

**Comparative Study on the Technology Transfer from Government-funded  
Research Institutes to the Private Sector  
Focusing on Licensing Contract**

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**초록**

본 연구의 목적은 정부출연연구소에서 연구개발된 기술이 민간부문에서 충분히 활용되지 못하고 있다는 문제의식으로부터 출발하여, 원천, 핵심기술의 확보가 국가경쟁력을 좌우하는 첨단기술경제시대에 막대한 국가자금으로 연구개발된 우수한 기술의 사장을 방지하고 궁극적으로 국가경제발전을 위한 전략적 기술이전 촉진 방안을 모색하는 것이다.

현재 국무총리산하 기초, 산업, 공공기술 연구회로 분류 조직되어 있는 3개 연구회 총 1 정부출연연구소의 지난 10년간(1992-2001)의 연구예산규모, 보유특허수, 기술이전건수, 기술징수액, 기술실시계약서를 방문 조사하고 각 연구소의 기술이전전담조직의 실무자를 대상으로 설문 조사하여 설문 및 통계분석 결과를 토대로 기술이전관련 문제점 파악 및 기술이전 촉진을 위한 전략적 개선방안을 모색해 보았다.

먼저 기술이전 현황을 살펴보면 기술이전건수는 보유특허수의 3%미만, 기술료 징수액은 연구예산규모의 2%미만으로 기술이전 및 기술상업화율이 상당히 저조하다.

설문 및 통계분석 결과로부터 TLO 조직의 비효율적인 운영, 비전문성, 열악한 운영인력, 적극적인 기술이전을 위한 동기부족, 정부의 제도적인 지원부족, 기술실시계약서 조항들의 경직성 등을 기술이전 관련 문제점으로 도출해 낼 수 있었다.

이러한 문제점을 극복하고 기술이전 촉진을 위한 개선방안으로는 첫째, TLO 조직을 전략으로 개편해야 한다. 즉 기술이전 전담인력을 변리사, 전문 협상가, 연구원 등 전문가들로 구성하여 지적재산권 관리, 기술평가, 시장조사, 기술마케팅, 사후관리 등을 효율적으로 수행해야 한다. 둘째, 정부의 정책적인 지원이 필요하다. 기술이전 전담조직에 대한 인센티브 시스템 기술이전을 위한 특별예산 편성 등을 정책적, 제도적으로 도입하는 등의 적극적인 지원이 요구된다. 셋째, 기술실시계약서 조항들을 기술실시자의 실질적인 기술 상업화에 도움이 되고 기술

유출 및 기술사장화를 방지하는 방향으로 개선하여야 한다. 특히, 전용실시권과 실시대가, 기술실시 및 지적재산권 관리와 관련된 제반 비용의 부담비율 등을 보다 유연하게 개선하여야 한다.

본 연구는 정부출연연구소에서 민간부문으로의 기술이전만을 고려하여 기술이전의 중요한 요소인 민간부문에 대한 고려가 전혀 없다. 따라서 보다 실질적이고 체계적인 결과를 도출하기 위해 민간부문을 고려한 연구가 진행되어야 한다고 생각한다.

## 1. Introduction

Technology transfer from government research organizations to private companies recognized in recent decades as crucial to international competitiveness (Kassicieh and 1994).

Korea is the 6th largest investor in science and technology, but its science and technology competitiveness lags behind and ranks as the 28th in the world. Therefore, as its investment efficiency is evaluated very low, there is a need to draw up a plan for technology transfer and commercialization.

Especially, several forces have converged recently to stimulate the flow of technology from GRIs<sup>1)</sup> (Government-funded Research Institutes) to the private sector marketplaces. First, the increasing recognition of the role technology transfer in economic development. Second, the growing perception that R&D funding in GRIs is as large as 27 percent (3,203 billion won) of total but the return from its R&D budget, in terms of technology commercialization in GRIs, is not adequate. The purpose of this paper is primarily to examine the status of technology transfer at GRIs focusing on licensing agreement for the last ten years; and then to identify the existing problems in transferring research results to marketplaces in order to outline the strategies for promoting technology transfer activities in the final section.

First, questionnaires were mailed to the official in charge of technology transfer at nineteen GRIs. Next, for main data research, personal visits were conducted to analyze t

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1) GRIs is limited here as such under jurisdiction of MOST(Ministry of Science & Technology), which are four GRIs controlled by the Research Council of Fundamental Science and Technology, six GRIs controlled by the Research Council of Industrial Technology, seven GRIs controlled by the Research Council of Public Technology excluding 2 GRIs with no technology activity.

contract documents. I compiled a data base of licensing contracts between GRIs and comp extracted critical variables from the original contracts of each GRI.

Using the OLS regression method, the influence on technology transfer acti commercialization of each variable was analyzed.

## 2. Survey Results

To address technology transfer activities in GRIs in general, I conducted a survey thr the executive officer of the TLO(Technology Licensing Office) (if no TLO the R&D Plann Management Division) which mainly manages patents and makes contracts. Both the overall and each council result were analyzed as follows.

First, the general status of technology transfer is described focusing on the infrastructure, such as researcher intrapreneur system, technology business inc techno-mart, and TLO, to enhance technology transfer.

### 1. Researcher Intrapreneur System<sup>2)</sup>

	All	KRCF	KOCI	KORP
Yes	17	4	6	7
No	0	0	0	0

### 2. Technology Business Incubator<sup>3)</sup>

	All	KRCF	KOCI	KORP
Yes	10	2	4	3
No	7	2	2	4

### 3. Cyber Techno-Mart

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2) According to Venture Enterprise Promotion Act on 1998, GRIs stipulate both dual position and leave of absence of re general, dual position is admitted for 1 year and leave of absence for 3 years.

3) According to SMEs Development Act on 1995, government grants funding to GRIs that manage Technology Business In Center.

	All	KRCF	KOCI	KORP
Yes	4	1	1	2
No	11	3	4	4
under construction	2	0	1	1

All the GRIs have managed Researcher Intrapreneur System(RIS) since 1999 as the Enterprise Promotion Act of 1998 prescribes. However, only some of the GRIs have managed Technology Business Incubator(TBI) and Cyber Techno-Mart(CTM) since late 1999 after the Enterprise Promotion Act of 1998. That is, all the systems that are considered as influencing technology transfer effectiveness were established in 1999. The increase in technology transfer is the highest between 1999 and 2000. This result is caused not only by factors, such as RIS, TBI, and CTM, but also by the effects of various government policies starting in 1999, to support effective technology transfer actively.

#### 4. TLO<sup>4)</sup> management.

	All	KRCF	KOCI	KORP
Yes	8	1	3	4
No	9	3	3	3

Although Technology Transfer Innovation Act stipulates a TLO in all GRIs, more than half of the GRIs does not run a TLO. Referring to Stevenson-Wydler Technology Innovation Act of 1980 in the US, at least more than 1 personnel per 200 researchers is needed to transfer technology effectively (Bozeman, 2000). Though most of the GRIs have more than 1 personnel per 200 researchers, there are several problems. First, all the personnel of TLO does not devote to only technology transfer. Specific working hours designated only for technology transfer are approximately less than 50% of the total working hours. Second, all the personnel of TLO do not work together in same office. It may obstruct efficient technology transfer. Therefore, more effective, more understanding for technology transfer and a more systematic approach are needed.

Second, how well technology transfer activities are conducted is described in terms of intellectual property management, market research, technology valuation,

4) As regard to Technology Innovation Act on 1999, GRIs are obligated to make up TLO as specific organization, which covers technology management, technology valuation, technology marketing, market research, licensing contract, and postagreement activities such as technology transfer, etc.

technology marketing, licensing agreement, and postagreement activities<sup>5)</sup>.

5. What is the most deficient part of technology transfer in your institute (plural answer)

Working Part	All	KRCF	KOCI	KORP
Intellectual property management	0	0	0	0
Market research for technology transfer	8	2	2	4
Technology valuation	14	3	5	6
Technology marketing,	12	3	4	5
Licensing contract	0	0	0	0
Postagreement activities	1	0	1	0

Except intellectual property management and licensing contract as administrative activities, necessary activities for effective technology transfer are not conducted. In insufficient personnel and lack of understanding for technology transfer, no GRIIs operate technology transfer systematically which was concluded after the interview with personnel in technology transfer.

Third, the motives for and the part suggesting technology transfer are presented.

6. Who suggests Technology Transfer?

Suggester	All	KRCF	KOCI	KORP
Personnel in TLO	1	0	0	1
Inventor	11	4	5	2
Prospective Transferee	5	0	1	4

Due to a deficient role of TLO as technology marketing organization, personnel seldom suggests technology transfer. On the other hand the inventor suggests technology general through private channels.

7. When the TLO initiates technology transfer what is the most essential motive(plural answer)

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5) Megantz, R.C. (1996)

Motive	All	KRCF	KOCI	KORP
To ensure accordance with the main purpose of the institute	9	2	4	3
To promote national economic growth	11	3	4	4
To get more government subsidiaries	2	0	1	1
Due to outside pressure especially from the government	2	1	0	1
No answer	5	1	2	2

The main motives for technology transfer are to promote national economic growth and to ensure accordance with the main purpose of the institute. However, this motive is only partially practical. This lack of practical motive can be explained by the absence of an incentive for TLO personnel (Ham and Mowery, 1998). This fact can be related to initial suggestion, not from the TLO, but mainly from inventors in order to be granted rewards.

Fourth, focusing on licensing agreement as the main part of this research, both the negotiation and the payment of licensing are evaluated, analyzing on how licensing is processed in terms of negotiation, and payment.

#### 8. Guide Book for technology transfer

	All	KRCF	KOCI	KORP
Yes	15	4	5	6
No	2	0	1	1

#### 9. Standard Form for technology transfer contract

	All	KRCF	KOCI	KORP
Yes	12	3	3	6
No	5	1	3	1

Most of the GRIs have a guide book and a standard form for technology transfer. Even though a well constructed administrative system for technology transfer apparently exists, the procedures of technology transfer are not closely related to the administrative provisions of the law. The effectiveness of technology transfer. The GRIs in general conduct government projects and they mostly use government project licensing form, not their own standard form.

#### 10. Evaluation of prospective transferee

	All	KRCF	KOCI	KORP
Yes	2	1	0	1
No	15	3	6	6

#### 11. Major transferee

Transferee	All	KRCF(3)	KOCI(1)	KORP(2)
Large firm	447	40	403	4
SME	1292	172	1100	20
Individual	10	10	0	0

#### 12. Postagreement management

	All	KRCF	KOCI	KORP
Yes	3	0	1	2
No	14	4	5	5

Most of GRIs do not carry out neither evaluation of transferee nor postagreement act respect to technology consulting, technology instruction for successful commercializa technology transfer is in reality a one time activity i.e. the contract leading to running royalty revenue due to poor technology commercialization (Muir, 1997).

More importantly, because the GRIs mostly transfer technology to SMEs, whic capacity and facilities for the successful commercialization, the poor supportive transferee can be a serious obstacle for effective technology transfer (Hartman and Mast

#### 13. Period of time from suggestion to contract

Period	All	KRCF	KOCI	KORP
Within 10 days	5	2	0	3
15 days	1	0	1	0
20 days	1	0	0	1
30 days	7	1	4	2
No Answer	3	1	1	1

#### 14. Position of the GRI contractor(plural answers)

Contractor	All	KRCF	KOCI	KORP
Office worker	1	0	0	1
Administrative officer	12	3	6	3
Research scientist (major in technology managen	4	2	0	2
Professional negotiator (Lawyer, Patent attor	2	0	1	1
Others (Scientist)	3	0	1	2

Referring to the Korea Technology Transfer Center(KTTC), the whole process for technology transfer takes one month on average. Hence, this result shows insufficient effective technology transfer as most GRIs complete agreement within less than one month. The representative contractor of GRIs is usually the administrative officer. Therefore, the contract will only be an administrative process, not a specialized technology transfer. This is one of the major impediments for effective technology transfer.

#### 15. Payment Estimation

Valuation	All	KRCF	KOCI	KORP
Cost Approach	3	1	2	0
Profit Approach	0	0	0	0
Market Approach	0	0	0	0
No Valuation	14	3	4	7

Most GRIs do not conduct technology valuation to estimate royalty revenue. However, there are a few cases of payment estimation. Technology transfer is in general carried out between universities and the industries as cooperative research. These research projects are mostly governed by government funding rather than licensing contracts. Accordingly, payment is based on government funding estimated by the cost approach in line with government project management regulations.

Fifth, the fundamental conditions for effective technology transfer are described

#### 16. Incentive System for the TLO workers

	All	KRCF	KOCI	KORP
Yes	1	0	0	1
No	16	4	6	6

#### 17. Special accounts for technology transfer



	A11	KRCF	KOCI	KORP
Yes	2	0	1	1
No	15	4	5	6

Most GRIs do not have any incentive system for the TLO personnel and special account for technology transfer. It results in a lack of motive for technology transfer. That personnel does not play an active role in technology transfer, that is marketing of technologies in various industries.

Technology transfer can be enhanced through the establishment of an incentive system for TLO personnel (Joly and Mangematin, 1996). Voluminous research results show a positive effect of an incentive system on technology transfer. This effect can be supported by legislation such as the Stevenson-Wydler Technology Innovation Act in the US.

### 3. Statistical Analysis

This section empirically analyzes how much technology transfer is influenced by the amount of patents, the amount of research funding, and the institutional factors; and also how much commercialization is affected by the elements of the licensing contract with respect to the type of payments and the presence of production commencement date.

The analysis consists of two parts. The first part analyzes the technology transfer in terms of R&D funding (RDF), patent holdings (PH), and policy reinforcement (PR) for technology transfer in line with the Venture Enterprise Promotion Act of 1998. The second part analyzes how much the clauses considered as the critical factors - exclusivity (EXC), minimum payment (MIN), production commencement date (PC) - influence the technology transfer commercialization with respect to royalty revenue.

#### *Analysis of Technology Transfer Activities*

First, the status of technology transfer of GRIs can be examined effectively by comparing the number of technology transfer with the number of patent holdings and royalty revenue with respect to R&D funding. The results show the insufficient number of technology transfer (See figure 3). Technology has been transferred less than 3% of the patent holdings and royalty revenue collected less than 2% of R&D funding on average for the last ten years.

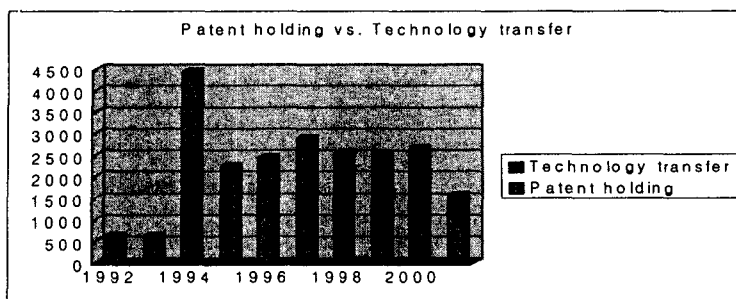


Figure 1. Patent holdings vs. Technology transfer

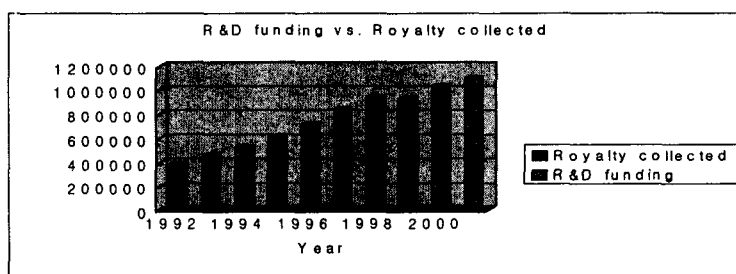


Figure 2. R&D funding vs. Royalty collected

Second, the results for analysis of technology transfer activities using OLS method are as follows.

Table 1. OLS Results of Technology Transfer Activities in KRCF

Variables	Beta	Std. Error	t value	Significanc
Constant	-.429	1.351	-.318	.752
RDF	9.867E-05	.000	1.240	.223
PH	8.002E-03	.003	2.368	.023
PR	.650	1.671	.389	.700

R<sup>2</sup> : .788

In the case of the GRIs under the KRCF, the coefficient of each variable is positive. more R&D funding and patent holding may generate more technology transfer. However, the of the policy reinforcement of 1998 is not that significant. It is due to the charact

technology developed by the GRIs under KRCF which can be categorized as basic techn  
 Basic technology is usually hard to transfer.

Table 2. OLS Results of Technology Transfer Activities in KOCI

Variables	Beta	Std. Error	t value	Significanc
Constant	17.255	16.959	1.017	.314
RDF	5.536E-04	.000	1.399	.168
PH	5.116E-04	.011	.048	.962
PR	37.784	21.256	1.778	.082

R<sup>2</sup> : .375

In the case of the GRIs under the KOCI, the coefficient of each variable is positive. Ev  
 are several things that are different from the case of the KRCF. First, patent holding  
 any influence on the technology transfer. Second, policy reinforcement is more signifi  
 the case of the KRCF. It is explained by the fact that technology transfer is mainly c  
 government research program in the GRIs under the KOCI which yields know-how rather  
 patent. Also the technology developed by the GRIs under the KOCI can easily be commerc  
 Therefore the GRIs may easily adapt and implement policies for technology commercializat

Table 3. OLS Results of Technology Transfer Activities in KORP

Variables	Beta	Std. Error	t value	Significanc
Constant	.701	.777	.902	.370
RDF	-1.30E-05	.000	-.513	.610
PH	1.27E-02	.004	2.833	.006
PR	2.900	.932	3.110	.003

R<sup>2</sup> : .356

In the case of the GRIs under the KORP, policy reinforcement effects is the most  
 variable, followed by patent holding with less than 1% significant level, although th  
 developed by the GRIs under the KORP, is not easy to market in private sector. Furth  
 funding influences technology transfer negatively without significance. It means that  
 does not generate adequate revenue, which can lead to serious impediments for technology

### ***Analysis of Technology Commercialization***

The first model analyzes the relationship between technology transfer and the royalty rate. The second model analyzes the influence of critical clauses of licensing on royalty revenue.

Table 4. OLS results

KRCF				
Variable	Beta	Std. Error	t value	Significance
Constant	1.942E-03	.001	2.748	.009
TT	6.085E-04	.000	9.401	.000
KOCI				
Variable	Beta	Std. Error	t value	Significance
Constant	2.108E-02	.004	4.779	.000
TT	7.383E-05	.000	1.753	.086
KORP				
Variable	Beta	Std. Error	t value	Significance
Constant	7.818E-02	.026	2.962	.004
TT	-8.15E-03	.006	-1.283	.204

The first two cases show that more technology transfer does generate more royalty revenue within the GRIs under the KRCF the royalty revenue do not increase in proportion with number of technology transfer, because the GRIs under the KORP prefer royalty basis which results in more volatile revenues.

Table 5. OLS Results of Technology Commercialization in KRCF

Variable	Beta	Std. Error	t value	Significance
Constant	9.174E-03	.003	3.031	.008
EXCLU	-5.18E-03	.007	-.792	.440
PROCOM	1.290E-02	.009	1.423	.174
MP	5.036E-03	.007	.701	.493
IP	-1.03E-02	.006	-1.610	.127

R<sup>2</sup> : .259

First, as for exclusivity, non-exclusive licensing may lead to a greater number and enhance competition among licensees toward commercialization, and thus generate amount of license revenue (Bercovitz et al., 2001). Therefore, exclusive rights affect revenue negatively.

Second, with respect to characteristics of the technology, the basic technology GRIs under the KRCF is hard to introduce in the market. Because of the uncertainty of basic technology regarding the future commercialization, the licensee may not make the for commercialization and may not report the revenue generated. Therefore, it is necessary

the clauses such as minimum payment and production commencement date.

Table 6. OLS Results of Technology Commercialization in KOCI

Variable	Beta	Std. Error	t value	Significanc
Constant	2.316E-02	.004	5.216	.000
EXCLU	-8.72E-03	.010	-.898	.376
PROCOM	-6.31E-03	.008	-.839	.408
MP	1.862E-02	.070	.267	.791
IP	9.414E-03	.010	.966	.341

R<sup>2</sup> : .138

As mentioned above, within the GRIs under the KOCI, technology is mainly transfe government research project, which start with a private sector partner from the begin project is completed successfully the GRIs give the prior licensing right to the private while the private sector makes a lump-sum payment. Therefore, all the clauses to commercialization on royalty payment basis licensing do not influence technology tr much.

Table 7. OLS Results of Technology Commercialization in KORP

Variable	Beta	Std. Error	t value	Significanc
Constant	4.608E-02	.027	1.698	.103
EXCLU	-3.35E-02	.041	-.817	.422
PROCOM	-9.17E-03	.044	-.210	.836
MP	-1.56E-02	.054	-.290	.774
IP	-2.16E-02	.040	-.540	.594

R<sup>2</sup> : .074

All the coefficients are negative without any significance. It can be expla characteristics of the technology transfer. First, technology transfer does not oc Second, once technology is transferred, it is almost always transferred by royalty p without initial payment or minimum payment that guarantee a collection of a royalty Thus, all the clauses to give incentives to expedite commercialization, that is, yield not influence royalty collected rate properly.

## 4. Conclusion

This research was conducted based on the perception that the technology developed at th Korea has not been properly utilized. The number of technology transfer and royalt compared the number of patent holdings and R&D funding reveals a low rate of technology and commercialization.

The purpose of this paper is primarily to examine the status of technology trans focusing on licensing agreement for the last ten years and then to identify the existin technology transfer to marketplaces in order to elaborate strategies for promoting tech activities.

First, the status of technology transfer of the GRIs can be examined by comp number of technology transfer to the number of patent holdings, and the amount of royalt to R&D funding. The results show the lack of technology transfer. Technology has been t less than 3% of the number of patent holdings and royalty revenue has been collected les of the amount of R&D funding on average for the last ten years.

Second, the impediment for effective technology transfer is identified and a survey instrument and statistical method. Institutional aspects of technology trans analyzed using the survey. The results show that the introduction of institution infrast researcher intrapreneur system, technology business incubator, and cyber-techno mart positive effect on technology transfer as the increasing number of technology transfe indicates. However, Technology Licensing Office(TLO) does not effectively help technolo because of insufficient personnel, unqualified office workers, deficient incentive transfer. Furthermore, TLO does not carry out the necessary activities for effecti transfer, in terms of intellectual property management, market research, technolo technology marketing, licensing contract, and postagreement activities except intell management and licensing contract, due to reasons mentioned above. Especially, technolog and postagreement activities are rarely conducted. It may cause several problems for transfer. One problem is that cost approach based on R&D funding without appropriate makes royalty payment inflexible resulting in a breakdown of negotiation. Another prob no postagreement activities make it more difficult for the licensee, which is usual entrepreneur or an SME, to fully commercialize the technology.

The analysis of licensing contract documents implies that several problems addressed. One problem is the inconsistency between the exclusive rights and the impr

the technology-licensed provision. The inconsistency suggests non-exclusive rights or sole licensing rather than exclusive rights. Another problem is the transaction cost, such as IPR maintenance cost and etc, which is a burden for the licensee and therefore prevents effective technology transfer.

The first statistical analysis of influence of R&D funding, number of patent ho institutional change in 1999 on technology transfer states that all the factors c technology transfer but at an insignificant level. The second statistical analysis of 1 documents shows that exclusive rights negatively affect to the competition among li commercialization. In addition, initial payment and minimum payment do not play a criti effective technology transfer. It can be explained by the fact that technology is prima by cooperative research with fixed process of research, licensing and payment.

Finally, strategies to expedite technology transfer are suggested from the abo follows.

First, government support is needed systematically in terms of introduction institutions and registration of a Technology Transfer Act to promote technology introducing an incentive system for the TLO and special accounts for technology transfe Second, the following measures may facilitate technology transfer: a more effective ma the TLO with regard to qualified personnel, full performance of necessary activiti technology valuation, technology marketing and postagreement activities. Third, an imp the provisions of licensing contract is needed to generate proper royalty revenue and to technology end up being useless in terms of exclusivity, payment type, and etc.

The significance of this paper is that empirical study of licensing contract GRIs in Korea was conducted for the first time. Furthermore, this research is the first systematic approach to technology transfer activities in Korea.

However, this paper is limited to GRIs without any consideration of the private an essential counterpart of technology transfer. Hence, further study is recommende research on the extensive research the private industries as recipients of technology tr



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