

The Performance Evaluation Framework for Cultivating the Technology Transfer

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Abstract

The concept of technology transfer has been changed for successful technology transfer with rapid technology innovation. There is a need to develop the performance evaluation framework for cultivating the technology transfer considering the change of definition of technology transfer. The suggested framework involves the phase of redefining the technology transfer as a shared two-way process, the phase of expanding the value chain, the phase of restructuring technology transfer barriers and the phase of deriving the hierarchy structure for evaluating the technology transfer containing strategies and critical success factors. Based on the suggested framework, officers in technology transfer would extract the important information and implementation plan for successful technology transfer based on strategies and critical success factors. The technology transfer of public research institutions would be cultivated by evaluating the performance of technology transfer through the proposed framework.

Keywords: Critical success factors, Performance evaluation, Technology transfer

1. Introduction

Competitiveness of enterprise would determine the launch of new products and services through technological innovation [1]. It is difficult to research and develop whole technologies that enterprises need for new products and services because of the rapid change in technology. So, enterprise has been interested in technology transfer for enhancing the competitiveness. The researchers also paid more attention to technology transfer with expanded research and development expenditure. The research about technology transfer has been evolved since the researches that extract and indentify the important factors for successful technology transfer have been done [2].

The concept or definition of technology transfer in most researches is the technology movement between technology supplier and technology buyer [3]. As most research of technology transfer focuses on the hardware perspective such as only the transaction of the license or patent, it would affect to the speed of technology transfer and successful technology transfer [4]. The hardware perspective of technology transfer has been investigated in spite of a number of researches [5]. The explicit knowledge sharing between technology supplier and technology buyer could be considered as important factor, namely. However, tacit knowledge sharing is also essential for successful technology transfer. Therefore, it is needed to redefine the definition of the technology transfer considering the perspective of software such as experts, best practice and know-how related with technology [5].

It is needed to develop the new performance evaluation framework of the technology transfer considering concept change of technology transfer. For this, the strategies and CSFs(Critical Success factors) and strategies should be extracted for indentifying the goals and plans for successful technology transfer [6].

However, the main researches dealing the performance evaluation of technology concentrated on the effectiveness. Therefore, this research proposes the new performance evaluation framework of technology transfer that involves both hardware and software perspective. The contributions of framework suggested in this research are as follows:

- Expanding the definition of technology transfer according to the point of view of Software
- Redefining the value chain and barriers of technology transfer for considering the expansion of technology transfer definition
- Suggesting perspectives considered to take the balance between the lagging results and leading processes
- Providing beneficial information in terms of grasping the whole picture of technology transfer according to Critical Success Factors(CSFs) and strategies
- Developing the structured framework for extracting CSFs and strategies

The remainder of this research is organized as follows. First, in Section 2, literature review of the evaluation in technology transfer will be presented. The framework for evaluating the technology transfer will be developed in Section 3. In Section 4, the case study will be analyzed to verify the suggested evaluation framework. Finally, the research finishes with contributions and limitations of this research in Section 5.

2. Literature Review

2.1. Success Factors of Technology Transfer

The research analyzed the factors that affect the technology transfer was initiated since mid-1980s [7-8] analyzed 9 factors such as organization, project and linking, etc. through technology transfer models. [9] presented 18 factors and classified into 4 dimensions: Strategic factors, Development process factors, Organizational factors and Market environment factors. [10] analyzed 24 factors and classified into 4 categories: Product characteristics, Firm strategy characteristics, Market place characteristics and Firm process characteristics. [11] identified 17 factors for technology commercialization and classified into 4 dimensions: Product-related factors, Firm related factors, Project-related factors and Market-related factors. [12] presented 24 success factors related with technology transfer, categorized in to 5 categories and ranked them: Relative advantage in economic terms, Marketing related benefits and forces, Technical features, Regulatory concerns and Managerial and strategic issues. [13] extracted 22 performance drivers of technology transfer, classified into 5 dimensions and calculated the relative importance of them: Human resources, Institutional/culture resources, Financial resources and Commercial resources.

2.2. Performance Evaluation of Technology Transfer

The performance evaluation of technology transfer has become an important issue because the resource utilization can be optimized by identifying insufficient CSFs based on the current performance evaluation.

Table 1. Research Related with the Evaluation of Technology Transfer

Evaluation method	Related researches
Technology assessment model	[14, 15, 16, 17, 18,19, 20]
Efficiency or effectiveness assessment	[21, 22, 23, 24, 25, 26]
Path Analysis	[27, 28, 29, 30]

Researches related with the evaluation of technology transfer are shown in Table 1. They are divided according to the evaluation method. A number of researchers in performance evaluation of technology transfer have focused on the technology value assessment. In addition, for the successful technology transfer, despite there is need to comprehensively consider the knowledge and experts related to the technology, most of previous researches focused on the only technology.

Meanwhile, it is difficult to reflect the recent conceptual change of technology transfer because the previous researches have focused on the effectiveness of technology transfer.

Hence, the purpose of this research is to suggest the evaluation framework considering the conceptual change of technology transfer.

3. Evaluation Framework

The Framework is shown in Figure 1. In order to reflect the extended concept of technology transfer and balance the results and processes of technology transfer, the various phases are consisted: Redefining concept of the technology transfer considering software perspective, analyzing the value chain of technology transfer such as primary and support activities, drawing the barriers of technology transfer and Extracting the CSFs of each perspective for successful technology transfer.

The framework focuses on the overcoming the limitation of previous researches and considering the well-balanced perspectives, strategies and CSFs. By using the proposed framework, managers can get the beneficial information in terms of grasping the whole picture of technology transfer according to CSFs and strategies. An enterprise can also focus on the important activities of technology transfer based on value chain.

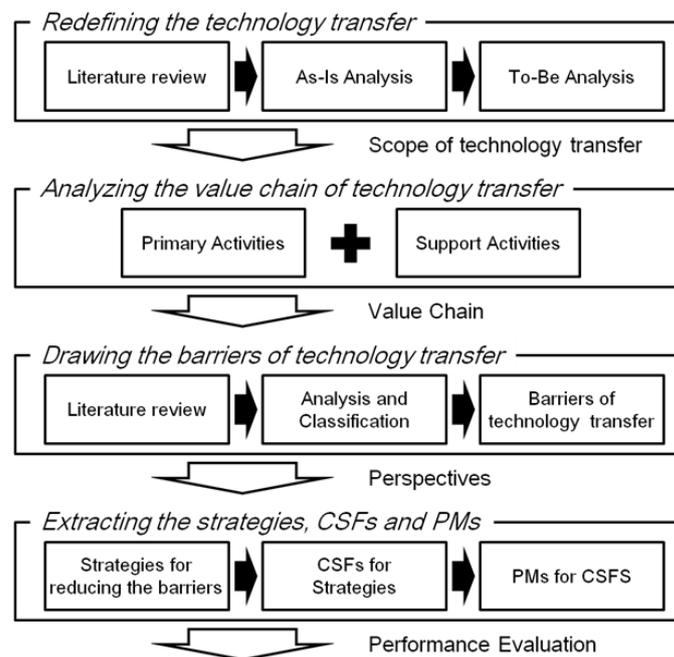


Figure 1. Evaluation Framework of Technology Transfer

3.1. Phase 1: Redefining the Technology Transfer

The technology transfer has been variously defined in the field of research and academy [31]. The technology transfer in the initial studies was defined as the technology flow from the technician donor to the technology recipient. [32] defined the technology transfer as the movement of intellectual property rights or invention from academic

research to the industry through a license(use right). [33] defined it as the movement of technical knowledge and research results from universities to potential users. Definition in most research focused on one-way process to deliver only technology from technology donor to technology recipient.

However, recently the technology transfer is defined as a shared two-way process of technical knowledge, know-how, best practice and so on from the various technology providers to the various techniques recipient [5]. The definition has been expanded from the transfer of license and intellectual property rights to the transfer of knowledge related with technology in perspective of software. To be the successful technology transfer, this research redefined the technology transfer as the shared two-way process of technology transfer process containing the information about processes, know-how, best practice and knowledge about technology.

3.2. Phase2: Analyzing the Value Chain of Technology Transfer

There are a lot of researches and corporate reports about the value chain of technology transfer. However, most researches have focused on the primary activities of the value chain. The primary activities of value chain consist of the research result, assessment, protection, licensing and implication in the results of most research. However, it is insufficient to embody the support activities. Not only the primary activities but also support activities are also very important. So, in this research, the value chain of [34] presenting the main activities is expanded by adding the support activities Figure 2. The expanded value chain makes it possible to know the various support activities to improve the speed of technology transfer and cultivate the technology transfer.

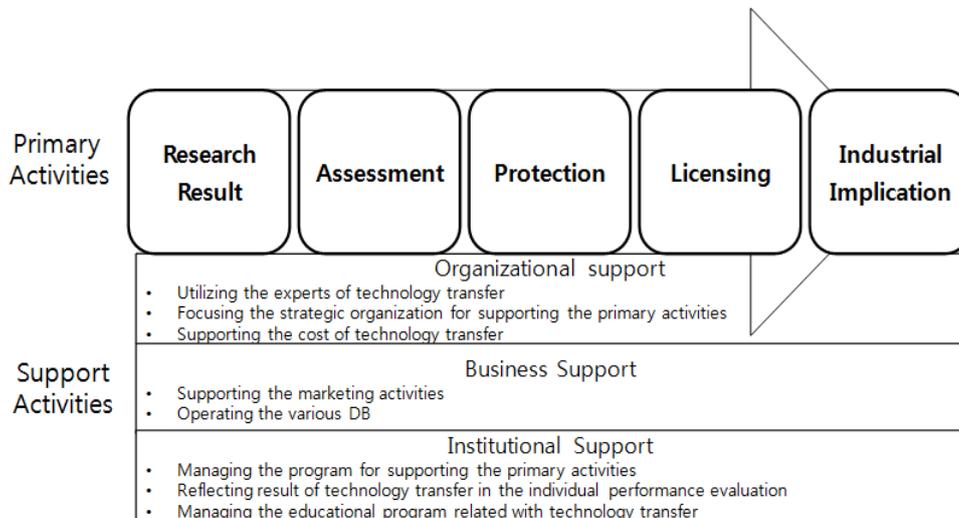


Figure 2. Restructured Value Chain of Technology Transfer [34]

3.3. Phase 3: Drawing the Barriers of Technology Transfer

Despite the various support of countries, the technology transfer have not been cultivated. In the researches about barriers that impede the value expansion from technology transfer, failure factors were validated. Barriers that interfere with the technology transfer have been derived in a view of technology transfer process. In order to prevent barriers, factors to hinder the technology transfer have been investigated in various researches. However, it is necessary to involve the process, organization, institution, knowledge, human resource, out of a view for attempting to evaluate only the technology. Although the technology assessment is important, the various activities that

determine the success or failure of technology transfer should be considered. Therefore, the restructured technology transfer barriers are derived based on the literature reviews for considering the various perspectives.

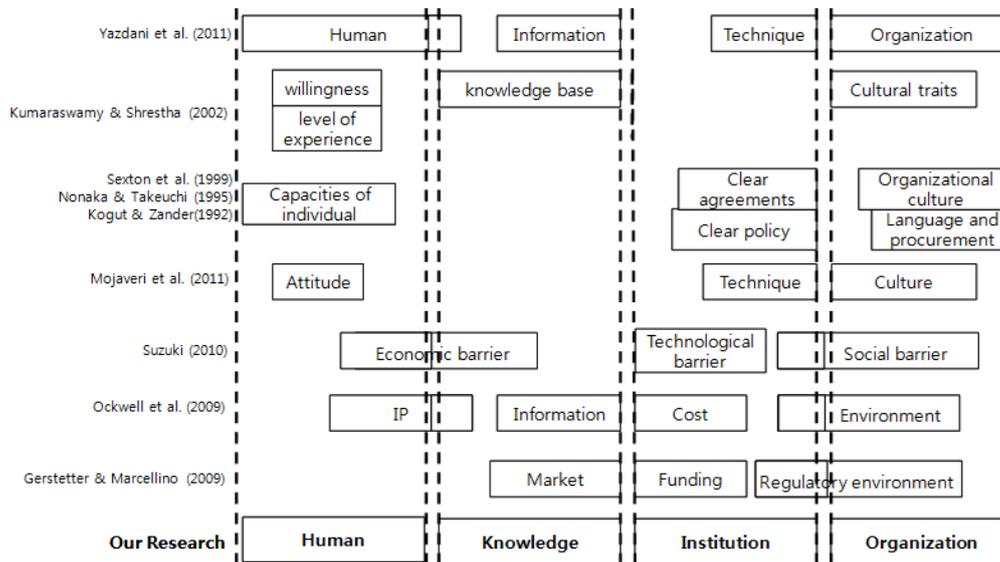


Figure 3. Barriers of Technology Transfer

3.4. Phase 4: Extracting the Strategies, CSFs and PMs

The evaluation perspective should include not only lagging views but also leading views. The perspectives in previous researches suffer from limitations; they measure past activities and are “lag” versus “leading” indicators. The traditional perspectives offer a narrow and incomplete picture of technology transfer. These perspectives hinder the creation of future business value. As a result, the traditional perspectives should be supplemented with additional perspectives that reflect tangible and intangible support activities.

Therefore, the perspectives for cultivating the technology transfer in this research are derived by analyzing the barriers. However, these perspectives have limitation that does not evaluate the performance of technology transfer. Thus, it is added in terms of the performance point of perspectives.

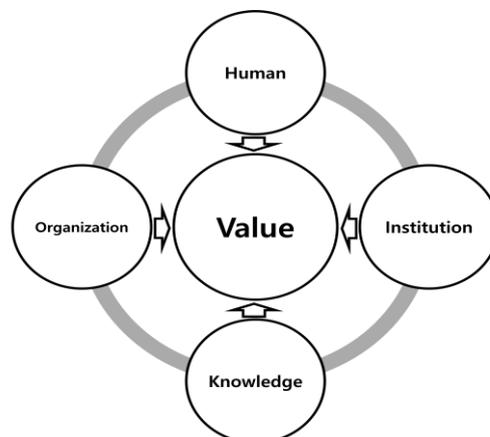


Figure 4. Balanced Perspectives for Evaluation of TT

It is essential to identify the strategies and CSFs. Since the hierarchy structure consisted from perspectives to CSFs will give the enterprise a stronger focus than before, it is extremely important. To extract strategies for consideration of various aspects of technology transfer, many literatures are reviewed. The two or three strategies are identified for each perspective. The strategies of each perspective are translated into tangible terms of CSFs. Additionally, the performance measures(PMs) are extracted for evaluation of technology transfer.

Table 2. Strategies and CSFs in Each Perspective

Perspectives	Strategies	Critical Success Factors
Organization	It is necessary excellent TT [26, 41].	Expertise and Experience of TT [32, 42, 43, 44, 45, 46]
	Culture and Interest of Organization is important [47, 49, 50].	Continuous Education [47, 48] Collaboration and Communication in Organization [9, 10, 51, 52]
	Strategic approach and Goal for TT is needed [9, 42, 51].	Establishment strategies of TT [11, 50]
Institution	Institutional support for R&D is essential [26, 47, 53, 54, 55].	Funding for R&D [42, 43, 46, 56, 57]
	Institutional support for TT is important [41, 50].	System and Financial support for TT [44, 45, 48, 55, 58]
	Incentive for TT has a strong relationship with effectiveness [43, 46, 59].	Incentive for TT [7, 41, 42, 45, 52, 55, 60, 61]
Human	There should be abundant human resources and expertise and experience for TT [26, 41, 55].	Human resources for TT [43, 44, 46, 56, 57]
		Expertise and experience for TT [45, 62]
	There should be abundant human resources and expertise and experience for R&D [10, 57].	Human resources for R&D [42, 43, 47, 54, 56, 61]
		Expertise and experience for R&D [57, 63]
Knowledge	It should possess a lot of superior technology [64].	Technological competitiveness [7, 65]
	Sharing technology information and Marketing is critical for successful TT [66, 67].	Efficient management and Sharing of technology information in Organization [51, 60]
		Marketing of technology in Organization [9, 10, 11, 50, 68]
	Transfer of Knowledge related with technology has been focused [5].	Transfer of Know-How and Technical Support [68]
Synergy through external network is needed to consider [41, 45, 47, 69].	Infra and External Network for TT [9]	
Value	Effectiveness and Efficiency of TT is important.	Effectiveness of TT [26, 50]
		Efficiency of TT [56]

* TTO : Technology Transfer Office, TT: Technology Transfer

4. Conclusion

The definition of the technology transfer should be extended based on the perspective of software, because nowadays technology transfers involve the transfer of knowledge,

best practice, know-how, implication process and expert. According to the scope change of technology transfer, it is needed to derive the new evaluation framework for evaluation of the technology transfer. Therefore, the new framework for evaluating performance of the technology transfer is needed to develop.

To be the successful technology transfer, this research redefined the technology transfer as a shared two-way process. The value chain is expanded by adding the support activities according to the redefinition of technology transfer. Moreover, the technology transfer barriers are restructured for considering the various perspectives of value chain. The hierarchy structure consisted from perspectives to CSFs are derived by analyzing the barriers and literature review. The hierarchy structure will give the enterprise a stronger focus than before.

By using the results of this research, practitioners can get the beneficial information in terms of grasping the whole picture of technology transfer according to CSFs and strategies. The structured hierarchy can review the current status and set the strategic achievements. And CSFs reveals the core parts of an enterprise that cause any strategic problems of technology transfer. Furthermore, the value chain is a way of learning what works and what does not. An enterprise focuses on the important activities of technology transfer based on value chain. The value chain and CSFs provide the manager with targets and goals for successful technology transfer through feedback on implementation, success assessment and lessons for future implementation.

However, our research has some limitations. The performance measures are very essential, because the performance measures inform important target. Therefore, it is necessary to add the new phase of extracting the performance measures. Furthermore, since the proposed framework is based on academic and theoretical research, the proposed framework should be verified through case studies.

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This research was expanded based on the previous research [70].

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