacles to the mutual transmission of discipline knowledge in different fields, help them absorb and apply knowledge more efficiently, and then lay the foundation for improving innovation performance. In addition, most of the existing literature is based on the research on the direct effect of big data capability on innovation performance, while the intermediary effect and regulatory effect of big data capability and innovation performance are rarely mentioned. Therefore, from the perspective of individual postgraduate students, this paper will explore the relationship between individual big data capability and innovation performance in more detail, and further reveal the role of knowledge transfer and self-efficacy in the influence process, Provide theoretical support and practical guidance for the subsequent targeted cultivation of the big data capability of the postgraduate group and improving the innovation performance of this group in scientific research.

## 2 Theoretical Basis and Research Hypothesis

### 2.1 Impact of Big Data Capability on Innovation Performance

According to the self-determination theory, when the psychological needs are met, individuals will produce more positive work behavior driven by internal motivation, so as to create more work results [3]. Solid big data analysis and integration ability can significantly improve the competence of postgraduate students in scientific research activities, meet their innate psychological needs of competence, and improve their innovation level. In addition, good competence can also significantly improve individual job happiness [8], so as to promote the generation of more innovative ideas, which is the inexhaustible source of power to create more high-quality innovative achievements. Based on the above analysis, this study puts forward the following assumptions:

**H1:** the big data capability of postgraduate students can positively predict their innovation performance.

### 2.2 Intermediary Role of Knowledge Transfer

Knowledge is an important strategic resource for individuals and organizations to gain advantages in the complex and changeable competitive environment [1], and know-ledge transfer refers to the behavior and process of knowledge exchange. Postgraduate students are not only the main body of scientific research activities in Colleges and universities, but also the main participants in knowledge transfer and exchange activities. Strong big data capability can help postgraduate students use various advanced information tools, so

as to provide effective support for the absorption and transmission of knowledge. At the same time, the big data capability of postgraduate students also helps them acquire and absorb professional knowledge beneficial to their own growth in innovation activities, and promote a virtuous circle of mutual learning and common progress among team members. It can be seen that the capability of big data can promote the knowledge transfer activities of scientific research groups to a certain extent.

In addition, knowledge transfer is another key factor affecting the innovation performance of postgraduate students. According to social learning theory, individuals can adjust and control their own behavior to deal with various effects of the external environment [2]. Due to the limitations of postgraduate students' own knowledge system, when they encounter obstacles in the process of innovation activities, they will actively seek the help of others and improve their own knowledge structure. To some extent, the improvement of postgraduate students' innovation performance stems from this positive behavior of knowledge transfer. To sum up, the big data capability of the postgraduate group helps to improve the knowledge transfer behavior among team members, so as to improve innovation performance. Based on the above analysis, this study puts forward the following assumptions:

**H2:** the big data capability of postgraduate students has a positive predictive effect on their knowledge transfer behavior.
**H3:** knowledge transfer acts as an intermediary between the big data capability of postgraduate students and their innovation performance.

### 2.3 Moderating Effect of Self-efficacy

Self-efficacy refers to the individual's psychological speculation and judgment on whether he is able to complete a task [11]. Klaeiisen et al. (2018) found through research that self-efficacy can significantly promote the creativity of different occupational groups. Big data capability can help individuals acquire more knowledge and resources, and also provide individuals with more creativity and ideas [10]. On this basis, the higher the self-efficacy of postgraduate students, the more inclined they are to put innovative resources and ideas into practice, so as to obtain more innovative scientific research achievements. In comparison, if the postgraduate students have low self-efficacy and lack self-confidence, even if they have innovative resources and ideas, they will tend to give up because of fear of difficulties, and their innovation performance level can be low. Based on the above analysis, this paper puts forward the following assumptions:

**H4:** self-efficacy positively regulates the relationship between big data capability and innovation performance of postgraduate students.

Based on the above assumptions, the theoretical model of this study is shown in Fig. 1.

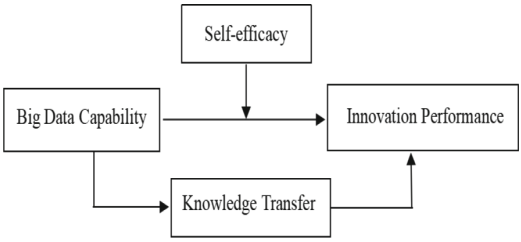


**Fig. 1.** theoretical model

## 3 Data and Research Methods

### 3.1 Research Procedures and Samples

The research object of this study involves postgraduate students from 13 colleges and universities in Shanghai with different professional directions. A total of 400 questionnaires were distributed through the combination of online and offline, of which 392 were recovered. After excluding the invalid questionnaires, 378 valid questionnaires were retained, with an effective recovery rate of 94.5%.

Among them, there were 196 males (51.9%) and 182 females (48.1%); 136 (36.0%) in the first year of master's degree, 128 (33.9%).in the second year of master's degree, 65 (17.2%).in the third year of master's degree, 22 (5.8%) in the first year of doctor's degree, 16 (4.2%). in the second year of doctor's degree and 11 (2.9%). in the third year of doctor's degree; 92 in Science (24.3%), 127 in Engineering (33.6%), 63 in Economics (16.7%), 47 in management (12.4%), 22 in Education (5.8%), 11 in agriculture (2.9%), 9 in law (2.4%), and 7 others (1.9%).

### 3.2 Variables and Measuring Tools

**Big data capability scale:** the scale developed by Hao et al. (2019) is used to measure the big data capability. The Cronbach's a coefficient of the scale is 0.896.
**Knowledge transfer scale:** the scale developed by Zhao Yunhui et al. (2018) is used to measure knowledge transfer. The Cronbach's a coefficient of the scale is 0.863.
**Self-efficacy scale:** the scale developed by Schwarzer et al. (1997) was used to measure self-efficacy. The Cronbach's a coefficient of the scale is 0.902.
**Innovation performance scale:** the scale developed by Han Yi et al. (2007) is used to measure individual innovation performance. The Cronbach's a coefficient of the scale is 0.877.

# 4 Research Results

## 4.1 Common Method Deviation Control and Inspection

Since the data collected in this research mainly comes from the universities affiliated to Shanghai, the possible common method deviation is tested first. In this study, Harman one-way ANOVA was used to verify the problem. The results showed that the largest factor without rotation accounted for only 21.24% (< 40%) of the total variance. It can be seen that the sample data obtained in this survey has no serious common method deviation, which is suitable for the next empirical analysis.

## 4.2 Confirmatory Factor Analysis

This study measures four main variables: big data capability (BDC), knowledge transfer (KT), self-efficacy (SE) and innovation performance (IP). The results are shown in Table 1. It can be seen from Table 1 that the fitting degree between the observation data and the four factor model is the best ($\chi^2$ / df = 1.072, RMSEA = 0.025, SRMR = 0.023, GFI = 0.842, IFI = 0.978, CFI = 0.992), which means that there is good discriminant validity between the four variables.

## 4.3 Descriptive Statistics and Related Analysis

The correlation analysis results among demographic variables, big data capability, knowledge transfer and innovation performance are shown in Table 2. The results show that big data capability is significantly positively correlated with knowledge transfer, self-efficacy and innovation performance, which provides preliminary support for the above hypothesis.

## 4.4 Hypothesis Test

(1) Test of the direct effect of big data capability on Innovation Performance: This study uses Amos 24.0 software to construct the corresponding structural equation model,

**Table 1.** Comparison of confirmatory factor analysis (N = 378)

| Model | Factors | χ2/df | RMSEA | SRMR | GFI | IFI | CFI |
|---|---|---|---|---|---|---|---|
| Four factors model | BDC;KT;SE;IP | 1.072 | 0.025 | 0.023 | 0.842 | 0.978 | 0.992 |
| Three factors model | BDC;SE;KT + IP | 1.422 | 0.058 | 0.044 | 0.796 | 0.931 | 0.918 |
| Two factors model | BDC + SE;KT + IP | 1.996 | 0.088 | 0.072 | 0.713 | 0.822 | 0.817 |
| Single factor model | BDC + KT + SE + IP | 3.986 | 0.163 | 0.113 | 0.412 | 0.422 | 0.402 |

Note: + indicates that two factors are combined into one factor;

**Table 2.** Mean, standard deviation and correlation coefficient of variables (N = 378)

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1Gender | 1.481 | 0.512 | | | | | | | | |
| 2 Age | 2.164 | 0.473 | 0.105 | | | | | | | |
| 3 Grade | 2.121 | 1.411 | 0.314 | 0.581 | | | | | | |
| 4 Major | 4.721 | 3.427 | 0.273 | 0.055 | 0.233 | | | | | |
| 5 BDC | 3.687 | 0.774 | -0.093 | 0.157 | 0.073 | 0.045 | (0.920) | | | |
| 6 KT | 3.563 | 0.732 | -0.211 | -0.063 | 0.160 | 0.081 | 0.229** | (0.845) | | |
| 7 SE | 3.769 | 0.684 | -0.231 | 0.065 | 0.144 | 0.005 | 0.273** | 0.235* | (0.899) | |
| 8 IP | 3.462 | 0.811 | -0.149 | -0.070 | 0.102 | 0.021 | 0.341** | 0.411** | 0.351** | (0.889) |

Note: *, * * respectively indicate $P < 0.05$, $P < 0.01$

and the fitting indexes of the model are within a reasonable range ($\chi^2/df = 1.481$, GFI = 0.916, NFI = 0.951, IFI = 0.978, TLI = 0.981, CFI = 0.992, RMSEA = 0.057).The results show that big data capability has a positive impact on innovation performance ($\beta = 0.391$, $P < 0.001$), H1 was supported.

(2) Intermediary effect test of knowledge transfer: This study establishes an overall structural equation model according to the influence relationship between variables, and uses the bootstrap method in Amos 24.0 to test the intermediary effect. In this paper, 6500 samples were repeatedly sampled, and the specific analysis results are shown in Table 3. The 95% confidence interval of indirect effect of knowledge transfer does not include 0 ($\beta = 0.352$, $P < 0.001$), indicating that knowledge transfer plays a partial intermediary effect between big data capability and innovation performance. H2 and H3 are supported. In addition, the total effect was 0.661 ($P < 0.001$), and the indirect effect of knowledge transfer accounted for 45.78% ($P < 0.001$).

(3) Test on the regulatory effect of self-efficacy: in order to avoid the influence of collinearity on the results, this study centralizes the data before analysis, and then uses the method of hierarchical regression analysis to test the regulatory effect of self-efficacy. The specific data analysis results are shown in Table 4. In the regression of model 3 innovation performance on big data capability and self-efficacy, the big data capability coefficient is significant ($\beta = 0.331$, $p < 0.001$), and the self-efficacy coefficient was significant ($\beta = 0.248$,$p < 0.01$).In model 4, the regression of innovation performance on self-efficacy and the interaction between big data capability and self-efficacy, and the interaction coefficient is significant ($\beta = 0.191$, $p < 0.001$), and the symbol is the same as that of big data capability coefficient. The results show that self-efficacy has a significant regulatory effect and belongs to enhanced interaction. H4 is supported.

**Table 3.** Intermediary effect test analysis (N = 378)

| Effect | Action path | Estimated value | Standard error | 95% confidence interval | | % of total effect |
|---|---|---|---|---|---|---|
| | | | | lower limit | upper limit | |
| Indirect effect | BDC → KT → IP | 0.311 | 0.062 | 0.211 | 0.451 | 45.78 |
| Direct effect | BDC → IP | 0.352 | 0.055 | 0.229 | 0.458 | 54.22 |
| Total effect | Direct effect + Indirect effect | 0.663 | 0.053 | 0.363 | 0.519 | —— |

Note: the 95% confidence interval adopts percentile test method

**Table 4.** Hierarchical regression analysis results (N = 378)

| Variable | | Innovation performance | | | |
|---|---|---|---|---|---|
| | | Model 1 | Model 2 | Model 3 | Model 4 |
| control variable | Gender | 0.144 | 0.105 | 0.085 | 0.077 |
| | Age | -0.037 | -0.113 | -0.127 | -0.167 |
| | Grade | -0.063 | -0.061 | -0.013 | -0.022 |
| | Major | -0.095 | -0.188 | -0.155 | -0.155 |
| Antecedent variable | BDC | | $0.441^{***}$ | $0.331^{***}$ | $0.291^{**}$ |
| Adjustment variable | SE | | | $0.248^{**}$ | $0.231^{*}$ |
| Interactive item | BDC × SE | | | | $0.191^{***}$ |
| R2 | | 0.049 | 0.195 | 0.256 | 0.279 |
| ΔR2 | | 0.013* | 0.149 | 0.205 | 0.241* |
| F | | 1.415 | $5.211^{***}$ | $5.887^{***}$ | $0.961^{***}$ |
| VIF | | 1.085 ~ 1.337 | 1.079 ~ 1.368 | 1.151 ~ 1.381 | 1.113 ~ 1.411 |

Note: * * * indicates P < 0.001.

## 5 Conclusion

The results of data analysis show that: postgraduate Students' big data capability can significantly promote their innovation performance; In the process of postgraduate students' big data capability affecting innovation performance, knowledge transfer plays a partial intermediary role; Postgraduate students' self-efficacy positively regulates the relationship between their big data capability and their innovation performance. The

higher the level of self-efficacy of postgraduate students, the stronger the impact of big data capability on their innovation performance.

The practical enlightenment of this study lies in: (1) the big data capability of postgraduate students can promote knowledge transfer, so as to enhance the scientific research and innovation ability of postgraduate students. Therefore, colleges and universities should focus on cultivating students' big data analysis capability, optimize the environment of knowledge transfer and knowledge sharing, stimulate the internal motivation of postgraduate students to learn from each other and make common progress, and then improve the output of their innovative achievements. (2) Self-efficacy is very important in the innovation activities of postgraduate students. Postgraduate students with high self-efficacy often have a great desire for success, so they are more willing to stick to it in the face of difficulties. Therefore, high efficiency should reasonably cultivate the self-efficacy of postgraduate students, so that they can maintain a more positive emotional experience in learning, scientific research and innovation activities, so as to produce high-level innovation achievements.

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