Innovation networks and innovation performance: the intermediary role of knowledge management capability

Zhongyuan Xu, Wei Chen
School of Management and Economics, Harbin Engineering University
P.R.China, 150001, xuruby0624@163.com

Abstract

This study extends the relationships between different innovation networks and innovation performance from a new perspective of knowledge management capability. Based on a survey to 239 Chinese knowledge intensive firms, this study empirically demonstrates how knowledge management capability plays an intermediary role from different innovation networks to innovation performance. The study reveals that there are significant positive associations from innovation networks with government agencies, inter-firms, horizontal institutions to knowledge management capability, and so relationship between knowledge management capability and innovation performance is. Surprisingly, relationships from both inter-firms and horizontal institutions to innovation performance are gained no support significantly, besides of stable positive relationship between innovation network with government agencies. Hence, these findings confirm that there is a part intermediary impact, where is from knowledge management capability, on the relationship between innovation network with government agencies and innovation performance. However, between innovation networks with both inter-firms and horizontal institutions and innovation performance, knowledge management capability plays full intermediary effect. In addition, the empirical results demonstrates that innovation network with suppliers, customers and competitors plays a more distinct role in the knowledge management process of KIFs than innovation network with universities, research institutions and nonprofit knowledge and technologic transfer organizations.

Keywords: Innovation networks; knowledge management capability; innovation performance, KIFs

Introduction

There is now a plenty of literature on the role of cooperation networks and their impact upon firm performance. Previous studies focused especially on an interest in the links between network ties and innovative performance. In China, since the implementation of the open policy in 1978, it has made great efforts to change from a former highly-centralized planned state to the current open-market economy (Siu, 2005). At the year of 2001, National Innovation System has been constructed explicitly in the 10th 5-year plan, which has

extremely stimulated the collaboration between universities, research institutions and enterprises. In this paper, knowledge management capability is concerned into the relationship between innovation networks and innovation performance, due to constructing a bridge from innovation co-operative organizations to innovation performance. Namely, how and how many degrees innovation networks effect on firm performance are focused through knowledge management capability. Specifically, the aim of this study is three-fold. First, we aim to formulate a structural framework of innovation networks along the vertical demand-supply chain and horizontal value chain. Secondly and dominantly, we focus to revealing direct and/or indirect effect of knowledge management capability on relationship between innovation networks and innovation performance. Thirdly and finally, our analysis seeks to draw conclusions for entrepreneurs, practitioners and policymakers.

Hypothesis development

The effect of government agencies on knowledge management capability and innovation performance

Some researchers indicate that it is necessary for governments to implement policies at all levels, that will enable companies to make their activities more innovative (Libutti, 2000). In addition, the role of government is usually embodied to support or establish public institutions or universities with the view to enhancing the knowledge and innovation base of the local economy. Cooperation with government agencies refers to the improvement of service provision such as government policies, related regulatory measures, strategic programs or public support. Among these service provisions, government policies refer to the “financial policies”, “industrial policies”, policies of “intellectual property protection” and “attracting and making full use of talents” and so on; related regulatory measures or strategic programs include the “scientific and technical projects” and “construction of innovation platform”, etc.; and public support involves, say for instance, “direct government subsidy” and “government purchasing policy” which provide support or subsidy to R&D and innovation activities for firms. In general improving service provision for firms is the crucial governance task. Surprisingly, according to the perspective of S. X. Zeng et al. (2010), there were not demonstrated any significant impact on the innovation performance through linkage with government agencies.

In general, government agencies can promote the implement of knowledge management capability of KIFs through related policies, and meanwhile, government can exert some impact on innovation of KIFs. Hence, we propose that:

H_1 The strength of networks between knowledge intensive firms and government agencies are positively associated with knowledge management capability

H_2 The strength of networks between knowledge intensive firms and government agencies have positive influences on innovation performance.

The effect of inter-firms on knowledge management capability and innovation performance

Generally, the innovative partners for inter-firm cooperation are customers, suppliers, producers, services providers and competitors. And networking activities of inter-firm cooperation primarily refer to the vertical relationships. Fischer and Varga (2002) utilized a recent survey providing data on innovation and inter-firm relationships, and found that networking activities were primarily based on vertical relationships (customer, supplier and producer service provider networks) rather than on horizontal linkages (industry-university linkages).

A number of studies have focused on the relationships between cooperation with customers or clients and

innovation of firms. Fischer and Varga (2001) noted that customer networks represented the most frequent form of inter-firm cooperation. Moreover, Füller and Matzler (2007) indicated that virtual customer integration, meaning that customers was virtually integrated into a company's innovation process, could provide valuable input for new product development. Some researchers focus on the cooperation with suppliers in innovation of firms, and suggest that cooperation with suppliers enables firms to reduce the risks and lead times of product development, while enhancing flexibility, product quality and market adaptability (Dhung and Kim, 2003). In particular, suppliers are valuable sources of information to develop or improve products (Nieto and Santamaría, 2007). As regards competitors, the purpose of cooperation with them, in general terms, is to carry out basic research and establish standards (Tether, 2002). Thus firms are likely to cooperate with competitors whenever they share common problems that are outside the competitor's area of influence, such as pre-competitive research programs and co-production arrangements (Tether, 2002).

The definition of inter-firm in our study indicates firms and/or institutions that interact with KIFs through downstream and upstream in the demand-supply chain. Firms and/or institutions from upstream include suppliers, while those from downstream include customers and clients. As members of vertical relationships, competitors and rivals are included in inter-firms of KIFs. Knowledge, information, technologic are flowing as the pattern of product and/or process among inter-firms and KIFs. Moreover, cooperation between inter-firms and KIFs has some impact on innovation performance. Therefore, we propose the following hypothesis:

H_3 The strength of networks between knowledge intensive firms and inter-firms are positively associated with knowledge management capability.

H_4 The strength of networks between knowledge intensive firms and inter-firms have positive influences on innovation performance.

The effect of horizontal institutions on knowledge management capability and innovation performance

Intermediary institutions, such as technology intermediaries, financing and training institutions, venture capital organizations, technology transfer organizations and technology market play some important roles within the innovation process, which have been variously described as intermediary firms, bridges, information intermediaries and innovation intermediaries (Howells, 2006). Research organizations (ROs) including universities, colleges, technical institutes and research institutions, have not traditionally focused on filling out the innovation processes of firms, but on providing them with new scientific and technological knowledge (Drejer and Jorgensen, 2005). The modes of innovative cooperation between firms and research organizations are mainly of informal communication of skills and knowledge, technology trade or technology transfer, formal R&D collaboration, joint R&D, training of innovative personnel, and provision of skilled workforce and graduates with knowledge and skills and so on. Generally, such collaboration in these networks is said to decrease transaction costs, correct market failures and decrease the risks of the interacting partners leading to increased productivity (Pekkarinen and Harmaakorpi, 2006). Belderbos et al. (2004) highlighted the cooperation with ROs as the most effective way to achieve innovations intended to open new markets and segments. Besides the provision of new knowledge for businesses through academic research activities, research institutions also provide knowledge in the form of a skilled workforce (Diez, 2000).

In this paper, we define horizontal institutions as intermediary organizations who provide services to firms to help them extract value from knowledge, in order to enhance their endogenous potential of innovation.

Therefore, in the light of the analysis above, it is hypothesized that:

H_5 The strength of networks between knowledge intensive firms and horizontal institutions are positively associated with knowledge management capability.

H_6 The strength of networks between knowledge intensive firms and horizontal institutions have positive

influences on innovation performance.

Knowledge management and innovation performance

Hurley and Hult (1998) concluded that new knowledge developed through organizational learning is important for firm innovation capability. Commitment to learning promotes learning orientation, which leads to innovation capability (Verona, 1999). The innovation process widely involves the knowledge management process, including acquisition, dissemination, and use of new knowledge (Moorman and Miner, 1998; Verona, 1999). For KIFs that mostly adopt knowledge management strategy, innovation capabilities are critical to achieving a superior innovation performance (Jie, 2012). The competitive advantage comes from intellectual assets-knowledge and innovation in KIFs. A study on traditional firms offers more limited insight than knowledge-based firms (Starbuck, 1993), which are represented typically by KIFs. KIFs mainly rely on their dynamic capability to transform the knowledge. Knowledge stocks and flows are regarded as idiosyncratic to the firm and, therefore, a source of sustainable competitive advantage. Successful innovation is highly dependent on the development and integration of new knowledge while knowledge creation and transfer are regarded as a basis for competitive advantage.

In our studies, knowledge management capability is divided into three sections: knowledge formulation capability, knowledge application capability and knowledge protection capability. As one section of this new conceptual framework of knowledge management capability, knowledge formulation capability is considered a process of knowledge creation, absorption, assimilation. It can be shown that firms acquire knowledge from internal creative intent or external innovation networks such as KIFs with information services institutions built by government agency, upstream providers from inter-firms, or research institutions from horizontal institutions. Knowledge application capability can be defined a stage of knowledge transfer and exploitation. And as the same predominant effect comparing with aforementioned capabilities, knowledge protection capability is also an important segment to foster innovation performance.Based upon the above discussion, we thus suggest the following hypothesis:

H_7 Knowledge management capability of KIFs is positively associated with innovation performance.

Research methodology

Questionnaire and variable construction

The questionnaire included questions on the firm's business background, firm size, their R&D and innovation activities, as well as their co-operative and network ties with partner firms. The questions were based upon those used in previous academic research. Table 1 presents the constructs and their corresponding measures in our study. The constructs in our study are based on the preceding studies on cooperation with government, cooperation with inter-firms, cooperation with horizontal institutions and knowledge management capability. To reduce response bias, the questionnaire scattered those related questions measuring each construct across the survey form. In addition, the questionnaire was pre-tested for validity to a panel of experts in the related field, including executives of KIFs, government officers, consultants, scholars.

Data source and sample

The data were collected via a cross-sectional survey approach by sending questionnaires to 600 KIFs. In this investigation, the questionnaires were mailed to the subjects with a covering letter, a complimentary card and a stamped envelope. The participants were informed that if they returned the completed questionnaire, they would receive a summary report of the study as an encouragement. Four weeks later, 275 questionnaires were received,

in which were 239 valid, with a response rate of 87%.

Table 1 Constructs, measures and literature sources

Constructs	Measures	Literature sources
Innovation networks with government agencies	Innovation service departments, Information service departments	Yanez, C. J. N., Magnier, A., Ramirez, M. A., 2008.
Innovation networks with inter-firms	Suppliers, customers/clients, competitors/rivals	Fischer, M. M., Varga, A., 2002.
Innovation networks with horizontal institutions	University technology transfer offices, public research organizations, nonprofit knowledge and technology transfer organizations	Rejean Landry, et al., 2013.
Knowledge management capability	Knowledge formulation capability, knowledge application capability, knowledge protection capability	Kogut, B., Zander, U., 1992.
Innovation performance	The growth rate of production of new products, the growth rate of market share of new products	Jie Yang. 2012.

Table 2 shows the characteristics of the sample. It indicates that there are, in terms of ownership 45.61% Private Enterprises, 40.17% State-Owned Enterprises, 14.23% Foreigh-Invested Enterprises. There are 10 industrial categories. And Table 3 shows the characteristics of the respondents.

Table 2 Characteristics of the enterprises

Characteristics	Number of enterprises	Percentage(%)
Ownership		
Private Enterprises	109	45.61%
State-Owned Enterprises	96	40.17%
Foreigh-Invested Enterprises	34	14.23%
Industries belong to		
Accoutants	16	6.69%
Legal Business	27	11.30%
Consulting Institutions	34	14.23%
Information Technics	26	10.88%
Medical	28	11.72%
Chemical	26	10.88%
Telecommunications	19	7.95%
Electric Equipments	45	18.83%
Precision Instruments	9	3.77%
Automobile Manufacturing	9	3.77%
Total	239	100

Methodology

Structural equation modeling (SEM), a multivariate statistical technique, is used in this study to analyze the data (Diamantopoulos, 1993). The data was inputted into SPSS 19.0, through which all the statistical analysis was

conducted.

Table 3 Characteristics of the respondents

Characteristics	Number of respondents	Percentage(%)
Level of education		
Doctor's degree	22	9.21%
Master's degree	62	25.94%
Bachelor's degree	88	36.82%
High school	61	25.52%
Junior high school	6	2.51%
Position in the enterprise		
Executive	98	41.00%
R&D	44	18.41%
Production	33	13.81%
Marketing	45	18.83%
Training	16	6.69%
Others	3	1.26%
Total	239	100

Results and analysis

Using AMOS17.0, statistics from sample have been analyzed, and the results are presented from three parts: firstly, statistics basis description, such as means, standard deviations, and so on; secondly, confirmation of creditability and validity of the 5-instrument model; finally, investigation of relationships among the latent variables.

Table 4 shows summary statistics, including means, standard deviations (S. D.), and internal consistencies (Cronbach's α) to test reliability, KMO and Bartlett's test for . As can be seen at the right part of Table 4, the Cronbach'sα range from 0.653 for innovation network with inter-firms to 0.871 for innovation network with horizontal institutions and knowledge management capability, indicating that the items forming each factor are reliable. We have to mention that, although the values of Cronbach'sα for innovation network inter-firms and innovation performance are not at the acceptable levels of reliability, which are hoped to be greater than 0.7 (Nunally, 1978), schalors and participers consider it can be accepted over 0.5 usually. KMO is accepted over 0.8, indicating the 5-instrument model constructing reasonably.

In examining the unidimensionality and convergent validity of the constructs, confirmatory factor analyzes were performed on a measurement model, including innovation network with government agencies, innovation network with inter-firms, innovation network with horizontal institutions, knowledge management capability, and innovation performance. The fit indices suggest a good fit for the model with GFI=0.848, AGFI=0.761, NFI=0.817, CFI=0.847, RMSEA=0.126. This reveals that the model does a good job in explaining the relationships between latent variables and observed variables.

Furthermore, according to the theoretical part aforementioned and the foundation of basis statistics analysis above, a hypothetical structural equation model has been constructed, describing the path from innovation networks to innovation performance.

Table 4 Means, standard deviations (S. D.), Cronbach'sα, KMO, Bartlett's test

Latent variables	Observed variables	Means	S. D.	Cronbach'sα
Innovation network with government agencies	Innovation service departments	4.7950	1.15401	0.763
	Information service departments	4.9582	0.97787	
Innovation network with inter-firms	Suppliers	5.0628	1.02091	0.653
	Customers/clients	4.8243	1.13504	
	Competitors/rivals	4.8745	1.12316	
Innovation network with horizontal institutions	Universities	4.5607	1.20724	0.871
	Public research organizations	4.2845	1.23440	
	Nonprofit knowledge and technology transfer organizations	4.8912	1.01495	
Knowledge management capability	Knowledge formulation capability	4.8075	1.05946	0.871
	Knowledge application capability	5.0293	0.81683	
	Knowledge protection capability	4.3347	1.16536	
Innovation performance	The growth rate of new products	5.2678	0.80142	0.686
	The growth rate of market share	4.8285	1.00830	
KMO=0.868; Bartlett's test=1486.212 (Sig.=0.000)				

Fig. 1 and Table 5 show the results of path analysis. Fig. 2 indicates the coefficients and error terms of the causal model. As the results of Table 5, hypothesis of a positive impact from innovation networks to innovation performance has been proved, and the intermediary role of knowledge management capability between innovation networks and innovation performance has been supported. More specifically, hypothesis 1, hypothesis 3 and hypothesis 5 have all received solid support, what means that there are significant positive associated with innovation networks and knowledge management capability because innovation network with government agencies exerts a marginally significant and positive effect ($p<0.001$) on knowledge management capability, innovation network with inter-firms is related positively to knowledge management capability ($p<0.001$), and meanwhile, innovation network with horizontal institutions is obviously positive impact on knowledge management capability ($p<0.001$). The analysis offers marginal support of hypothesis 2. But surprisingly, hypothesis 4 and hypothesis 6 receive no support from the analysis. In addition, Table 5 suggests that knowledge management capability is significantly related to innovation performance.

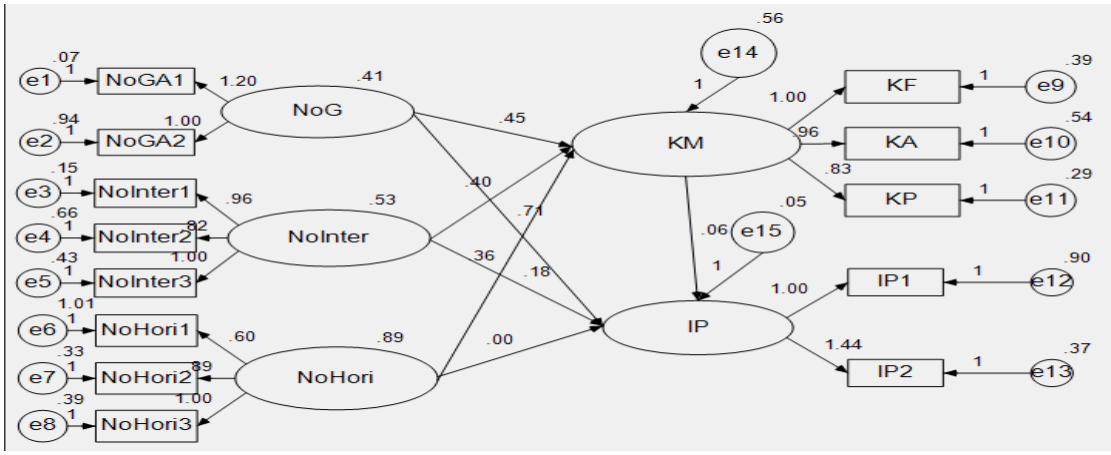

Fig. 1. Path coefficience for hypothetical structure

Table 5 Path estimates and hypothesis confirmation

Parameter path	Coefficient	Model hypotheses	Results
NoG→KM	0.45***	H_1	Supported
NoG→IP	0.713***	H_2	Supported
NoInter→KM	0.40***	H_3	Supported
NoInter→IP	0.176	H_4	Not statistically significant
NoH→KM	0.36***	H_5	Supported
NoH→IP	0.003	H_6	Not statistically significant
KM→IP	0.65**	H_7	Supported

H_1 predicts the path from government agencies to knowledge management capability. As the path coefficient from government agencies to knowledge is positive (0.45) and significant ($p<0.001$), H_1 is supported. The result reveals that innovation networks with government agencies for firms investigated can improve their knowledge management capability. Government proposes some long or short innovative orientation, providing innovation service and information service to knowledge intensive firms, due to fostering the level of science and technic. Types of government policies, such as "scientific and technical project", make an important impact on knowledge management capability. At meanwhile, H_2 which predicts innovation network with government agencies is positively associated with innovation performance is supported, either. Because, the path coefficient is statistically significant (0.713, $p<0.001$). The result reveals that there is significant correlation between innovation network with government agencies and innovation performance. That is to say, the linkage with government agencies has a significant impact on the innovation performance of KIFs. This result maybe not consistent some studies from other sample choiced which refuse the significant positive associated between innovation network with government agencies and innovation performance (101). Located in the similar environment, S. X. Zeng et al. (2010) have argued that no significant relation between government agencies and innovation performance, foundation of 137 small- and medium-sized enterprises sample of Shanghai in China. This distinction may come from the different sample investigated, knowledge intensive firms we investigated more come from state-owned firms, one type of ownership. The related policies on technology innovation, particularly the intellectual property protection and financial policies, to some extent, are more leaned to large enterprises.

H_3 accounts for the path from innovation network with inter-firms to knowledge management capability. This is supported since the path coefficient is positive (0.4) and significant ($p<0.001$). The result shows that there is, as predicted, a significant positive correlation between innovation network with inter-firms and knowledge management capability of KIFs. Therefore, to focusing on the innovation network with inter-firms will lead to better knowledge management capability. This result reveals that the close linkage with suppliers, customers and even competitors will extremely foster the implement of knowledge management capability. However, H_4 which predicts innovation network with inter-firms is positively associated with innovation performance is not supported because of no statistically significant path coefficient. This result indicates that there is no significant correlation between innovation network with inter-firms and innovation performance. However, this finding is not consistent with some other studies. There are some possible explanations for the result. According to KIFs, patents and licenses as tacit knowledge, are the key core competitive advantage. This tacit knowledge is hard to be explicit through transferring, especially in the vertical structure. Hence, we consider that maybe there are some intermediary role between innovation network with inter-firms and innovation performance, instead of the

direct relationship.

H_5 predicts the path from innovation network with horizontal institutions to knowledge management capability. As the path coefficient is positive (0.36) and significant ($p<0.001$), this hypothesis is supported. The result shows that, as to be predicted, there was a significant positive correlation between innovation network with horizontal institutions and knowledge management capability. It reveals that the close linkage with horizontal institutions, in another words, intermediary institutions, such as universities, research institutions and nonprofit knowledge and technologic transfer institutions, will lead to better knowledge management capability for KIFs. However, compared with innovation network with government agencies and inter-firms, innovation network with horizontal institutions has the most weakly impact on knowledge management capability. This reason may be analyzed from some parts below. Although in KIFs, information resource is considered as the most important driving force for corporate growth, the service from intermediary institutions have not been satisfied. The channels from horizontal institutions to KIFs are lack, currently the most patern of building the relationship relying to Science Zone or Industry Park, where are limited by some regulations to take part in. However, to be surprised, H_6 which we predict that innovation network with horizontal institutions is positively significant correlation with innovation performance, as the path coefficient is negative. It means that there is no significant positive relationship between innovation network with horizontal institutions and innovation performance, which is not consistent with some studies which argued that there is significance of innovation network with intermediary institutions in support of firms' innovation performance (101). This maybe explained possibly as follows. From the macro-economic environment in China, KIFs are not main body compared with macro-manufacturing industries. Hence, the policy guidance, support and effective market mechanisms are building, and the construct of this knowledge, technologic and information transfer needed is time. Furthermore, universities and research institutions in China are pursuing professional theory basis rather engaging in supporting technical commercialization.

H_7 is tested with the path from knowledge management capability to innovation performance. This hypothesis is supported since the path coefficient is positive (0.65) and significant ($p<0.05$). The result of statistical analysis shows that knowledge management capability is positive significant correlation with innovation performance. In practice way, KIFs could improve innovation performance by managing of knowledge through every stages: knowledge formulation, knowledge application and knowledge protection. Combined with aforementioned study results, knowledge management capability makes different effects among different innovation networks to innovation performance. In our empirical study, knowledge management capability could be seen as some intermediate role between innovation network with government agencies and innovation performance for KIFs. A promoting effect has been proved in the path analysis model because of the path coefficient from innovation network with government agencies to knowledge management capability (0.45, $p<0.001$) and to innovation performance (0.713, $p<0.001$). Hence, knowledge management capability makes a partly intermediate role between innovation network with government agencies and innovation performance for KIFs. In similar way, knowledge management capability has been proved that it makes a full intermediate role among the relationship between innovation network with inter-firms and horizontal institutions and innovation performance. Since innovation network with inter-firms is significant positive associated knowledge management capability, but no significant correlation with innovation performance. And the same situation occurs to the relationship between innovation network with horizontal institutions and innovation performance.

Conclusions

Based on the analyzed results above, there are some implications as follows:

As the important intermediary role of knowledge management capability, executives of KIFs should build more explicit and specifical system to strengthen knowledge management through every stage, from knowledge formulation (such as knowledge creation, knowledge absorption and knowledge assimilation), knowledge application (such as knowledge transfer, knowledge exploitation) to knowledge protection (such as intellectual property, training employees).

From governments' angle, due to the significant positive association with both knowledge management capability and innovation performance, policy makers should put more focus on creating effective policies to facilitate different innovation networks for KIFs, and establish a stable platform for knowledge flowing between KIFs and related partners like vertical firms (namely inter-firms, including suppliers, customers/clients, competitors/rivals), horizontal institutions (including universities, research institutions and nonprofit knowledge and technology transfer institutions).

To enhance public intent of using science, technic, information is an important project. There should be more encouraged for horizontal institutions from theory knowledge in laboratories to new products or processes. For example, some supportive policies might propose to increasing the level of university participation in some R&D programs. And that might improve knowledge transfer among vertical firms as well as horizontal institutions, in that to foster innovation performance.

There are of course a few limitations in this study. One limitation is that the empirical results are local, due to the sample of KIFs participated in coming from China. Hence in future study, this deficiency might be solved by extending the range of samples. Another limitation is that there is no distinction between knowledge intensive service firms and knowledge intensive manufacturing firms, which might be subtle internal differences existing. Therefore, distinguishing between service and manufacturing of KIFs should be studied separately in future study. Finally, one of limitations is that there are lack discussed how each stage of knowledge management capability drives positively between different innovation networks and innovation performance. Further research should consider whether each stage of knowledge management has some associations with innovation networks and innovation performance, and how each of them effect on the relationships between different innovation networks and innovation performance specifically.

Acknowledgements

This work recerved support from a Notional Social Science Fund of China in 2014 (No. 14BGL007). And this paper is funded by the International Exchange Program of Harbin Engineering University for Innovation-oriented Talents Cultivation.

References

Alvesson, M., 2000. Social identity and the problem of loyalty in knowledge-intensive companies. Journal of Management Studies, 37(8), 1101-1123.

Belderbos, R., Carree, M., Diederen, B., Lokshin, B., Vergelers, R., 2004. Heterogeneity in R&D co-operation strategies. International Journal of Industrial Organization 22(8-9), 1237-1263.

Brioschi, F., Brioschi, M. S., Cainelli, G., 2002. From the industrial district to the district group: an insight into the evolution of local capitalism in Italy. Regional Studies 36(9), 1037-1052.

Chung, S., Kim, G. M., 2003. Performance effects of partnership between manufacturers and suppliers for new product development: the supplier's standpoint. Research Policy 32(4), 587-603.

Diamantopoulos, A., 1993. Modelling with LISREL, a guide for the uninitiated. Journal of Marketing Management 10(1-3), 105-136.

Diez, J. D., 2000. Innovative networks in manufacturing: some empirical evidence from the metropolitan area of Barcelona. Technovation 20(3), 139-150.

D. M. DeCarolis and D. L. Deeds, “The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry,” Strateg. Manage. J., vol. 20, pp. 953-968,1999.

Drejer, I., Jorgensen, B. H., 2005. The dynamic creation of knowledge: analyzing public-private collaborations. Technovation 25(2), 83-94.

Füller, J., Matzler, K., 2007. Virtual product experience and customer participation-a chance for customer-centred, really new products. Technovation 27(6-7), 378-387.

Fischer, M. M., Varga, A., 2002. Technological innovation and interfirm cooperation: an exploratory analysis using survey data from manufacturing firms in the metropolitan region of Vienna. International Journal of Technology Management 24(7-8), 724-742.

Freel, M. S., Harrison, R. T., 2006. Innovation and cooperation in the small firm sector: evidence from Northern Britain. Regional Studies 40, 289-305.

Hurley, R. F., Hult, G. T., 1998. Innovation, market orientation, and organizational learning. Journal of Marketing 62(3), 42-54.

I. Nonaka, R. Toyama, and A. Nagata, “A firm as a knowledge-creating entity: A new perspective on the theory of the firm,” Ind. Corporate Change, vol. 9, no. 1, pp.1-20, 2000.

J. C. Spender, “Making knowledge the basis of a dynamic theory of the firm,” Strateg. Manage. J., vol. 17 (Winter Special Issue), pp. 45-63, 1996.

Jie Yang. 2012. Innovation capability and corporate growth: An empirical investigation in China. Journal of Engineering and Technology Management 29(2012), 34-36.

L. Argote and P. Ingram, “Knowledge transfer: A basis for competitive advantage knowledge,” J. Knowl. Manage., vol. 3, no. 4, pp. 252-261, 2000.

Libutti, L., 2000. Building competitive skills in small and medium-sized enterprises through innovation management techniques: overview of an Italian experience. Journal of Information Science 26(6), 413-419.

Liefner, I., Hennemann, S., Xin, L., 2006. Cooperation in the innovation process in developing countries: empirical evidence from Zhongguancun, Beijing. Environment and Planning A 38(1), 111-130.

M. Alavi and D. Leidner, “Knowledge management and knowledge management systems: Conceptual foundations and research issres,” MIS Quart., vol. 25, no. 1, pp. 107-136, 2001.

Moorman, C., Miner, A. S., 1998. Organizational improvisation and organizational memory. Academy of Management Review 23(4), 698-723.

Nunally, J., 1978. In: Psychometric Theory, McGraw-Hill, New York.

Pekkarinen, S., Harmaakorpi, V., 2006. Building regional innovation networks: the definition of an age business core process in a regional innovation system. Regional Studies 40(4), 401-413.

R. M. Grant, “Toward a knowledge-based theory of the firm,” Strateg. Manage. J., vol. 17 (Winter Special Issue), pp. 109-123, 1996.

Rejean Landry, et al., 2013. Technology transfer organizations: services and business models. Technovation, 33, 431-449.

S. X. Zeng, X. M. Xie, C. M. Tam, 2010. Relationship between cooperation net works and innovation performance of SMEs. Technovation 30(2010), 181-194.

Siegel, D. S., Waldman, D. A., Link, A. N., 2003. Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study. Research Policy

32(1), 27-48.
Siegel, D. S., Waldman, D. A., Atwater, L. E., Link, A. N., 2004. Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies. Journal of Engineering and Technology Management 21(1-2), 115-142.
Siu, W. S., 2005. An institutional analysis of marketing practices of small and medium-sized enterprises (SMEs) in China, Hong Kong and Taiwan. Entrepreneurship and Regional Development 17(1), 65-88.
Starbuck, W. H., 1993. Strategizing in the real world. International Journal of Technology Management 8(1/2), 77-86.
Theodorakopoulos, N., SanchezPreciado, D. J., Bennett, D., 2013. Transferring technology from university to rural industry within a developing economy context: the case for nurturing communities of practice. Technovation 32(9-10), 550-559.
Verona, G., 1999. A resource-based view of product development. Academy of Management Review 24(1), 132-142.
Yanez, C. J. N., Magnier, A., Ramirez, M. A., 2008. Local governance as government business cooperation in western democracies: analyzing local and intergovernmental effects by multi-level comparison. International Journal of Urban and Regional Research 32(3), 531-547.