

A Study on Relationship between Dynamic Capability and Technology Transfer Performance of Public Research Institutes

Injong Lim¹, Seo Yun Paik² and Jeonghwan Lee^{3*}

¹Senior Researcher(PhD), Korea Electronics Technology Institute
25, Saenari-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13509, Korea

²PhD Candidate, College of Business Administration, Seoul National University,
Seoul, Korea

34, Geobukgol-ro, Seodaemun-gu, Seoul, 03674, Korea

³Associate Professor, Dept. of International Business and Trade, Myongji University
34, Geobukgol-ro, Seodaemun-gu, Seoul, 03674, Korea

¹limij@keti.re.kr, ²eunice.mypaik@gmail.com, ³tankee@mju.ac.kr (Corresponding Author)

Abstract

Recently, it is widely recognized that the technology developed in the public sector should not merely lead to knowledge generation but also lead to social and economic benefits, and the importance of commercialization is increasing in the field of R&D (research and development). This study investigated factors influencing technology transfers of public research institutes that are technology providers on small and medium-sized enterprises, and venture companies that are technology consumers. This study focused on dynamic capabilities which are factors influencing technology transfers. Dynamic capabilities were divided largely into R&D capability, coordination capability, marketing capability, and learning capability. The following results were shown: The R&D capability, coordination capability and marketing capability have had a positive impact on the performance of the technology transfer, but there has been no significant correlation in learning capability. The TLO that carries out technology transfer activities with limited resources should recognize the importance of R&D capability, coordination capability and marketing capability, and resource and time should be allocated

Keywords: Technology transfer, Technology commercialization, Dynamic capabilities

1. Introduction

In a knowledge based society, interest in R&D has been increasing, creating new value-added by producing knowledge, acquisition, dissemination, sharing, utilization, and accumulation as the contribution of knowledge to economic growth increases rather than the traditional production elements of capital and labor. As a result, countries continue to expand their investment in R&D to secure future competitiveness [1].

The quantitative expansion of R&D investment is important to enhance long-term national competitiveness, improving efficiency in terms of quality is important as well. I researched

Article history:

Received (November 2, 2017), Review Result (November 12, 2017), Accepted (November 22, 2017)

and developed technology is transferred to the industry, but it does not lead to the product innovation and product itself, the economic growth effects by research funds cannot be generated [2].

This study aims to examine factors that improve commercialization performance through technology transfer from public research institutes as providers of technology transfer to small/mid-sized ventures as consumers of technology consumers.

2. The technology transfer status of public research institutes

2.1. Revenues of the technology transfer fee

At the end of 2015, revenue from public research institutes and universities stood at 1,403.3 million won. Over the eight consecutive years since 2007, more than 100 billion won of technology fee has been achieved. It is reported that 33 institutes compared to the previous year (29) achieved more than 1 billion won in annual revenue of technology fee.

Table 1. Revenues status of technology transfer

Division	2007	2008	2009	2010	2011	2012	2013	2014
Public Research Institute	89,342	102,320	74,017	91,836	83,209	117,017	98,461	89,797
University	15,071	26,466	27,650	32,678	42,603	48,162	36,892	50,535
Total	104,413	128,786	101,667	124,514	125,812	165,180	135,353	140,332

Source: Investigation Report on Technology Transfer and Commercialization(2015)

2.2. Number of technology transfer contracts and technology transfer rate

In 2014, the number of technology transfers in public research institutes was 8,524 cases, which has increased 13.7 percent from the previous year (compared to 7,495 cases). Moreover, the technology transfer rate [(Inspection target year) number of technology transfer cases / (Inspection target year) number of new technology acquisitions (development)] in 2014 was 31.7 % increased of 0.5% from the previous year (31.2%).

Table 2. Number of technology transfer contracts and technology transfer rate

Division	Secured new technology (case)	Technology transfer (case)	Ratio of technology transfer (%)
Public Research Institute	12,240	4,812	39.3
University	14,633	3,712	25.4
Total	26,873	8,524	31.7

Source: Investigation Report on Technology Transfer and Commercialization(2015)

2.3. Type of technology consumer

Among the technology transfer contracts, technology transfers from public research institutes to large businesses accounted for 5.3 percent, 3.2 percent of strong-midsize businesses, 42.9 percent of midsize businesses, and 44.6 percent of small businesses. Small and medium sized businesses were major technology consumers of universities and public research institutes.

3. Literature review

3.1. Technology transfer

Unlike other products, technology has different characteristics, so it is difficult to apply general market functions, i.e. the principles of demand and supply, in the technology marketplace. Normally, the market is naturally formed by reducing transaction costs such as searching costs and information costs incurred in transactions between the provider and the supplier. However, the features of the technology including the characteristics of public enrollment, the context dependence, implication of technology, and transference with other factors is characterized by buying a license in terms of the form of a contract and transfer of ownership does not immediately occur through market transactions [4].

Open technology innovation has been developed within the enterprise, but it can generate revenue through licensing or sale of unused technologies. It also has advantages that are saving time and money by utilizing external resources. As the technology innovator turns into open technology, technology providers (public research institutes), technology brokers (TLO) and technology consumers (companies) are increasingly engaged in the technological market, increasing awareness and importance of technology transfer.

Technology transfer in this study is defined as the phenomenon and the process of tangible and intangible knowledge (know-how, explicit knowledge, and tacit knowledge, etc.) related to technology which is utilized by the transition between owners and users [5].

The procedure for transferring technology can be divided into five stages: report of inventions, evaluation of inventions, patent applications and registration, technology marketing, and technology transfer. When a professor or researcher of a public research institute reports the results of the technology development to a technology transfer institution, the technology transfer institution evaluates whether the reported invention is commercially acceptable. And if the evaluation that the assessed invention needs to be protected by commercial value, it acquires intellectual property rights by applying for the patent. Later, the technology transfer organization completes technology transfers through granting intellectual property rights or a method of license by agreement or promoting its technology publicly or seeking out a company that needs technology. Launching a business can be chosen if it is deemed effective for a researcher to directly commercialize or a company where the researcher belongs to [6].

3.2. Dynamic capability

Companies need to reformulate existing organizational capabilities to meet the needs by changing organizations and strategies to actively respond to changes in the environment. These capabilities can be understood as dynamic turnover capability, i.e., dynamic capability [7].

It is unrealistic to assume that resource transfer is difficult in today's market environment because the business environment is rapidly changing and evolving, such as sales, mergers, acquisition and production, and revolutionary innovations of technology. In addition, it is no longer possible to achieve a competitive advantage over other rival companies with the unique resources that a company currently has, especially in an environment where it is changing fast. Only companies that relocate resources to adapt to changing environments and form new capabilities can achieve a constant competitive advantage [8].

The characteristic of dynamic capabilities is as follows [9][10].

First, dynamic capability consists of a continuum of specific organizational processes and capability combinations that enable to implementation of a new value creation strategy by developing resources where the environments change extremely. Moreover, the purpose is to create new capabilities or for interaction between capabilities.

Second, the dynamic capability is based on cases that are defined as a best practice within the company and is highly likely to be able to predict the consequences of applying the results to the company and there is a great deal of substitution for existing capabilities. In addition, dynamic capabilities can be developed through various learning activities and can be copied within the company. Because of the learning mechanism, dynamic capabilities evolve based on the dependencies of a company's strategy and resources that have been established by the company.

Third, the pattern of dynamic capability varies depending on the dynamic of the market. Under the industrial structure where the environment changes are stable, dynamic capacity produces predictable outcomes based on existing knowledge. In a highly dynamic environment, a simple, experimental and unstable process is carried out and produces unpredictable outcomes depending on new knowledge.

Fourth, dynamic capability reflects the management ability of a company. Based on the organization- management process, market position, and path dependency, resources and capabilities should be adjusted and relocated effectively for businesses to adapt themselves to the changing promptly and to innovate at the right pace, this reflects the management ability of a company.

4. Research model and hypotheses

4.1. Research model

In this study, the dynamic capabilities of the public research institute that influences technology commercialization performance were divided into R&D capability, learning capability, coordination capability, and marketing capability. The performance of technology commercialization was measured by the number of technology transfer cases. The number of technology transfer cases refers to how much knowledge (technology) produced by the public research institute was transferred to the private sector (industry), and it is a performance that demonstrates whether the role of the “public technology spread” is performing well or not.

4.2. Hypotheses

(Hypothesis 1) The R&D capability will have a positive effect on the performance of the technology commercialization.

(Hypothesis 2) Learning capability will have a positive impact on the performance of the technology commercialization.

(Hypothesis 3) Coordination capability will have a positive impact on the performance of the technology commercialization.

(Hypothesis 4) Marketing capability will have a positive impact on the performance of the technology commercialization.

4.3. Variables

The independent variables include R&D/learning/adjustment/marketing capability and the dependent variable includes technology commercialization. A research and development cost is the control variable, which includes research and development costs for a year, public research institutes or universities, and whether TLO is possessed or not.

Table 3. Operationalization of variables

Division	Variable name	variable descriptions
Independent variable	R&D capability	Number of new technology acquisitions
	Learning capability	Number of technical transfer training
	Adjustment capability	Incentive system status
	Marketing capability	Number of technology transfer seminars/participation cases
Dependent variable	Performance of Technology commercialization	Number of technology transfer contract cases
Control variable	Research and development expenses	Total amount of research and development expenses
	Public research institutes	Status of public research institutes
	TLO	Whether or not the organization has TLO

5. Conclusion and discussion

Results showed that R&D capability, adjustment capability, and marketing capability have significantly affected the performance of the technology commercialization while learning capability is not.

The TLO, which carries out technical transfer activities with limited resources, should recognize the importance of R&D capability, adjustment capability and marketing capability adopted above, and resource and time should be allocated preferentially.

Competition between countries is intensifying due to rapid changes and rapid advancement into the future industry. In particular, the social and economic importance of technology and its influence continues to dramatically increase as the fusion and convergence of the two different industries endures. Public research institutions will need to carry out active technological transfer activities so that small and medium-sized enterprises can actively utilize the government's superior R&D results to achieve successful technology commercialization.

Acknowledgements

This research was supported by 2017 Research Program funded by the Korea Sanhak Foundation.

References

- [1] I. Lim, J. Lee and S.M. Lee, "An Analysis and Improvement Strategy of the Technology Transfer Efficiency for Public Research Institutes". *International Journal of Software Engineering and Its Applications*, Vol. 12, pp.227-238 (2016)
- [2] H. Ergas, "The Importance of Technology Policy, in: Dasgupta, P., Stoneman", P.(eds.), *Economic Policy and Technological Performance*, Cambridge University Press, Cambridge (1987)
- [3] Korea Institute for Advancement of Technology, Ministry of Trade, Industry and Energy, "An Investigation Report on Technology Transfer and Commercialization" (2015)
- [4] J.B. Park, Y. Cho, and T.K. Ryu, "Developing the Korean Technology Market for Creating New Economic Growth". *Korea Institute for Industrial Economics & Trade* (2009)
- [5] I. Lim, J. Lee and S.M. Lee, "A Case Study on the Success Factors of Commercialization of Technology in the High-Tech Industry". *Journal of Korea Technology Innovation Society*, Vol. 17, pp.490-518 (2014)
- [6] I.K. Yeo, "A Study on the Public Technology Transfer Promotion Strategy through Analysis of Influence Factors for Transfer Performance". *The Graduate School of Konkuk University* (2009)
- [7] Eisenhardt, K. M. and Martin, J. A., "Dynamic capabilities: What are they?," *Strategic Management Journal*, Vol. 21, pp.1105-1121 (2000)
- [8] Newbert, S.L., "New Firm Formation: a dynamic capability perspective". *Journal of Small Business Management*, Vol. 43, pp.55-77 (2005)
- [9] Eisenhardt, K. M. and Martin, J. A., "Dynamic capabilities: What are they?," *Strategic Management Journal*, Vol. 21, pp.1105-1121(2000)
- [10] Teece, J. Pisano, G. and Shuen, "A., Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18, pp.509-534 (1997)

Authors



Injong Lim

A senior researcher at the KETI(Korea Electronics Technology Institute). His research interests include technology transfer, technology commercialization, R&D planning and start-up strategy.



Jeonghwan Lee

A professor of Department of International Business and Trade at Myongji University. His research interests focus on innovation, knowledge management, M&As, and foreign direct investment. His research has appeared in the *Industry and Innovation*, *Asia Pacific Journal of Management*, *Journal of Organizational Change Management*.