

A Meta-analysis of the Effects of Firm's Social Capital on Innovation Performance

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Abstract

Despite a surge of studies examining the impact of firm's social capital on the innovation performance, empirical research shows controversial results. To resolve this problem, this paper conducted a meta-analysis to restudy the impact of the firm's social capital and its three dimensions on innovation performance based on the previous empirical research results of independent samples. This paper also explored some moderators affecting this relationship from culture, industry, firm and methodology. The results indicated that the firm's social capital and its three-dimension had positive impact on innovation performance. At the same time, the age of the firm and the cultural context can also affect the impact of social capital on innovation performance to a large extent. Based on these findings, this paper developed recommendations for future research.

Keywords: *Social Capital; Innovation Performance; Meta-analysis; Moderating Factors*

1 INTRODUCTION

With the Since the concept of social capital was firstly proposed, more and more sociologists, political scientists, economists, and management scientists have begun to explore the answers to the problems of their fields from the perspective of social capital. In recent years, the concept of social networks and social capital has gradually entered the field of innovation research, and a large number of studies have been done in order to explore the relationship between social capital and innovation[1].

Previous theoretical studies have clarified that social capital can play a positive role. The contribution of social capital to corporate innovation was that social capital could help reduce transaction costs, search and information costs, negotiated decision costs, and strategy development and implementation costs[2]. Social capital could not only increase the degree of participation in innovation, but also could promote radical innovation[3]. Social capital was the foundation of innovation, mainly because innovation is gradually considered to be the result of the interaction and exchange of knowledge from actors in different organizations[4]. Therefore, innovation requires the accumulation of diverse knowledge from different types of actors. Obviously, social capital can achieve it. However, empirical research shows some results that are different from the theoretical analysis. Some scholars' researches show that there is a positive and significant relationship between the two variables. Social capital has a positive and significant effect on the effectiveness of new product innovation[5]. Social capital has a positive and significant impact on the performance of technological innovation and service innovation [6,7]. Furthermore, some researches have shown that there is no significant relationship between the two variables. The structural and relational dimensions of vertical and horizontal social capital incubating enterprises have no direct impact on technological innovation performance [8]. The impact of social capital on innovation is not significant when human capital interacts.[9]. In addition, some researches have shown that there is a negative relationship between the two variables. The cooperative network structure hole has a negative impact on innovation [10]. High social capital did not give rise to high levels of innovation[11], and network connections have a negative impact on the number of new products or services[12]. In addition, some scholars believe that there is a curvilinear relationship between the two variables. The effect is more significant when engaged in exploratory innovation tasks, and it will be difficult to play its role under innovative tasks [13].

In sum, although the importance of firm's social capital in the innovation process has been generally recognized, no consensus has been reached on whether social capital can improve innovation performance. Therefore, the author uses the meta-analysis method to quantitatively evaluate the existing empirical research, and to obtain a more general conclusion by correcting the sample and measurement errors. It is expected that it will be helpful to the corporate practice. This article will focus on two issues: (1) Can firm's social capital improve innovation performance? (2) What factors affect the relationship between firm's social capital and innovation performance?

2 HYPOTHESIS

2.1 The Relationship between Corporate Social Capital and Innovation Performance

The research of Nahapiet gave an analysis framework of corporate-level social capital. He defined social capital as embedded in the corporate, available, and derived from the network of relationships owned by individuals or social units, actual and potential. It is believed that corporate social capital has three interrelated dimensions of structure, relationship and cognition[14]. Uzzi pointed out that social capital can provide three key benefits: information, influence and solidarity. Information benefit means that social capital can provide opportunities to access a large number of information sources and improve the quality, relevance and timeliness of information; Affecting interests means that social capital enables enterprises to accomplish things and achieve goals; solidarity interests mean that social capital can urge members to consciously abide by rules and conventions without formal control. Therefore, social capital can create a more effective and safe environment, which is conducive to the acquisition, transfer and utilization of knowledge[15]. Innovation is a business process with uncertainties and risks. It needs to rely on effective knowledge exchange between people with different professional backgrounds and key opinions. Its success requires the integration of special capabilities[16].

Previous empirical studies have shown that the realization of social capital benefits can bring gratifying results in innovation. Tsai found that social capital can promote the exchange and integration of resources between business units to improve the effect of product innovation[17]. Yli research on high-tech companies in the UK shows that social capital can increase the number of new products by improving the effectiveness of knowledge utilization[18]. Zhang found through an empirical analysis of 210 Chinese companies that social capital can effectively promote the acquisition of information, funds and knowledge between companies and external organizations, thereby improving technological innovation performance[19]. The empirical study of Gima on Chinese high-tech enterprises shows that social capital can improve the performance of new products by balancing exploratory and utilization learning[20]. The research of Tsai also shows that the social capital of buyers and sellers can promote the development of customer knowledge and employees' commitment to innovation, which in turn can improve technological innovation performance[21].

In addition, the three dimensions of social capital's structure, relationship, and cognition will each have a certain impact on innovation performance. The dimensions of the social capital structure are determined by the type of network connection and its location. Close social interaction allows members to understand each other, share important information, reach consensus on tasks and goals, and help them obtain resources from others. All of these are the creation and Implementation provides convenience[22]. The social capital relationship dimension describes specific aspects of the relationship, including concepts such as friendship, trust, and commitment that affect behavior, which will reduce the generation of opportunistic behaviors and give organization members the ability to share tacit knowledge and high-quality information[23]. The cognitive dimension of social capital is the common background and language in the structure, which can reduce conflicts, promote negotiation, and establish common goals, so it can realize knowledge transfer and exchange[24]. Empirical research also supports the positive effects of the above three dimensions. The research of Wei shows that the three dimensions of social capital have a positive and significant impact on technological innovation performance[25]. The studies of Wang and Yu also show that the three-dimensional degree of social capital has a positive impact on knowledge management and innovation performance[26][27]. In summary, this article proposes the following hypotheses:

Hypothesis 1: There is a significant positive correlation between corporate social capital and innovation performance.

2.2 Contingency Factor

1) Cultural Background

National culture reflects a society rooted in common values and traditional modes of thinking, emotion, and action[28], which also means that the relationship between corporate social capital and innovation performance is different under different cultural backgrounds. Here, we choose the simplest and most useful variable of individualism/collectivism in the national culture that explains cross-cultural differences in attitudes and behaviors for analysis. Usually individualism is characterized by seeking self-interest and loose connections, while collectivism seeks group benefits. Van believe that innovation activities require interaction between companies, companies and customers, suppliers, and other stakeholders. Collectivism can promote social interaction and collaborative behavior, and therefore can achieve marketization of innovation. In contrast, individualism may be dangerous to the enterprise because it weakens the collaboration among members[29] Similarly, Edmondson also pointed out that innovation activities imply special challenges, patience, and a lot of effort, and require collaboration among members of the organization. Since enterprises have limited resources for innovation, they must rely on collaboration. This is obviously difficult to achieve under the high-level individualistic cultural characteristics[30]. In addition, Nakata believes that although both types of doctrines can affect innovation, individualism emphasizes the promotion of innovation through individual initiative, endurance, and risk-taking, while collectivism emphasizes the implementation of innovation through collaboration, planning, and unified goals[31]. In summary, this article proposes the following hypotheses:

Hypothesis 2: In the context of collectivist culture, the relationship between corporate social capital and innovation performance is more significant.

2) Industry Characteristics

The contingency theory treats corporate performance as a function of the matching of organizational structure and task environment characteristics, which also means that the corporate industry background will have an important impact on the relationship between social capital and innovation performance. Ruef believe that in the context of high-tech industries, knowledge has gradually become specialized and more dispersed within the industry, which requires companies to obtain knowledge from multiple sources, and companies with strong social capital will be able to obtain more unique knowledge , And carry out effective integration to improve the chance of producing innovative effects[32]. In contrast, in the context of low-tech industries, companies will benefit more from maintaining fewer network relationships, and companies will be easier to share and absorb knowledge with similar backgrounds without spending more energy and resources Coordinate and communicate a large number of relationships[33]. In addition, Kim pointed out that in the context of high-tech industries, companies with strong social capital can more sensitively detect external opportunities and threats that appear at any time, and will also prevent companies from being trapped in relationship inertia and unable to quickly restructure themselves. On the contrary, resources can prompt enterprises to adjust their strategic orientation more autonomously and flexibly to make full use of sudden changes[34]. In summary, this article proposes the following hypotheses:

Hypothesis 3: In the context of high-tech industries, the relationship between corporate social capital and innovation performance is more significant.

3) Firm Age

Sørensen studied the relationship between company age and innovation earlier, and believed that old companies would rely more on stereotypes and bureaucratic structures, confined to existing routines and practices, and therefore often fall into competence traps and cores. Stereotypes prevent them from successfully innovating[35]. Similarly, Gopalakrishnan also believes that due to limitations in existing cognitive frameworks and cultural norms, old companies are unlikely to effectively acquire and apply new knowledge that can break industry standards and paradigms, and tend to be more internal Search within the field of competence and expertise, so this also reduces the enterprise's knowledge base and reduces the scope of integration[36]. In addition, Hill believes that the specialization and flexibility of strategic assets are particularly important to the innovation process, and these will be a dilemma for

old enterprises. Old enterprises can benefit from the specialization of resources, but they have limited resources. The price of flexibility. In addition, Hill believes that the specialization and flexibility of strategic assets are particularly important for the innovation process, which will be a dilemma for old companies. Old companies have to sacrifice limited resource flexibility to obtain specialized benefits. In contrast, new enterprises can freely create processes and structures to form specific capabilities to gain competitive advantage. Therefore, new enterprises will exhibit a high degree of entrepreneurial orientation and are often called the pioneers of radical innovation in a discontinuous technological environment[37]. In summary, this article proposes the following hypotheses:

Hypothesis 4: In new enterprises, the relationship between corporate social capital and innovation performance is more significant.

3 RESEARCH DESIGN

3.1 Data Collection and Encoding

The following criteria for sample selections are used in this paper: (1) The research must be empirical; (2) The outcome variables in research must be relevant variables reflecting innovation performance, and predictive variables must include social capital; (3) The research must provide the correlation coefficient r between social capital and innovation performance or other statistical values that can be converted into r by calculation; (4) The research must be at the enterprise level, not at the individual, teaming or regional level; (5) The research sample must be independent samples. If there are multiple studies using the same sample, only one of them will be selected. If two samples are used for one study, the two independent studies are considered.

The database includes John Wiley, Elsevier Science, Emerald, EBSCO, SAGE Premier, cnki.net. Search in titles with terms such as “social capital”, “innovation performance”. The literature includes not only journal articles, but also conference papers, dissertations and working papers. A total of 63 articles were selected, including 21 dissertations, 39 journal articles and 3 conference papers, 38 English documents and 25 Chinese documents. The 63 articles collected were coded, and the first author of each study, the number of samples, the year of publication, the type of literature (thesis D, journal article J, and conference paper P) and correlation coefficients were extracted. When extracting correlation coefficients or other statistics, some studies may not report the overall relationship between the two, but only the relationship between the dimensions. Therefore, the overall value is obtained by averaging the results of each relational dimension at the time of processing the data.

3.2 Encoding and Defining Variables

Moreover, the author defined the corresponding contextual factors and variable measures. Scenario moderators include cultural background, industry characteristics, and firm age: (1) According to cultural background, it can be divided into individualism (L) and collectivism (C). The former is mostly presented in western countries, and the latter is mostly presented in eastern countries.(2) Industry characteristics include high technology (H), low technology (L) and mixed technology (M) while high technology includes biotechnology, internet, software, electronic communications, etc., low technology includes food, agriculture, manufacturing, construction, etc.; (3) According to the age of the firm, it can be divided into new enterprise (N) and old enterprise (O), which are regarded as new enterprises for those whose average age is less than eight years, and vice versa. In addition, the influence of variable measurement is also considered in this paper: social capital metrics is divided into multi-dimensional (M) and single-dimensional (S), and social capital evaluation is divided into subjective criteria (S) and objective criteria (O). Innovation performance dimension is divided into technical categories (technical innovation T and product innovation P) and non-technical categories (service innovation S, management innovation M, and comprehensive innovation G). Innovation performance evaluation is divided into subjective criteria (S) and objective criteria (O), and the evaluation sources are divided into single source (S) and multiple sources (M).

4 RESULTS ANALYSIS

4.1 Main Effects and Homogeneity Analysis

Table 1 shows the results of the meta-analysis of the relationship between social capital and innovation performance. It can be seen from $Q=464.010$ that each effect value is heterogeneous and it needs to be analyzed by random effect model. I^2 (I-squared) = 86.6%, indicating that only 13.4% of it is caused by random errors. And $\tau^2=0.031$, which indicating that 3.1% inter-study variation can be used as the weight calculation. From the results of the stochastic model in Table 1, it can be seen that the effect size between social capital and innovation performance is 0.380. After Fisher transformation, the correlation coefficient is 0.363, indicating that the intensity is moderate, and 95% confidence interval does not include 0, indicating that the relationship is significant in general.

TABLE 1 META-ANALYSIS OVERALL EFFECT AND HOMOGENEITY TEST

Variable	K/N	Method	ES	95% CI	Z	Q	I ²	Tau ²
Social capital	63/13619	Fixed	0.374	[0.357 0.391]	43.301***	464.010***	86.6%	0.031
Innovation performance		Random	0.380	[0.333, 0.428]	15.611***			
Structural dimension	22/4499	Fixed	0.441	[0.412, 0.470]	29.628***	236.476***	91.1%	0.051
Innovation performance		Random	0.446	[0.346, 0.545]	8.761***			
Relationship dimension	24/4747	Fixed	0.489	[0.459, 0.520]	31.269***	371.564***	95.2%	0.093
Innovation performance		Random	0.428	[0.287, 0.570]	5.934***			
Cognitive dimension	19/4058	Fixed	0.476	[0.448, 0.504]	33.418***	396.528***	94.2%	0.080
Innovation performance		Random	0.421	[0.303, 0.539]	7.013***			
Structural dimension	20/4236	Fixed	0.559	[0.529, 0.589]	36.470***	140.002***	87.3%	0.033
Relationship dimension		Random	0.572	[0.485, 0.658]	12.985***			
Structural dimension	19/4058	Fixed	0.577	[0.546, 0.608]	36.859***	187.242***	90.4%	0.044
Cognitive dimension		Random	0.565	[0.464, 0.666]	10.959***			
Relationship dimension	19/4058	Fixed	0.601	[0.570, 0.632]	38.394***	232.554***	92.3%	0.056
Cognitive dimension		Random	0.594	[0.482, 0.707]	10.369***			

Note: K and N represent the literature and sample size of the study, respectively, ** $p < 0.05$, *** $p < 0.001$

In addition to considering the overall relationship between social capital and innovation performance, this article also analyzes the impact of various dimensions of social capital. From the results in Table 1, it can be seen that the relationship between the structural dimension, the relationship dimension, the cognitive dimension and the innovation performance and the relationship between the structure, the relationship and the cognitive dimension are also positively significant, but this is also heterogeneous. In order to accurately examine the impact of the three dimensions of interconnected social capital on innovation performance, referring to the practice of Colquitt [38], using the results of Table 1 to construct a correlation coefficient matrix, the total sample size is the harmonic average of each study. On this basis, use AMOS software to implement path analysis, The final result is shown in Figure 1. From the results in Figure 1, it can be seen that the three dimensions have positively significant impacts on innovation performance, and their impact strengths are also relatively close.

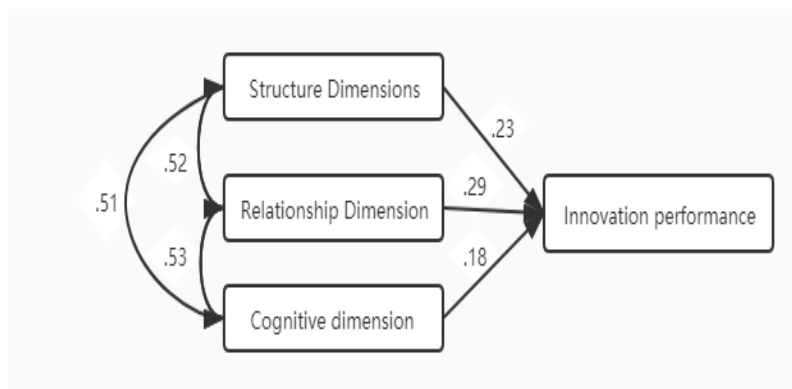


FIGURE 1 THE IMPACT OF THREE DIMENSIONS OF CORPORATE SOCIAL CAPITAL ON INNOVATION PERFORMANCE

In addition, this article also examines the issue of publication bias. Use the funnel chart method for qualitative detection, and the results are shown in Figure 2. In Figure 2, the horizontal axis represents the effect value, the vertical axis represents its standard error, the vertical solid line represents the comprehensive effect value, and the diagonal dashed line on both sides represents the 95% confidence interval of the comprehensive effect value. From the results, the scattered points are basically symmetrically distributed and mostly located within the confidence interval, so there is no publication bias. In addition, Begg rank correlation method and Egger linear regression method are used for quantitative test. The results of the Begg method show that the Z value after continuous correction is 0.07, the p value is 0.948, which is greater than 0.05, indicating that there is no statistical significance, that is, there is no publication bias. The result of Egger method shows that the bias t value is 4.57, the p value is 0.591, which is greater than 0.05, and the confidence interval [-1.567, 2.726] includes 0, that is, the intercept line spans 0 points, which also shows that there is no publication bias.

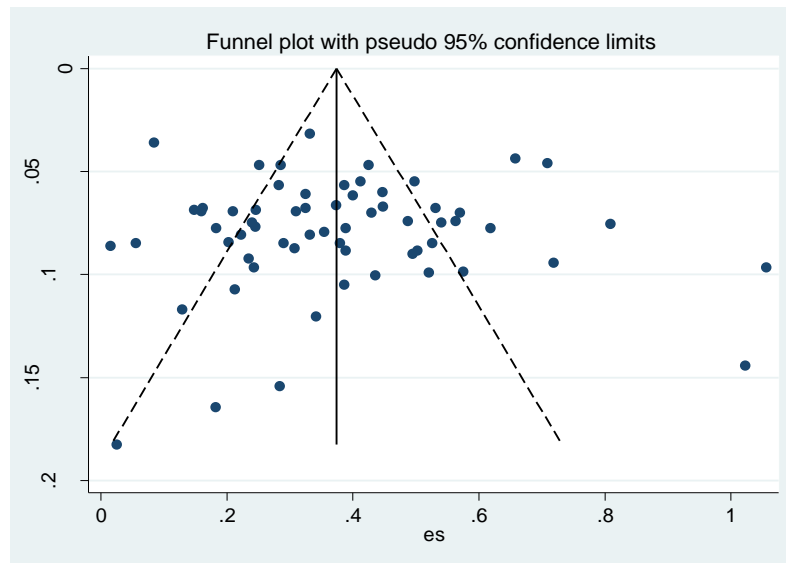


FIGURE 2 FUNNEL CHART OF PUBLICATION BIAS DETECTION

4.2 Analysis of Moderating Effects

This paper uses subgroup and regression analysis to analyze cultural background, industry characteristics, firm age, and variable measurement factors. The subgroup is divided according to the variable category, and the regression is divided according to the 0-1 variable (where collectivism, high technology, new enterprises, multi-dimensional social capital, subjective, technological innovation performance, and multi-party evaluation sources are set to 1). The final results are shown in Tables 2 and 3.

1) Cultural Background

The study divided the cultural background into collectivism background and individualism background. From Table 2, we can see that there is significant heterogeneity within the group ($QC=425.41$, $QL=16.57$), and the two variables have a stronger positive relationship under collectivism ($ESC=0.4$, $ESL=0.27$). According to the results of regression analysis Model 1, the cultural background regression coefficient is positive and significant ($B=0.159$, $p=0.023$), which is consistent with the subgrouping results. Therefore, the cultural background has a positive regulating effect on the relationship between social capital and innovation performance, and in the context of collectivist culture, the relationship between firm's social capital and innovation performance is more significant.

2) Industry Characteristics

In Table 2, there is significant heterogeneity within the industry characterization cluster ($QH=231.86$, $QM=28.19$, $QL=192.84$) and a stronger positive relationship between the two variables in high technology industries ($ESH=0.408$, $ESM=0.387$, $ESL=0.350$). According to the results of regression analysis Model 1, the regression coefficient of industry characteristics is positive but not significant ($B=0.011$, $p=0.665$), which is consistent with the

subgroup results. So it is impossible to explain the impact of industry characteristics on innovation performance.

TABLE 2 SUBGROUP ANALYSIS RESULTS

Moderators	K	N	ES	95% CI	Q	I ²	Tau ²	Z
Total	63	13619	0.380	[0.333, 0.428]	464.01***	86.6%	0.031	15.61***
Cultural Background								
C	54	11057	0.400	[0.346, 0.455]	425.41***	87.5%	0.035	14.36***
L	9	2562	0.270	[0.207, 0.332]	16.57*	51.7%	0.004	8.44***
Industry Characteristics								
H	24	4596	0.408	[0.313, 0.502]	231.86***	90.1%	0.049	8.47***
M	13	3920	0.387	[0.336, 0.439]	28.19***	57.4%	0.005	14.72***
L	26	5103	0.350	[0.270, 0.431]	192.84***	87.0%	0.036	8.58***
Firm age								
N	13	2655	0.517	[0.401, 0.633]	100.55***	88.1%	0.039	8.73***
O	50	10964	0.344	[0.297, 0.392]	290.97***	83.2%	0.023	14.17***
Social capital dimension								
M	31	5949	0.372	[0.291, 0.453]	286.97***	89.5%	0.046	9.03***
S	32	7670	0.385	[0.329, 0.440]	168.83***	81.6%	0.019	13.60***
Social capital evaluation								
S	59	12528	0.381	[0.334, 0.428]	390.21***	85.1%	0.028	15.80***
O	4	1091	0.383	[0.113, 0.654]	39.80***	92.5%	0.069	2.78**
Innovation performance dimension								
TP	50	10921	0.359	[0.306, 0.413]	367.27***	86.7%	0.031	13.11***
SMG	13	2698	0.459	[0.357, 0.561]	82.91***	85.5%	0.030	8.82***
Innovation performance evaluation								
S	55	11944	0.386	[0.337, 0.436]	384.45***	86.0%	0.029	15.28***
O	8	1675	0.335	[0.180, 0.491]	55.35***	87.4%	0.040	4.22***
Evaluation source								
M	47	9611	0.377	[0.324, 0.431]	304.62***	84.9%	0.028	13.85***
S	16	4008	0.390	[0.284, 0.496]	156.35***	90.4%	0.041	7.20***

TABLE 3 REGRESSION ANALYSIS RESULT

Variables	Model 1	Model 2	Model 3
	B (t)	B(t)	B(t)
Constant	0.359*** (3.93)	0.546*** (3.68)	0.501*** (2.83)
Cultural Background	0.159** (2.34)		0.188** (2.43)
Industry Characteristics	0.011 (0.44)		0.003 (0.10)
Firm age	-0.169*** (-2.75)		-0.169** (-2.57)
Social capital dimension		-0.016 (-0.30)	-0.017 (-0.34)
Social capital evaluation		-0.113 (-0.72)	-0.128 (-0.84)
Innovation performance dimension		-0.115 (-1.70)	-0.054 (-0.82)
Innovation performance evaluation		0.091 (0.78)	0.109 (0.98)
Evaluation source		-0.056 (-0.87)	-0.101 (-1.53)
Tau ²	0.027	0.034	0.029
I ²	84.68%	86.29%	83.64%
Adjust R ²	16.32%	-4.17%	12.38%
F	4.10	0.77	1.93
p	0.010	0.575	0.07

Note: ** p < 0.05, *** p < 0.001

3) Firm Age

It can be seen from Table 2 that the results within the two groups of new and old enterprises have significant heterogeneity (QN=100.55, QO=290.97). There is stronger positive relationship in the new firm (ESN=0.517, ESO=0.344). According to the results of regression analysis Model 1, the age regression coefficient of the company is negative and significant (B=-0.169, p=0.008), which is consistent with the subgroup results. Therefore, the research results show that company age has a negative moderating effect on the relationship between social capital

and innovation performance, and the moderating effect is more significant in new enterprises.

4) Variable Measurement

From Table 2 and Table 3, the influence of variable measurement factors on the relationship between firm's social capital and innovation performance can also be obtained.

For social capital, the value of the relationship between the two when using multiple dimensions is smaller than the value when using a single dimension (ESM=0.372, ESS=0.385). Regression analysis Model 2 supported the conclusion but showed no significant difference ($B=-0.016$, $p=0.769$). The relational value of subjective evaluation is slightly smaller than that of objective evaluation (ESS=0.381, ESO=0.383). Although regression model 2 supports this conclusion, it shows that the difference is not significant ($B=-0.113$, $p=0.477$).

For innovation performance, the relationship value of technological innovation is smaller than that of non-technical innovation (ESTP=0.359, ESSMG=0.459). Regression analysis Model 2 supported the conclusion but showed no significant difference ($B=-0.115$, $p=0.094$). The value of the relationship between the two when using subjective evaluation is greater than the value when objectively evaluating (ESS=0.386, ESO=0.335). Although regression model 2 supports this conclusion, it shows that the difference is not significant. ($B=0.091$, $p=0.438$).

For the evaluation source, the value of the relationship between the two sources when using multiple sources is smaller than that when using single sources (ESS=0.377, ESM=0.390). Although regression model 2 supports this conclusion, it shows that the difference is not significant ($B=-0.056$, $p=0.390$).

In addition, in Model 3, when the situational variables and measuring variables are included simultaneously, the results of the sub-group analysis and regression analysis are the same.

5 CONCLUSION

We use meta-analysis to analyze 63 literature, and the results show that the relationship between firm's social capital and innovation performance is positive and significant. Therefore, investing in the construction of social capital can help companies improve their innovation performance and achieve long-term development.

The analysis of the moderating effects of situational factors shows that cultural background and the age of the firm have an important impact on the relationship between firm's social capital and innovation performance, the effects of collectivism and new enterprises are more significant, and positive impact of the relationship between industry characteristics and firm's social capital and innovation performance is not significant. Therefore, for enterprises, the impact of different cultural backgrounds on corporate attitudes and behavior patterns is profound and significant, and it should be used to coordinate the development of corporate innovation activities; Although new enterprises have their own unfavorable conditions, they are better at using relationship networks to exert their value. Although the industry has different technological content and different resource elements required for innovative activities, enterprises can use their own advantages to achieve innovations that meet their conditions.

This paper also has some important practical implications. The meta-analysis in this paper has certain limitations that need to be improved in the future. Firstly, the literature collection only focuses on the research that directly addresses social capital and innovation performance, and ignores similar descriptions such as network structure. At the same time, no unpublished papers have been collected. In the future, it may join to enhance universality. Secondly, when selecting situational factors, due to the lack of literature data itself, the author does not analyze other variables that may have an impact on the relationship between social capital and innovation performance, such as the size of the enterprise, which can be analyzed in the future.

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