Relationship Between Firm's Social Capital and Innovation Performance: A Meta-Analysis

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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 relationship between firm's social capital and innovation performance based on the empirical research results of 63 independent samples. This paper also identified some moderators affecting this relationship. The results indicated that the firm's social capital-innovation performance link was positive and significant ($r = 0.363$), and the age of the firm and the cultural context affected the impact of social capital on innovation performance to a large extent. Based on these findings, this paper developed recommendations for future research.

Keywords: firm's social capital, innovation performance, meta-analysis, moderating factors

Introduction

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 (Yeşil & Doğan, 2019).

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 (Giuseppe, 2020). Social capital could not only increase the degree of participation in innovation, but also could promote radical innovation (Zhao, Li, & Liu, 2016). 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 (Chen & Wang, 2018). 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 not only has a significant positive impact on new product listing (Presutti, Cappiello, & Johanson, 2020), but also has a significant positive impact on technological innovation and service innovation performance (Sulistyo, 2016; Ozcan, Cakan, & Kayacan, 2017).

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 (Delgado-Verde, Mart ń-de Castro, & Amores-Salvadó, 2016). The structure and relationship of internal social capital have no significant effect on product innovation (Dost & Badir, 2019).

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 (Srivastava & Gnyawal, 2017). High social capital did not give rise to high levels of innovation (Safran & Zdemirci, 2020), and network connections have a negative impact on the number of new products or services (Eiteneyer, Bendig, & Brettel, 2019). 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 (Duodu & Rowlinson, 2019).

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?

Research Design

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.

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).

Results

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 $Tau^2 = 0.031$, 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

K/N	Method	ES	95% CI	Z	Q	I^2	Tau^2
63/13,619	Fixed	0.374	[0.357, 0.391]	43.301[***]	464.010[***]	86.6%	0.031
	Random	0.380	[0.333, 0.428]	15.611[***]			

Notes. K and N represent the literature and sample size of the study, respectively, *** $p < 0.001$.

Analysis of Moderating Effects

In order to test the moderating effect between social capital and innovation performance, the author 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.

Table 2

Subgroup Analysis Results

Moderators	K	N	ES	95% CI	Q	I^2	Tau^2	Z
Total	63	13,619	0.380	[0.333, 0.428]	464.01***	86.6%	0.031	15.61***
Cultural background								
C	54	11,057	0.400	[0.346, 0.455]	425.41***	87.5%	0.035	14.36***
L	9	2,562	0.270	[0.207, 0.332]	16.57**	51.7%	0.004	8.44***
Industry characteristics								
H	24	4,596	0.408	[0.313, 0.502]	231.86***	90.1%	0.049	8.47***
M	13	3,920	0.387	[0.336, 0.439]	28.19***	57.4%	0.005	14.72***
L	26	5,103	0.350	[0.270, 0.431]	192.84***	87.0%	0.036	8.58***
Firm age								
N	13	2,655	0.517	[0.401, 0.633]	100.55***	88.1%	0.039	8.73***
O	50	10,964	0.344	[0.297, 0.392]	290.97***	83.2%	0.023	14.17***
Social capital dimension								
M	31	5,949	0.372	[0.291, 0.453]	286.97***	89.5%	0.046	9.03***
S	32	7,670	0.385	[0.329, 0.440]	168.83***	81.6%	0.019	13.60***
Social capital evaluation								
S	59	12,528	0.381	[0.334, 0.428]	390.21***	85.1%	0.028	15.80***
O	4	1,091	0.383	[0.113, 0.654]	39.80***	92.5%	0.069	2.78**
Innovation performance dimension								
TP	50	10,921	0.359	[0.306, 0.413]	367.27***	86.7%	0.031	13.11***
SMG	13	2,698	0.459	[0.357, 0.561]	82.91***	85.5%	0.030	8.82***
Innovation performance evaluation								
S	55	11,944	0.386	[0.337, 0.436]	384.45***	86.0%	0.029	15.28***
O	8	1,675	0.335	[0.180, 0.491]	55.35***	87.4%	0.040	4.22***
Evaluation source								
M	47	9,611	0.377	[0.324, 0.431]	304.62***	84.9%	0.028	13.85***
S	16	4,008	0.390	[0.284, 0.496]	156.35***	90.4%	0.041	7.20***

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

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 (Q_C = 425.41, Q_L = 16.57), and the two variables have a stronger positive relationship under collectivism (ES_C = 0.4, ES_L = 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.

Industry Characteristics

In Table 2, there is significant heterogeneity within the industry characterization cluster (Q_H = 231.86, Q_M = 28.19, Q_L = 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. Therefore, it is impossible to explain the impact of industry characteristics on innovation performance.

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.

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

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

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.

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.

Limitations

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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