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The Impact of Technical–Nontechnical Factors Synergy on Innovation Performance: The Moderating Effect of Talent Flow

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Abstract: Innovation and talent are the guarantee of the sustainable development of an enterprise. However, internet companies are facing two major problems: innovation scarcity and frequent talent flow. The gradual intensification of competition is leading internet companies to realize the importance of collaborative innovation of an enterprise's internal elements. Previous studies have pointed out that appropriate talent flow is conducive to improve the corporation's innovation performance, too low or too high talent flow has a negative impact on the enterprise's innovation ability. This study explores the relationship between talent flow, technical–nontechnical element synergy and collaborative innovation performance in the internet industry. The results show that the technical–nontechnical element synergy is beneficial to improve the collaborative innovation performance, and the comprehensive coordination of the elements can generate integration advantages that single element synergy cannot produce. As a moderator variable, talent flow can positively moderate the relationship between technical–market synergy, technical–strategy synergy, technical–institution synergy and collaborative innovation performance. However, because of the particularity of organization and culture, talent flow has no moderating effect on the relationship between technical–culture synergy, technical–organization synergy and innovation performance. Finally, this paper puts forward some suggestions on how to promote internet enterprise internal element synergy and use the talent flow frequency to improve collaborative innovation performance.

Keywords: talent flow; element synergy; collaborative innovation; collaborative innovation performance; sustainable development

1. Introduction

Since the beginning of the twenty-first century, the high profit and low threshold of the internet industry are attracting a large number of enterprises and entrepreneurs to enter this industry. This phenomenon leads to a shorter product life cycle, serious homogenization, increasingly fierce competition and other issues. Enterprises that want to survive in the competition must enhance innovation ability. The enterprise innovation is a systematic process, and unilateral innovation of technology is far from enough. It is necessary to cover the internal innovation network, including organization, strategy, culture, market, system and other elements of the synergy.

In the process of enterprise innovation, an internet company can coordinately use technology, market, organization, culture, strategy, system and other elements to enhance the sustainability of its collaborative innovation ability [1]. A large number of studies have shown that technical factors and nontechnical factors (market, organization, culture, etc.) are not synergistic in the practical process of innovation. This is an important reason for the failure of many product technology innovation projects [2,3]. Zheng Gang and Zhu Ling analyzed the relationship between comprehensive synergy and company innovation performance based on the five-stage model and synergy theory. They found that comprehensive element synergy can enhance innovation performance when experiencing the five stages, such as communication, competition, cooperation, integration and synergy [1]. Organization structure is an important factor that influences company innovation performance. Adarves-Yomo, Postnes and Haslam studied group member innovation behavior from a corporation organization perspective and found that organization and group norms have an important impact on group innovation performance [4]. Brettel and Cleven studied the influence of corporation culture and collaboration with external partners on new product development performance. It was found that culture has a direct impact on new product development [5]. Hadjinanolis conducted an empirical study on small and medium manufacturing corporations to study the antecedents of innovation [6]. He concluded that institution, strategy, culture and organization can influence corporation innovation performance. Additionally, corporation elements synergy is also studied by some researchers, who indicated that elements synergy will influence innovation performance [7–9]. From a corporation performance management perspective, Lian Zhimei also indicated that culture, strategy, organization and management control influence innovation performance [10]. Of course, there are many other elements that also influence corporation innovation performance such as enterprise network, enterprise knowledge and social capital [11].

Based on previous research on the factors that influence enterprise innovation, we can conclude that enterprise innovation is related to market, organization, culture and strategy. The synergy between technology and production element is very important for enterprise innovation performance.

On the other hand, the rapid development of the internet industry not only brings fierce competition; it also results in talent shortage. Highly frequent talent flow is another major problem that internet companies face. Talent flow refers to the inflow and outflow of talents in a company. It hints at the instability of talent. Highly frequent talent flow of an enterprise means that many new employees enter the company and many old employees leave as well.

Based on the transformation efficiency of tacit knowledge, Sun Jinhua found that there was a positive correlation between the appropriate talent flow rate and collaborative innovation performance [12]. The Katz curve also showed that companies with a talent flow rate of less than five percent did not have the ability to innovate. However, the highly frequent talent flow also has an adverse impact on enterprise innovation. For example, Pan Jing pointed out that highly frequent talent flow would have a negative impact on the enterprise's innovation ability, and reduce the enterprise's innovation performance [13].

Therefore, both the talent flow and technical–nontechnical factors synergy are considered in this paper. We want to further research the cross effect of talent flow and technical–nontechnical factor synergy on enterprise innovation performance. Concretely, we choose internet enterprises as a sample with which to study whether there is a correlation between technical–nontechnical factors synergy and collaborative innovation performance, and whether the talent flow has a moderating effect on this relationship. Although this paper focuses on internet companies, it is also valuable for other industries or research areas, such as sustainable high-technology industries. Based on our results, we provide the corresponding countermeasures and suggestions to improve the internet enterprises' innovation ability through factor cooperation.

2. Research Design

2.1. Conceptual Model Construction

The relationship between the enterprise elements and innovation performance has been studied by many researchers. Chen Jin pointed out that the key way to obtain the success of new product development was to closely link the R&D and market demand [14]. Satisfying the market demand is the only way to succeed in the competition and get a good innovation performance. So, it is important to link R&D and market demand. Adaves et al. found that technology innovation was related to internal organization [4]. The enterprise organization influences the handling process of every decision. It has an important effect on enterprise innovation. Cleven and Brettel found that innovation culture influenced the development of new products by influencing the ability of enterprises to acquire external knowledge [5]. Hadjimanolis found that strategy innovation has an impact on corporate innovation [6]. The synergy between technology and institution has an important impact on final innovation performance. Xu Qingrui et al. pointed out that the synergy of internal factors (technology, market, organization, culture, strategy, system) was conducive to improving the collaborative innovation performance [7–9].

With the intensification of market competition, enterprises compete for high-tech talents to ensure success. Throughout the world, the flow of talent is intensifying [15]; every country and corporation tries to attract more high-level talents. More and more companies realize that it is important to get external knowledge to accomplish Open Innovation, which is important for enterprise innovation performance [16]. One of the effective ways to acquire external knowledge is to attract external talent. In other words, companies try to increase innovation by appropriate talent flow. At the same time, every employee also tries to pursue better employment opportunities. Especially the internet industry, the scarcity of talent intensifies the flow of talent. As a result, talent flow becomes an important problem faced by every internet company. Talent is the basis of corporate development. It interacts with every corporate element such as culture, organization, institution and so on.

Innovation performance is first defined as "a kind of evaluation index for enterprise product innovation results and innovation efficiency". Hagedoom and Myriam (2003) believed that "innovation performance" is used to evaluate the performance of leading enterprises in product development and market share of new products [17]. Corporate innovation performance determines a company's final performance to a large extent. Researchers who studied innovation performance have indicated that corporate innovation performance is influenced by many factors, such as market, culture, organization, institution and so on.

This paper takes the influence of technology–nontechnical element (market, organization, culture, system, strategy) synergy on innovation performance (Zheng Gang, Zhu Ling [1]) as the basic research frame, and use talent flow as a moderating variable to construct the conceptual model of the study (Figure 1).

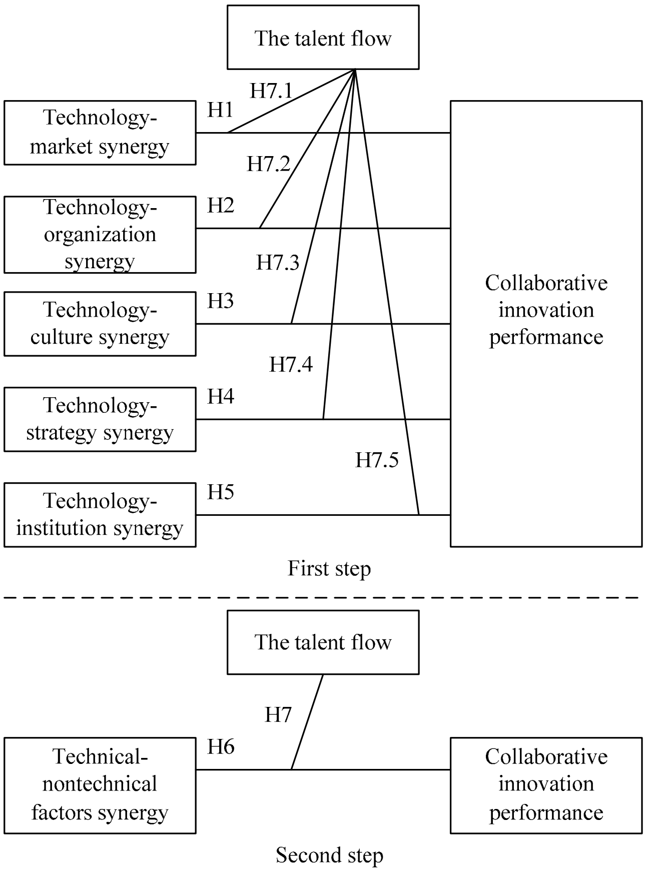

Figure 1. Conceptual model.

2.2. Research Hypothesis

2.2.1. The Relationship between Technical–Nontechnical Element Synergy and Innovation Performance

The synergy emphasizes the fact that the interaction of the elements produces the overall effect that the single factor cannot achieve [18], that is "1 + 1 > 2". According to synergy theory, when two corporate elements coordinate with each other, they will produce a better result. The innovation of the modern enterprise is no longer a mere technological innovation, but a collaborative innovation of technical and nontechnical factors [13]. In the world of theory, there are many researchers who have studied or discussed the relationship between synergy and innovation performance.

Norton (2001) indicated the positive relationship between the technical–market element synergy and corporate innovation performance by studying the 19 indicators which describe the interaction between technology and market [19]. Christensen (2015) empirically researched the corporate innovation performance with market demand and technology supply [20]. He also pointed out that synergy between market demand and technology positively increases corporate innovation performance. The market determines the corporate success, and the technological innovation ensures the company to obtain success. So, we make the following hypothesis:

Hypothesis 1 (H1). *In the internet enterprise, the technical–market elements synergy has a positive effect on the collaborative innovation performance.*

Some researchers have argued that corporate organization that cannot match the technology innovation may lead to company failure. Bessant J. (1990) found that organization has a close relationship with technology [21]. Proper organization can make it easy for a company to obtain success in technology innovation. Shi Chunsheng et al. (2011) indicated that it is important for a company to establish the synergy between technology and organization [22]. We also think proper organization helps corporate technology innovation and company success. So, we make the following hypothesis:

Hypothesis 2 (H2). *In the internet enterprise, the technical–organizational elements synergy has a positive effect on the collaborative innovation performance.*

Company culture determines the value of the enterprise, operation style and decision method. It influences technology development and innovation. Hamilton provided some principles for company to establish technology–culture synergy [23]. He indicated that technology culture is important for company success. Referencing articles researching culture, we make the following hypothesis:

Hypothesis 3 (H3). *In the internet enterprise, the technical–cultural elements synergy has a positive effect on the collaborative innovation performance.*

Company strategy determines company development direction and operational decisions, which directly influence technology innovation and corporate success. Hadjinanolis indicated that strategy is one of the important factors that influence corporate innovation performance [6]. Dougherty and Hardy also found that successful companies have a better synergy between strategy and technology by studying 25 companies in Canada [24]. So, we make the following hypothesis:

Hypothesis 4 (H4). *In the internet enterprise, the technical–strategic elements synergy has a positive effect on the collaborative innovation performance.*

Corporate institution is the basis for element synergy and ensures the company's normal operation. It is found that proper institution has a positive impact on technology innovation. Xu Yingji and Xu Xiangyi also indicated that companies should make synergy between technology and institution to obtain competitive advantage [25]. So, we make the following hypothesis:

Hypothesis 5 (H5). *In the internet enterprise, the technical–institutional elements synergy has a positive effect on the collaborative innovation performance.*

2.2.2. The Relationship between Comprehensive Coordination of Technical–Nontechnical Elements and Innovation Performance

Scholars around the world have indicated that the synergies of the various elements have an important role in enhancing the innovation performance of the enterprises. Zhang Fanghua and Tao Jingyuan (2016) indicated that synergy between technical elements and nontechnical elements can enhance corporation comprehensive synergy [26]. He Ling and Qiu Jianhua found that the comprehensive collaboration of internal innovation elements has a positive effect on improving the innovation performance of enterprises [27]. Based on this, this paper puts forward the following assumptions:

Hypothesis 6 (H6). *In the internet enterprise, technical–nontechnical elements comprehensive synergy has a positive effect on the collaborative innovation performance.*

2.2.3. Talent Flow Moderating Effect

Human capital is the foundation of the survival and development of an enterprise. A good enterprise environment is beneficial to giving full play to the role of talent. The enterprise environment includes the factors such as market, organization, culture, institution, strategy and so on. Although those factors of an enterprise are difficult to change, they are all related to the enterprise employee. An enterprise's market, organization, culture, institution, strategy and technology largely determine the final performance of the enterprise. However, every enterprise has a certain level of talent flow. Talent flow is an important issue that internet enterprises face. This may influence the positive effect of element synergy on corporate innovation performance.

Appropriate talent flow is conducive to injecting fresh vitality to the enterprise and improving the innovation of the whole enterprise. Kwaku and Felieitas argued that cooperation within the various departments in an enterprise could reduce market and technical uncertainties and help improving corporate collaborative innovation performance [28]. Li Baoxia pointed out that talent flow had a positive effect on improving the innovation ability of high-tech enterprises, in which talent flow has a more significant positive impact [29]. Zhang Shengtai and Zhu Hongmiao studied the relationship between talent flow and corporation based on an organization knowledge sharing perspective [30]. They found that proper talent flow can positively influence organization sharing. However, if the talent flow frequency exceeds a certain range, it will hinder innovation. Wang Liying, Ding Weiming, Ma Wanli found that the frequent flow of personnel will undermine team cohesion, and even have a chain effect or destroy the cohesion of the entire enterprise [31]. In other words, when an enterprise has an appropriate talent flow, it has greater innovation performance as a result of factors synergy. Based on this, this paper puts forward the following assumptions:

Hypothesis 7 (H7). *Talent flow can moderate the relationship between the comprehensive coordination of internet enterprise internal technical–nontechnical elements and the collaborative innovation performance.*

Hypothesis 7.1 (H7.1). *Talent flow can moderate the relationship between technical–market elements synergy and the collaborative innovation performance.*

Hypothesis 7.2 (H7.2). *Talent flow can moderate the relationship between technical–organizational elements synergy and the collaborative innovation performance.*

Hypothesis 7.3 (H7.3). *Talent flow can moderate the relationship between technical–cultural elements synergy and the collaborative innovation performance.*

Hypothesis 7.4 (H7.4). *Talent flow can moderate the relationship between technical–strategic elements synergy and the collaborative innovation performance.*

Hypothesis 7.5 (H7.5). *Talent flow can moderate the relationship between technical–institutional elements synergy and the collaborative innovation performance.*

2.3. Data Collection

In order to improve the effectiveness of the designed questionnaire and measure the variables as accurately and efficiently as possible, this study adopts three measures in the process of the questionnaire design: (1) Massive literature research; (2) Academic team opinion; and (3) Small sample test.

The entire investigation began in July 2016 and took 4 months. We randomly selected internet companies and surveyed all famous companies as far as possible. We paid more attention to first 100th Chinese internet companies and invited about 3 employees in each company to make the survey. A total of 212 questionnaires were issued, of which there were 155 valid questionnaires. Generally, when the effectiveness rate is more than 70%, the survey data is accepted. According to previous empirical articles such as Hung [32], Zhu Zhaohui [33], Chen Lei [34] and Nie Tingting [35], the questionnaire was given a 7-point Likert scale, which was scored according to the degree of conformity of the option description. In this scale, "7" represents the most agreement and "1" represents most disagreement.

2.4. Variable Measure

The items used to measure our variables mainly derive from previous papers. The specific reference as follows.

2.4.1. Innovation Performance

Considering that many researchers have tried to studied innovation performance, including some empirical study, we use the mature and existing scale. The items to measure innovation performance mainly include new product development speed, R&D cycle, R&D costs, sales and the number of projects (Hung [32], Zhu Zhaohui [33]). Zhu Zhaohui empirically studied the relationship between exploratory learning, excavative learning and innovative performance. Its measure content is similar to this article [34].

2.4.2. Internal Factor Synergy

This study designed seven scales to measure the seven latent variables. In order to use the proper items to measure the important variables, we not only reference more studies, but also asked for comments from experts in this area. According to the references and experts' suggestion, we produced the final items which were made to a survey. Items used to measure technical–nontechnical elements synergy were referenced from the development scale of Wang Xiushan, Nan Meiling [36] and Zhou Min [37]. Combining the two articles' items, we used 3 items to measure technical–nontechnical element synergy. The technical–market element synergy was measured by 3 items from Chen Lei [34] and Nie Tingting [35]. Referencing Zhang Fanghua and Tao Jingyuan, we used 4 items to measure the technical–cultural element synergy [27]. The technical–organization element synergy was measured by 3 items from Chen Yuanzhi [38]. The technical–strategic element synergy was measured by 4 items from Yang Liwei [39] and Chen Guang [40]. The technical–institution element synergy was measured by 5 items from Chen Yuhe, Li Jing [41], including cross-sector cooperation, exchange platform, innovation culture, innovation strategy, management support, etc.

2.4.3. The Talent Flow

Chen Guang (2005) studied corporate internal element synergy and discussed the factors which influence corporate innovation performance, involving talent flow [40]. Drawing on the measurement scale of Chen Guang, we measured the concept of talent flow from the perspective of employees' perception of demission and entry. We used 3 items to measure talent flow, including new colleagues, working with unfamiliar colleagues and frequent resignations.

Then, considering limited research which study talent flow by using survey, we asked for comments from 3 practitioners in company and 3 researchers in this research area. According to their comments, we modified our measure items. Before structural model verification, we also mathematically verified the reliability and validity of measurement [42–49].

This study uses A to represent innovation performance, B0 represents technical–nontechnical elements comprehensive synergy, B1 represents technical–market elements synergy, B2 represents technical–organizational elements synergy, B3 represents technical–cultural elements synergy, B4 represents technical–strategic elements synergy, B5 represents technical–institutional elements synergy, and C represents the talent flow. The detail measures are provided in Table 1.

Table 1. Results of the detailed measures.

Item	Variable Measure
A	Compared with competitive companies, the company's product development is faster Compared with competitive companies, the company has more innovative projects Compared with competitive companies, the company's product development cycle is shorter Compared with competitive companies, the company's product development costs are lower Compared with competitive companies, the company's new product sale is higher
B0	The technical department and nontechnical department cooperate smoothly in the new product development The company has a platform to promote cooperation between the technical department and nontechnical department The technical and nontechnical departments can support each other to solve problems
B1	R&D and Marketing support each other to solve the problem A specific person is responsible for the communication between the R&D and Marketing The company's top support technology and marketing cooperation

Table 1. *Cont.*

Item	Variable Measure
B2	The company has a flexible organizational structure which has a suitable technology development characterization The company has a flat organizational structure to ensure technology development There is informal technology communication in the company
B3	Corporate culture encourages innovation and tolerates failure in technology development Employees can give full play to their strengths to promote technology innovation Corporate culture encourages employees to participate in collective technology Companies encourage intellectual asset to grow
B4	The company has a clear and reasonable technology development strategy The company has a clear plan for collaborative technology in strategic planning The company's technology strategy has been recognized by the majority of staff The company's technology strategy is consistent with the company's overall strategy
B5	The company develops a management system that encourages employees to cooperate and innovate in technology The company has a learning and training mechanism to support employee technology improvement The company has developed incentives and promotion mechanisms to encourage technology development The company has an organization platform to promote employee exchange for technology communication The company is fully authorized for employee technology improvement
C	There are often resignations in the unit There are often new colleagues Often working with unfamiliar colleagues

3. Empirical Analysis

3.1. Descriptive Statistics

3.1.1. Sample Sector Distribution

The 155 valid questionnaires come from all the departments needed for the study, namely, the Integrated Management Department (Human resources, Administration, Strategy, and Finance), Marketing Department and R&D Department. The Recycling Questionnaire covers all the elements of this study—technology, market, organization, culture, strategy and system—which lay a solid foundation for researching the relationship between internal factor collaboration and innovation performance. The specific distribution is shown in Table 2.

Table 2. Sample sector distribution.

Sector Classification	Specific Sector	Number	Total Number	Sample Total
Integrated Management Department	Administration Human resources Finance others	4 9 7 14	34	155
Marketing Department	Marketing	40	40	
R&D Department	R&D Department	81	81	

3.1.2. Sample Age and Academic Distribution

From Table 3, we can see that the age of the internet industry practitioners is generally relatively small, basically under 35 years old; employees have a higher education, basic education for undergraduate or master; such employees pay more attention to the realization of their own value and they are more likely to quit, which is the reason for the high turnover rate of talent.

Table 3. Sample age and academic distribution.

Age	Senior School	Junior College	Bachelor	Master and above	Total
Less than 25		1	17	4	22
25 to 30	1	4	64	32	101
Greater than 30			19	13	32
Total	1	5	100	49	155

3.1.3. Variable Descriptive Statistics

The measurement of eight variables and the description of the statistics are shown in Table 4. Table 4 shows that the score of the enterprise internal factors synergy is more than four points and the score of the talent flow is five points or more. This indicates that the internet business collaboration innovation is good and the talent flow is frequent.

Table 4. Variable descriptive statistics.

Variable	Variable Code	Mean	Std. Deviation	Anova
A	A1	5.57	1.075	1.156
	A2	5.87	0.972	0.944
	A3	5.53	1.095	1.199
	A4	5.27	1.234	1.524
	A5	5.57	1.134	1.285
B0	B01	4.38	1.645	2.705
	B02	5.33	1.297	1.683
	B03	5.59	1.283	1.645
B1	B11	5.17	1.367	1.868
	B12	5.08	1.45	2.103
	B13	4.92	1.358	1.844
B2	B21	5.8	1.316	1.732
	B22	5.6	1.351	1.826
	B23	5.66	1.245	1.549
B3	B31	5.41	1.409	1.984
	B32	5.08	1.531	2.345
	B33	5.05	1.465	2.147
	B34	5.39	1.43	2.045
B4	B41	4	1.6	2.558
	B42	4.38	1.645	2.705
	B43	4.35	1.723	2.969
	B44	4.26	1.635	2.673
B5	B51	5.65	1.242	1.542
	B52	5.59	1.283	1.645
	B53	5.39	1.388	1.927
	B54	5.35	1.297	1.683
	B55	5.48	1.35	1.823
C	C1	5.33	1.094	1.196
	C2	5.37	1.162	1.351
	C3	5.29	1.195	1.428

3.2. Reliability and Validity Test

Cronbach's alpha value is often used to evaluate the reliability of latent variables. The threshold of Cronbach's alpha value is 0.6. From Table 5, we can see that Cronbach's alpha value of each variable is more than 0.65, which indicates that the reliability of each variable is high and the data consistency is good. We evaluated the validity of latent variables by adopting factor analysis. The results are showed in Table 5. The KMO (Kaiser-Meyer-Olkin) values of the variables are all greater than 0.6, the Bartlett significance probability is 0.000 (p-value), and the cumulative variance explanatory rate was more than 60%, indicating that the questionnaire is effective enough to measure variables. For survey method, it is necessary to check common method bias. We use Harmon single factor analysis to evaluate whether there is a common method bias problem with our data. The result shows that common method factor does not influence latent variable measure item. So, we conclude that there is not a common method bias problem with the data.

Table 5. Reliability and validity test.

Variables	Variable Code	Cumulative %	KMO	Sig.	Cronbach's Alpha
A	A1 A2 A3 A4 A5	66.204	0.857	0.00	0.866
B0	B01 B02 B03	79.820	0.833	0.00	0.871
B1	B11 B12 B13	72.021	0.699	0.00	0.804
B2	B21 B22 B23	61.053	0.639	0.00	0.679
B3	B31 B32 B33 B34	65.193	0.728	0.00	0.821
B4	B41 B42 B43 B44	72.456	0.795	0.00	0.873
B5	B51 B52 B53 B54 B55	86.953	0.904	0.00	0.962
C	C1 C2 C3	84.785	0.752	0.00	0.909

3.3. Hypothesis Test

After judging the data validity and reliability, this paper starts to verify the hypothesis. In order to test the relationship between technical–nontechnical element synergy and collaborative innovation performance, the paper takes collaborative innovation performance as the dependent variable and technical–nontechnical element synergy as independent variables to carry out the correlation analysis. As can be seen from Table 6, there is a significant positive correlation between technical–nontechnical element synergy and collaborative innovation performance, the significance level is 0, concluding that H1, H2, H3, H4, H5 and H6 were supported. In addition, it is found that the synergistic effect of comprehensive coordination of technical–nontechnical elements is more positive than that of the synergies of two of technical–nontechnical elements, which means that the interaction of the elements produces the overall effect that the single factor cannot achieve, and achieves "1 + 1 > 2" advantage.

Table 6. Correlation coefficient.

	Item	B0	B1	B2	B3	B4	B5
A	Pearson Correlation	0.706 ***	0.599 ***	0.471 ***	0.536 ***	0.568 ***	0.568 ***
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00	0.00
	N	155	155	155	155	155	155

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, N = 195.

3.4. Regulation Test

Based on the previous verification of the basic hypothesis, this paper further verifies the moderating effect of the talent flow. The paper uses the method of hierarchical regression to verify the moderating effect of the talent flow on the correlation between technical–nontechnical element synergy and collaborative innovation performance. In order to verify the moderating effect, we firstly calculated the regression relationship between independent variable and dependent variable. Then, by calculating the regression relationship between cross-value and dependent variable, we verified whether the moderating effect was significant.

3.4.1. Technical–Nontechnical Element Comprehensive Synergy and Talent Flow

ΔR^2 and the coefficients were used to evaluate the efficiency of regression. It can be seen from Table 7 that the three equations of ΔR^2 and the coefficients of B0*C are significant, which indicates that the regulation effect exists. Furthermore, we judged the moderating direction by drawing the moderating regression figure. Figure 2 shows regression result. The abscissa represents the value of the moderating variable and the ordinate represents the correlation coefficient between independent variable and dependent variable. According to Figure 2, we can see that the greater the C is, the greater the correlation coefficient is. This means the moderating variable positively moderates the relationship between technical–nontechnical element comprehensive synergy and collaborative innovation performance. This supports H7.

Table 7. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	2.601 ***	1.927 ***	3.546 ***
B0	0.581 ***	0.424 ***	0.081
C		0.277 ***	−0.054
B0*C			0.068 *
R^2	0.498 ***	0.57 ***	0.585 ***
ΔR^2		0.071 ***	0.015 *
Sig.	0.00	0.00	0.019

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

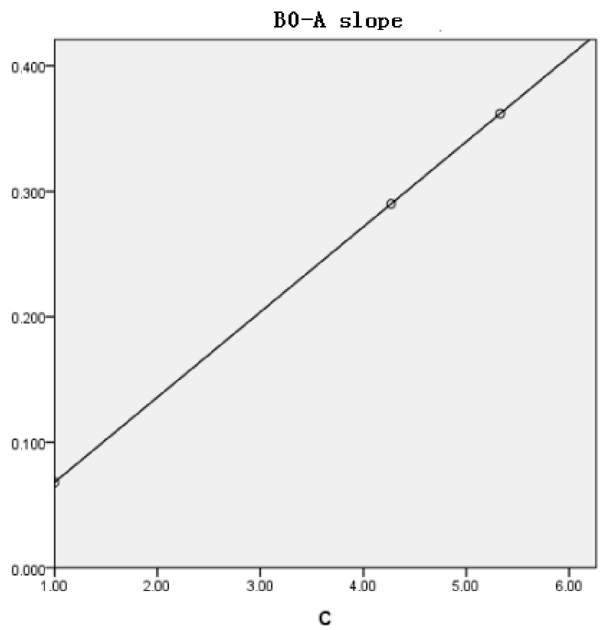

Figure 2. C and B0-A slope regression graph.

3.4.2. Technical–Market Element Synergy and Talent Flow

Table 8 shows the results of moderating analysis between technical–market element synergy and collaborative innovation performance. With Table 8, we can see that the three equations of ΔR^2 and the coefficients of B1*C are significant, which indicates that the regulation effect exists. It can be seen from Figure 3 that the greater the C is, the greater the effect of B1 on A is, which supports H7.1—the talent flow has a positive regulation effect on the correlation between technical–market element synergy and collaborative innovation performance.

Table 8. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	3.271 ***	1.807 ***	2.342 ***
B1	0.453 ***	0.324 ***	0.254 ***
C		0.398 ***	0.261 ***
B1*C			0.023 ***
R^2	0.359 ***	0.553 ***	0.581 ***
ΔR^2		0.193 ***	0.028 ***
Sig.	0.00	0.00	0.00

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

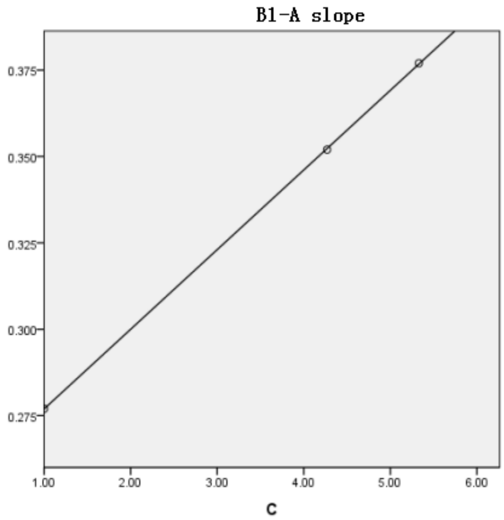

Figure 3. C and B1-A slope regression graph.

3.4.3. Technical–Organizational Element Synergy and Talent Flow

Table 9 shows the results of moderating analysis between technical–organizational element synergy and collaborative innovation performance. According to Table 9, we can see that the three equations of ΔR^2 and the coefficients of B2*C are not significant, which indicates that there is no moderating effect on the correlation between the synergy between technical–organizational element synergy and collaborative innovation performance and assumes that H7.2 is not established.

Table 9. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	3.215 ***	1.777 ***	0.851
B2	0.413 ***	0.25 ***	0.416 ***
C		0.444 ***	0.624 ***
B2*C			−0.032
R^2	0.222 ***	0.465 ***	0.467 ***
ΔR^2		0.243 ***	0.002
Sig.	0.00	0.00	0.489

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.4.4. Technical–Cultural Element Synergy and Talent Flow

Table 10 shows the results of moderating analysis between technical–cultural element synergy and collaborative innovation performance. According to Table 10, we can see that the three equations of ΔR^2 and the coefficients of B3*C are not significant, which indicates that there is no moderating effect on the correlation between the synergy between technical–cultural element synergy and collaborative innovation performance and assumes that H7.3 is not established.

Table 10. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	3.436 ***	1.775 ***	1.503
B3	0.407 ***	0.286 ***	0.34 ***
C		0.43 ***	0.481 ***
B3*C			−0.01
R^2	0.288 ***	0.523 ***	0.523 ***
ΔR^2		0.235 ***	0.00
Sig.	0.00	0.00	0.78

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.4.5. Technical–Strategic Element Synergy and Talent Flow

Table 11 shows the results of moderating analysis between technical–strategic element synergy and collaborative innovation performance. According to Table 11, we can see that the three equations of ΔR^2 and the coefficients of B4*C are significant, which indicates that the regulation effect exists. It can be seen from Figure 4 that the greater the C is, the greater the effect of B4 on A is, which supports H7.4—the talent flow has a positive regulation effect on the correlation between technical–strategic element synergy and collaborative innovation performance.

Table 11. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	4.029 ***	2.509 ***	3.113 ***
B4	0.361 ***	0.227 ***	0.136 ***
C		0.392 ***	0.13
B4*C			0.043 ***
R^2	0.323 ***	0.495 ***	0.562 ***
ΔR^2		0.172 ***	0.067 ***
Sig.	0.00	0.00	0.00

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

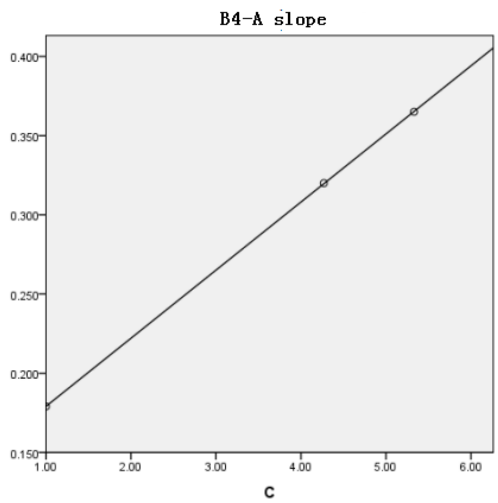

Figure 4. C and B4-A slope regression graph.

3.4.6. Technical–Institutional Element Synergy and Talent Flow

Table 12 shows the results of moderating analysis between technical–institutional element synergy and collaborative innovation performance. According to Table 11, we can see that the three equations of ΔR^2 and the coefficients of B5*C are significant, which indicates that the regulation effect exists. Figure 5 shows that the greater the C is, the greater the effect of B5 on A is, which supports H7.5—the talent flow has a positive regulation effect on the correlation between technical–institutional element synergy and collaborative innovation performance.

Table 12. Hierarchical regression results.

Variables	Model 1	Model 2	Model 3
constant	3.29 ***	2.214 ***	3.684 ***
B5	0.414 ***	0.239 ***	−0.047
C		0.383 ***	0.065
B5*C			0.06 ***
R^2	0.323 ***	0.471 ***	0.487 ***
ΔR^2		0.172 ***	0.067 *
Sig.	0.00	0.00	0.031

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

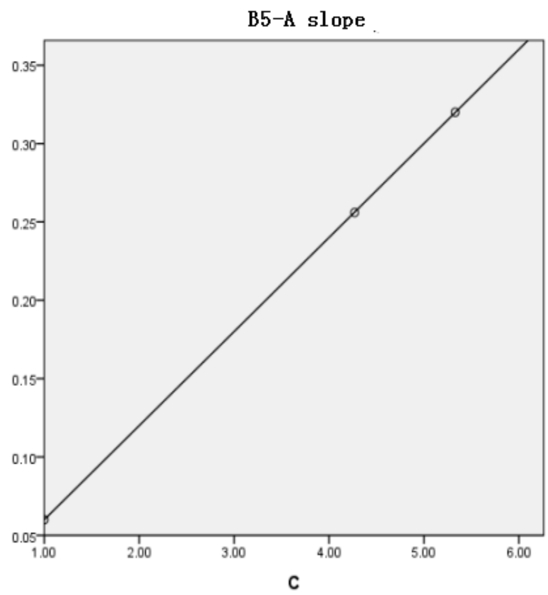

Figure 5. C and B5-A slope regression graph.

3.5. *Results Discussion*

Based on the above analysis, it can be concluded that H1, H2, H3, H4, H5, H6 are supported. In the internet enterprise, the technology–nontechnical factors synergy are beneficial to the improvement of the collaborative innovation performance, and the comprehensive coordination of the elements can generate integration advantages that single factor synergy cannot produce.

According to Table 6, all of the Pearson correlations are greater than 0.4. This means all technical–nontechnical element synergy is related to corporate innovation performance. For example, the Pearson correlation for technical–market synergy is 0.599 and p value is less than 0.001. When a company makes synergy between technology and market, it will have a better innovation performance. This result is similar to previous research and discussion. With these results, companies that want to improve corporate innovation performance should establish the synergy between technical element and nontechnical element. Especially, the Pearson correlation for comprehensive technical–nontechnical element synergy is 0.706 and p value is less than 0.001. This result demonstrates that comprehensive synergy also has a close relation with corporate innovation performance. So, for every company, it is better to accomplish comprehensive synergy. Comprehensive synergy is beneficial to help company to obtain a greater advantage.

As for the moderating effect of talent flow, we establish the hypotheses: H7, H7.1, H7.2, H7.3, H7.4, H7.5. According above moderating test result, we can conclude that H7, H7.1, H7.4, H7.5 are established and H7.2, H7.3 are not established. This shows that the talent flow can positively moderate technical–market element synergy, technical–institutional element synergy, technical–strategic element cooperation, technical–nontechnical element synergy to collaborative innovation performance. Market demand changes fast. The synergy between technology and market is beneficial to help companies to make fast responses to market demand change. Talent flow influences this relationship. Company institutions are established by employees and are also manages their behavior. Talent flow will influence institution operation effectiveness, and influence finally corporate innovation performance. Company strategy generally includes talent strategy. So, talent flow that is too high will influence the strategy accomplishment effectiveness. Talent is the most important resource for a company; talent flow moderates the relation between comprehensive synergy and innovation performance.

However, there is no moderating effect on the correlation of technical–organizational element synergy, technical–culture element synergy and collaborative innovation performance. In order to adapt to the rapid development of the environment, the organizational structure of the internet is flat and the level is less. This organization structure can adapt to the high-speed talent flow, and the company's corporate culture in the early days of the enterprise has been finalized, unless there is a major change. So the flow of talent cannot adjust the two groups' relationship. As for company culture, employee's decisions of leaving or entering a company are greatly related to the company's culture. In other words, talent flow is one part of company culture. So, talent flow may not moderate the relation between technical–culture synergy and corporate innovation performance.

4. Research Conclusions

This article explores the correlation relationship between technical–nontechnical element synergy and collaborative innovation performance and whether the talent flow frequency has a moderating effect on the relationship in the context of the internet industry. It mainly uses the method of correlation analysis and hierarchical analysis. After analysis, the following conclusions can be obtained:

1. The synergy of the internal factors of the internet company can enhance the performance of enterprise collaborative innovation performance. Additionally, the synergy of the overall factors can produce an integration advantage that cannot be produced by single factor synergy. Therefore, in the process of strengthening innovation, enterprises should not only improve the technical factors, such as the proportion of R&D investment, the standardization of scientific research equipment, but also should pay attention to the nontechnical factors in innovation network, strive to achieve technical–nontechnical elements synergy and build collaborative innovation networks.
2. The talent flow has a positive moderating effect on the correlation relationship between technical–nontechnical element synergy and collaborative innovation performance. Therefore, internet companies can moderate the flow of talent to adjust the relationship between internal factors synergy and innovation performance, and then improve the performance of enterprise innovation. However, it should be noted that the high rate of talent turnover should be caused by new staff and internal staff team cooperation, rather than by employees leaving. So, internet companies need to control the turnover rate. At the same time, they should strengthen the internal flow frequency to enhance the internal staff vitality and passion, stimulate their innovative thinking and finally enhance corporate innovation performance.

Considering the fact that innovation and talent drive sustainable development, any company should pay more attention to innovation performance and talent reservation. In other word, sustainability cannot be separated from technology innovation and talent. So, the results have valuable references for any sustainability, such as environment, society, economic and so on.

The research of this paper has great theoretical and practical significance. On the one hand, this paper broadens the research scope of collaborative innovation theory. It specially focuses on the effect of talent flow on the relationship between element synergy and innovation performance. This provides new research perspectives, inspiring future research to pay more attention to talent flow. On the other hand, the results offer practical suggestions for members of this area. Internet companies should try to enhance corporate element synergy including technical–nontechnical synergy, which is positively related to innovation performance. At the same time, although proper talent flow is beneficial for company to get external knowledge and open innovation, more frequent talent flow will influence the positive effect of synergy on innovation performance. So, every internet company should pay more attention to their talent flow problem.

Of course there are some limitations in our paper. The data used in model analysis are surveyed from internet companies. So, the results may not be directly applicable for other industry with special characteristics. At the same time, it is better to use long term and continuous data to analyze the effect of synergy on innovation performance. We will try our best to improve the research in future.

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