

Technology Transfer Principle & Strategy

Chapter 2: Technology Commercialization

- Defining the concept of technology commercialization, understanding the mutual relationship of technology transfer by which its importance is learned
- Learning various technology commercialization strategies and forms through cases
- Understanding re-modeling in relation to the technology commercialization process, and constructing actual technology commercialization plans
- Finding out about domestic technology commercialization systems and deriving points of suggestion

Part 1: The Concept & Importance of Technology Commercialization.

1. The Concept of Technology Commercialization

Technology Commercialization is making a business model of increasing profits after the break even point by providing value to subject customers through the development of products (products, services etc.) using the special technologies of particular industries and fields and commercializing this. Here specialized technology means combined technology which has integrated the already commercialized individual technologies, creative technology developed in house by corporations and technology licensed by other corporations or research organizations.

In terms of the Technology Commercialization concept there are other definitions. Firstly, with a concept of consultation technology commercialization is produced into a prototype through researched and developed technology transfer, and it can be seen as a process before the market release of the product by combining manufacturing processes and engineering technology.

Secondly, as a slightly expanded concept technology commercialization is seen as a process from production shipment to sales of mass produced products by implementing new technology obtained through in house Research and Development or external technology transfer to production activities such as manufacturing process and engineering.

Thirdly, as the widest concept it is the series of activities enabling the acquisition of technology commercialization ideas, maturing them, developing technology to realize through research, making prototypes using developed technology that is accumulated, develop new process or make improvements to the existing process to enable mass production of products, through the process release mass produced new products to the market, make sales, construct new infrastructure if necessary to enable easy consumption in the market, and maintain the superior position of the new product in the market place.

In summary as seen in (figure 1) the important points of technology commercialization are classified into in-house R&D Commercialization & Technology in Commercialization in the view of the technology source and oneself Technology Commercialization & Technology-out Commercialization in accordance with the changes in the technology commercialization organization. That is, technology commercialization has to be thought of in relation to technology transfer, and appropriate technology transfer activities can increase the success rate of technology commercialization.

[Figure 1] Concept & Classification of Technology Commercialization.

2. The Importance of Technology Commercialization

In a society based on knowledge, technology innovation is being appraised as the important factor that sways national competitiveness and corporate competitiveness. As a result, governments of various countries around the world are becoming involved in technology innovation with a keen interest and active involvement in technology commercialization.

Technology innovation can be seen in two ways, technology development and technology commercialization including (technology transfer – technology spread concept). Domestically and Internationally up until the 1980's it was believed in line with R&D expansion that technology development policy would bring technology innovation. However at present the recognition that developed technology itself is not the result but that technology must create additional value through proliferation & commercialization has set in, and technology commercialization policy has taken the core position of industrial technology policies of each country.

This originated from America. With the problem awareness in regards to R&D investment effectiveness the national assembly focused and established laws on technology transfer to promote new technology & technology commercialization and through drastic measures reduced the budget on the national research centers R&D to lead the technology commercialization policy. The national research centers felt a social crisis and transferred research results to private enterprise, and through commercialization gain recognition of the value of their existence, and secured royalty income source to be utilized as research funds while the application of the research institute would contribute and compensate national technology commercialization. It is known that NASA's many technology transfer commercialization cases represent successful case studies. This is very much an American based utilization method, stabilized and actively contributing to the late 1990's American economy through the national policy assistance and the diverse private consulting companies and consultants. On the other hand in Japan after the economic crisis of the 1990's management emphasized economic strategies to maximize outcome or results through optimum resource allocation rather than transfer technology development, and expression towards technology commercialization gained spotlight. Especially from the recovery point of view of investment in managerial resources in research and development there was interest in outsourcing and technology transfer of research and development in technology commercialization.

In Korea, according to the year 2000 standards rank no.5 for the number of patent applications, despite being ranked no.3 for the number of registered patents, it is a comparatively low rate for utility model commercialization and registered patents. According to the survey of The Korean Intellectual Property Office in April 2002 for the status of Korea's patent commercialization of patent registered product development, production and sale commercialization rate was 26.6%, utility model based commercialization rate was reported as 41.1%. Again it was reported that registered patent commercialization success rate was 11.2%, registered utility model commercialization success rate was 22.4%. The commercialization success rate is again only less than half the commercialization rate. Especially confirmed low ratio survey results were for transfer to others at 0.4%, the ratio of utility models transferred to others was 1.2%. In addition the success rate of transfer technology is expected to be less than 50% and estimated to be to less than 0.4% for patents and utility models combined. Meanwhile, the problems encountered in utility model commercialization, 'lack of funds in commercialization' appeared to be the highest at 37.8%, next is 'marketing & sales' (19.5%), 'forgery & imitation products' (15.4%), 'technology & research factors' (11.4%), 'excessive screening and settlement periods' (10.6%) to the lowest order.

[Figure 2] Obstacles in the commercialization of patents & utility models

insufficient funds for commercialization

marketing & sales
imitation industry
technical & research personnel
burdensome evaluation standards
<Source> Intellectual Property Office, 2002,

As a result, increasing the commercialization rate and the commercialization success rate is definitely necessary in strengthening national science & technology competitiveness, and in terms of finding solutions for the above obstacles, support policies must be created. Also, with the emergence of the participatory government, discovery and cultivation of new generation growth dynamic business areas are being actively conducted as a new platform for accomplishing the \$20,000 per capita national income. However, economic value does not increase solely with radical technology developments, but the developed technology must be commercialized and lead to products and industries, and eventually this will be the natural consequence of a rise in efficiency through innovative R&D systems. In 2001, Korea's R&D investment relative to the GDP has been highly appraised as being number 5 in the world, however the commercialization rate of government supported R&D projects from 1982 to 1000 was only 12%. So, when the technology development commercialization system which connects technology development – technology commercialization (technology transfer, diffusion) – reinvestment is constructed, it will activate industry & economic development through the settlement of a favorable circulation structure in relation to technology innovation. Consequently, there needs to be a transformation of policy aims from the policy of increasing technology development investment scale to a commercialization policy. Our government has recognized the importance of technology commercialization and is increasing the budget figures for technology commercialization related funds. <Table 1> shows the current status of technology commercialization funding support per government department.

[Table 1] Status of technology commercialization funding support per government department
(Unit: \100million)

Department Name	Project Name	'02 Budget	'03 Budget
	Technology transfer & commercialization infrastructure construction project (contribution)	71	84
	New technology utilization development project (contribution)	170	150
	New technology incubation project (contribution)	248	216
	Industrial technology development project (loan)	2,000	1,600
	Development technology transfer support project (including private university TLO support) (contribution)	71	64
	Small & medium business development technology commercialization fund (loan)	500	600
	Small & medium venture enterprise incubation support project (loan)	2,700	2,700
Intellectual Property Office	Patent management & commercialization support (supplement, loan, investment)	27	77
	Technology transfer, commercialization promotion project (contribution)	15	16
	Leading technology development support project	1,200	1,000
	Superior new technology (IT) support project (contribution)	100	88
	Transfer technology R&D support (contribution)	32	22
	New technology business start-up support (contribution)	16	6
	Patent expense support (contribution)	35	35
	Technology transfer exclusive organization support (contribution)	18	18

	Technology development funding support from the Science & technology promotion fund (loan, investment)	1,535	900
	Environmental technology commercialization funding support (loan)	40	40
	Environmental venture incubation project support (contribution)	3	2
	Environmental industry technology information system construction (contribution)	10	10
	Environmental technology utilization support project (contribution)	-	6
Ministry of Health & Welfare	Health industry technology transfer support project	2	4
	Total	8,793	7,638

<Source> Public release data of each department

The following details are being proposed to strengthen the technology commercialization policy. First, technology which has not been commercialized does not have any economic value. In other words, investments in technology developments that are not feasible in terms of business must be reconsidered. Not just procedurally but evaluations of business feasibility through precise examination & analysis by specialized organizations must be conducted from the technology planning stage. For medium and large projects, continuous evaluation for each stage must be conducted, and if there is an event of insufficiencies in business feasibility, measures such as bold development stoppage should be taken in action in order to raise the research productivity.

Second, application technology development support systems in contribution fund supplement support forms that are low in effectiveness should be transformed into investment support systems and improved into systems to raise results. Along with this, by increasing the development technology utilization budget of the government R&D budget from the current 1% to 5% within the next 5 years, the investment shirking phenomenon in the technology transfer stage can be solved. Furthermore, the current formation of the corporate start-up investment centered technology investment funds must diversify into the Technology Commercialization Investment Fund and Venture Enterprise M&A Investment Fund, etc. Moreover, the construction of support systems that connect technology development support and commercialization investments, such as the component & material technology development support project, must be magnified.

Third is the financial institution support system improvement through the strengthening of the technology evaluation function. Currently, apart from the technology guarantee of the Korea Technology Credit Guarantee Fund which exclusively supports technology financing, the connection between Korea technology Transfer Center, technology evaluation organization and financial institutions must be strengthened. Also, by introducing new technology evaluation guarantee systems such as technology valuation, technology evaluation insurance etc. contribution must be made to the raising of public confidence in relation to evaluation techniques and advancement of evaluation through the operation of a competitive system between evaluation organizations. Along with this, when financial institutions support technology commercialization fund but do not possess technology evaluation systems, they must receive evaluation of business feasibility by technology evaluation organizations, and part of the evaluation cost can be provided by the government.

Fourth is the cultivation of specialized R&D companies that support utilization development on transfer of technology developed by universities & research organizations to small & medium corporations. To raise the rate of technology utilization by making the civil R&D system efficient and strengthening incentives in relation to the research burden, research bodies with strong utilization development capabilities, corporate subsidiary research centers etc. must be cultivated into specialized utilization research companies in the form of independent legal entities. So, the national technology development system must be reorganized by making the corporate research system

efficient and forming a new research core which connects the initial research function of universities and public research organizations with the utilization of corporations. Fifth, by discovering technologies with business feasibility whether domestic or international, technology transfer commercialization in relation to our corporations must be actively supported. Although the technical personnel of Israel, Australia, Canada, Sweden etc. are superior, there is a need for attempts to establish advanced policies to enable efficient technology commercialization through joint international projects with technology superpowers with no manufacturing infrastructure for the cultivation of advanced industries. Along with this, rather than simply leaving technology commercialization to the market logic and preventing technology stagnation, investment type support should not be reserved to lower the high risks in early commercialization and to promote technology transfer activation.

Part 2: Strategy & Types of Technology Commercialization

1. Technology Commercialization Strategy

Strategy is said to be the process of devising efficient and positive plans centering corporate resources and efforts on a particular direction in the mid-long term based on analysis of the external environment and internal capabilities, and executing this as an organization to achieve the aim of continuous corporate growth.

Subjects of strategy are different depending on the system level or the organizations where strategy is established and executed. So, the corporate strategy can be classified into management strategy, business strategy, and functional strategy. Of the many business fields, management strategy includes business portfolio strategy which determines the businesses to concentrate on and invest in, and business strategy is a tool to decide on specific competitive methods by utilizing the given fusible resources to deal with the given environment and obtain a superior competitive position. Functional strategy includes technology strategy, production strategy, marketing strategy, finance strategy, human resource strategy etc. and the relationship between these are conditional on a higher level strategy, and they are inter-connected through the proposal of aims.

Technology strategy is the process of devising specific plans to establish phases of technology development, determining & selecting strategically required technologies, and effectively acquiring & securing these for the achievement of corporate aims based on analysis of the external technology environment and internal technology capabilities, and executing these plans. In a wider sense, it can also include the proposal of methods to effectively manage & utilize the already acquired technologies, and construction of specific systems in order to execute these. In this viewpoint, the scope of technology strategy subjects can finally be divided into technology acquisition strategy, technology management strategy, and technology utilization strategy.

Technology acquisition strategy is the establishment and execution of strategy on the methods of how to receive supply of new technologies that are determined to be additionally required through the analysis of technology and the technology capabilities of the corporation needed to conduct business in the chosen field. In determining the technology acquisition strategy, consideration and analysis of strategic position, technology life cycle position, superiority in technology competitiveness, possible technology acquisition choice alternatives, time & funding limitations, risks in the acquisition of technology, strategic autonomy etc.

Before discussing technology acquisition strategy in depth, technology outsourcing will be explained. Outsourcing is the acquisition of required technology from external organization. The need for technology outsourcing is expected to increase as the speed of technology development becomes

more rapid and global competition becomes more intense. Technology outsourcing consists largely of 4 stages. Stage 1 is the confirmation of technology needs in business sections. It is the stage where technology needs are confirmed and set through the analysis of latest technology trends in the related business section. Stage 2 is the evaluation of technology standards currently possessed. It is the stage where possible in-house development areas and core competencies to be possessed are precisely determined through the evaluation of internal technological capabilities. Stage 3 is the establishment of technology acquisition strategy. It is the stage where technology development or acquisition routes are set in connection with the corporate technology strategy. Stage 4 is the execution of outsourcing. It is the stage where subject technology, subject organization, and acquisition methods for outsourcing are selected.

[Figure 3] Stage by stage process of technology outsourcing

Stage 1 confirm technology needs of the business section

Stage 2 Evaluates the standard of current technology possessed

Stage 3 Establish technology acquisition strategies

Stage 4 Execute outsourcing

Strategic selection stage of technology outsourcing subject & acquisition method

Specific outsourcing execution stage including company selection, contract management etc

A proposal of the selection standard for outsourcing subject technology is as follows. First is the superiority of the subject technology. It is whether the subject technology can show superiority in differentiating the company's products in terms of performance & cost. If superiority can be guaranteed, that technology becomes an important core so in-house development would be the best option, but if it cannot be guaranteed, outsourcing would be the better option in order to more efficiently utilize internal resources because that technology is easily accessible by any one.

Second is the utilization of the subject technology. It is whether there has been a loss in differentiation due to its wide usage. If there has been a loss in differentiation, acquisition through outsourcing would be more appropriate as opportunity for a more efficient utilization can be lost through in-house development, but if differentiation is maintained, in-house development would be the better choice to secure competitive advantage.

Third is the supplementation of the subject technology. Although it is well known in other companies, it is whether the new technology can adequately supplement existing technology in one's own company. If this can be done, it is better to acquire more quickly and economically through outsourcing as new product opportunities can be gained through product integration and early market release can be achieved through process improvements.

Fourth is the attraction level of the subject technology. It is whether the value of the differentiated technology is great enough to make the sharing of the development cost attractive. If the value of the technology is high, sectional outsourcing would be favorable as the reduction in time and cost can justify the partial losses in the governance of the technology, if not, in-house development which assures complete governance would be more rational.

Fifth is whether the subject technology can be acquired from specialized external leading corporations that are more superior than one's own company. If this is possible, outsourcing would be more favorable because access to the highest technology is more important than technology governance, if not, in-house development utilizing internal resources through the implementation of in-house capabilities would be the more rational choice.

Sixth is the governance of the subject technology. It is whether the new technology of one's company is already occupied by another party possessing governance. If this is the case, outsourcing would be more favorable as the reduction in time and cost may be more important than technology governance, and securing in-house competencies through this would be more attractive than requesting technology development from another company (including private research organizations, universities, government research organizations etc.).

Next, forms and characteristics of technology acquisition strategies for technology commercialization will be explained. Possible new technology acquisition strategies can be divided into in-house R&D, acquisition of possessing firms. Joint venture & alliance, external R&D contracts, licensing, purchase of final products and components, internal venturing, venture capital & equity participation, educational acquisition etc. (Dussauge et al 1996). With in-house R&D, a lot of resources are required and forecast of R&D success and utilization is difficult, but on the other hand autonomy in technology utilization can be gained, and it has the technology assets accumulation feature enabling the absorption of additional related technology. This method can be utilized most effectively in developing technology that is connected to existing technology assets. Acquisition of possessing firms involves the takeover of existing corporations or business sections by which the required technology and infrastructure can be secured. Commercialization period and investment burden is reduced, and overall governance can be maintained. However, it is a strategy that is only effective in the case where companies possessing relevant and required technology exist, and the post-merger integration between the research teams of the target company and the takeover company determines the success or failure.

A joint venture is a new company established and operated by 2 or more corporations and is a strategy which enables technology acquisition with a reduction in cost and risk. Various joint ventures became standard and were utilized extensively after 1990 with the emergence industry complexities and strengthening of competition levels. However, there is a weakness in that management is difficult due to the differences in aims and governance between the participating companies.

Strategic alliance is a method where 2 or more corporations share profits resulting from prearranged cooperation and alliance. There is the vertical type alliance like sales agencies and horizontal alliances where specialized technologies of other corporations are utilized to penetrate a particular market more efficiently.

External R&D contract is a strategy whereby particular technologies are acquired by requesting the development to external research centers, universities, specialized research centers etc. and there are methods such as joint research development, R&D outsourcing etc. Especially, even in Korea, with the emergence of specialized R&D corporations, the demand for and interest in R&D outsourcing is increasing. Outsourcing is generally utilized for cost reduction, but R&D outsourcing is effective in terms of specialization and speed of technology development as it utilizes organizations with established technology infrastructure. However, with this method, there is the problem with a preoccupation to technology development leadership and concerns regarding the release of confidential technology of the company.

Licensing is a strategy where the technology license is secured by paying a fee in accordance with the technology transfer contract. It used extensively as a method to overcome the differences between developed & developing countries as well as leading companies & and companies lagging behind, but has been provided mainly based on technology in the mature & declining stages in terms of the technology life cycle, and because there is a strong tendency to pass over unnecessary technology within a package, recently there has been a wide usage of cross licensing between competing companies on an equal level. Purchase of final products and components is not

an acquisition of technology but a method of securing technology by purchasing final products or components and selling with the brand of one's company. It is used to temporarily maintain market position in a particular market or for business entrance or securing knowledge for market entrance.

Internal venturing is a method for the development of internal technological capabilities by cultivating a separate technology organization within the corporation. Large scale initial investment is required and risk & potential profit is the greatest. It has been encouraged in large corporations to induce technology innovation, and the success factor is whether there are internal businessmen possessing business mentality. Venture capital & equity participation is a method to secure governance of potentially prospective technology by strategic participation in share subscriptions of new companies possessing innovative technology, and if successful it can also lead to corporate M&A. Educational acquisition is used to provide familiarization opportunities in relation to new technology through supplement funding or cooperative programs, but there is no possibility of utilization in the near future.

<Table 2> shows the new technology acquisition strategies in accordance with the technology and market attributes.

[Table 2] New technology acquisition strategies in accordance with the technology and market properties

		Technological Attributes		
		Existing Technology	New/Related Technology	New/Non-Related Technology
	Existing Markets	Joint venture & alliance Internal venturing	Venture capital & equity participation Educational acquisition	Spin-off Technology sales
	New/Related Markets	In-house R&D Acquisition of possessing firm	In-house R&D Licensing Acquisition of possessing firm	Venture capital & equity participation Educational acquisition
	New/Non-Related Markets	In-house R&D	In-house R&D Licensing Acquisition of possessing firm	Joint venture Internal venturing

As seen above, methods in acquiring new technology are very diverse. Although individual firms decide in consideration of cost, risk, and time, autonomy in relation to the relevant technology, required technology & the characteristics of the relevant business etc. also are factors of influence. As mentioned before, the connection between the firm's overall strategy and the all-inclusive business strategy must be considered. As a reference, <Table 3> shows the checklist of divisional control in relation to technology development strategy.

[Table 3] Checklist of divisional control in relation to technology development strategy

Checklist	Yes	No
What are the function allocations of the research center and the development section of the business division like?		
What are the function allocations of the central research center and the development research center like?		
How are overlapping R&D themes being solved?		
Which system should be comprised for the theme to be done by joint PJT?		
In the case of the production technology development theme, how should the functions of the technology section and the R&D section be allocated?		

When developing new products, how will the R&D section area and the business division activity area be classified?		
To what level will the research center be involved in the technology development theme of information technology?		
How will the connection with the R&D section be achieved in relation to new product development?		
Given that both technology & marketing is needed in product development, how will the functions be allocated?		
Should the leader of product development be the marketing section or the technology planning section?		
When will the new product be introduced by the division in charge of the new product?		
In the case where the new product promotes a change in production & distribution line, how will this be done?		
How will the advertisement commercial methodology of the new product be improved?		
How will the control between the production, distribution, and human resource strategies be done?		
How will the duties of the research section and the production section be allocated in relation to production technology development?		
To what extent will the production & distribution information network extend to?		
How will the determination of personnel needs & human resource policy for the cultivation of promising personnel reach consensus?		
How will human resource management in accordance with the technology strategy are done in employment, cultivation, and development of technology personnel.		

2. Classification of Technology Commercialization

There are diverse classifications of technology commercialization. Firstly, the characteristics differ greatly depending on whether it is in the public sector or the private sector, and whether the technology discovery is motivated by seeds or needs, and there are differences due to business types (start-up, technology transfer, spin-off, R&D services), and characteristics are held in accordance with the business principal (research center, technician, professor, corporation etc.).

(1) Technology commercialization in the public sector and the private sector

Technology commercialization in the public sector means that the technology is developed by a government funded research center, then transferred and commercialized by the private sector. At times, it involves technology that will not or cannot be done by a private enterprise but is necessary to develop. These technologies include infrastructure technology, leading technology, large scale national policy technology etc. However, given the characteristics of the public sector, technology diffusion unfolds manually, so it is a section where involvement and inducement of proactive commercialization policies are required.

For a successful commercialization strategy in the public sector, the following details must be considered. For a successful commercialization strategy, the problem must be precisely recognized through site visitation. The recognition of a challenge mentality must be stimulated through the incorporation of the transfer aim concept geared to the changes in the external demand environment and the setting of challenging research aims. It is also favorable to enhance pride and challenge mentality through media promotion of research results. It is also necessary to form a sharing culture including the creation of smooth communications & teamwork by holding MT & evaluation meetings.

Systematic research plans and project execution plans must be provided, and it is also important to encourage R&D consortiums through the operation of a 'matching fund system geared to research achievements' and "competition & cooperation" between member companies. A network must be

established for successful innovation, and industrial property rights must be secured and innovative partners discovered. Along with this, through the application of the 'OJT + Dual Plant?' concept, technology transfer must be carried out successfully. Acquiring technology through the utilization of foreign scientists is also a good strategy.

Technology commercialization (spreading of technology) of the private sector is aimed at maximizing profit creation through the commercialization of innovative technology. Consequently, rather than technology commercialization being the purchase of products that incorporate innovative technology, it is a more active involvement. In the case of large corporations, capabilities and resources to conduct the entire process of technology commercialization is possessed. On the other hand, small & medium businesses can only perform parts of the technology commercialization, so there is a greater need for technology transfer utilization in technology commercialization. Specialized R&D firms that have been emerging recently must be actively cultivated as they function in this role.

The constituent factors for the success in technology commercialization of the private sector are as follows. First, if people fail, personal loss follows, so a liberal environment that compensates success and guarantees progressiveness is needed. To increase the opportunities for personal success, each individual must be educated about businessmen and sponsors. Small & medium businesses operating based on technology need workers and advisers with ability, so to increase the probability of commercialization success it is good for small & medium businesses to be located near universities.

Second is whether the technologies demanded by people are possessed. To achieve technology innovation, the technology itself must be advanced, and something that others cannot easily follow. To protect science & technology, a well developed patent system and appropriate related laws are required.

Third, innovators face the most difficulty due to funding and the market. In the past, the market was thought of as a series of concentric circles consisting of local, national, and global markets. However, these days, there are many cases where the market in relation to new technology is thought of as a global demand from the outset. Because of this, firms with an interest in technology commercialization must think first about the combined issue of allocation and protection of intellectual property which is aimed at the global market.

Fourth, start-up firms need capital. Small and medium businesses can receive sponsorship through alliances with large corporations, but as time passes they become more interested in hunting for new science & technology rather than possessing and developing their own technology. Rather than funding support, the government must provide other benefits to innovators, that is, they must secure other incentive types such as tax benefits for the technology innovators.

<Public sector technology commercialization case of P firm>

P firm succeeded in technology transfer through the competitive tender in regards to 130 patented technologies in the mobile phone field possessed by ETRI. Of the technology transfer from the public to the private sector, this was the largest. Rather than being a licensing method, it was a lumped transfer of 50% of the rights share, and because of this, it raised enormous interest in the related industry. The transferred technology is a patented technology in relation to the core section of mobile phones, and a part of this includes patent registrations not only in Korea but also in foreign countries like the US and Japan, and the 130 patented technologies were classified into 5 group packages and were sold in those groups by a competitive tender. This tender showed a high average competition rate of 3.5 to 1 reflecting the earnest desire of firms to possess patented

technology in the field of mobile phones. The firms that came to possess ETRI developed patented technology through this technology transfer, were able to speed up their production of high quality mobile phones, and with the construction of a protective patent network, it is expected that firms will be able to better deal with patent disputes amongst major mobile phone companies and technical fee negotiations with foreign companies. The CEO of P company, who received assignment of marketing rights from ETRI and discovered the technologies and conducted the marketing for this technology transfer, stated "after the technology transfer law came into effect, each government department did not reserve support policies to transfer technology possessed by public organizations to private firms, but the results had already been achieved. Many public organizations must actively consider technology products discovery and marketing through outsourcing to specialized technology transfer companies."

(2) In-house development commercialization & technology implementation commercialization

Generally, technology developments required for the support of new products & services, and processes are all managed by the R&D division. New technology developments in most companies are core competencies and are not subject to outsourcing, and this is due to the controlling factor of the recognition that these have to be performed internally. These technology commercialization types were previously defined as in-house R&D commercialization, and the concept of technology commercialization utilizing external technology was defined as technology-in commercialization.

The success of technology-in is determined by whether the firm creates profits through the technology transfer. As a result, to maximize profits, not only does it mean a 1 stage profit creation from the technology implemented but a complete absorption and improvement of the technology to create a better technology. A representative case in the 1980s was through the complete absorption and improvement of the technology-in, the home appliance industry in Japan was successful in reducing the size of products by which it swept the world home appliance market.

Especially, if the rapid growth in the information communications industry and the development in related technology in the 1990s is taken as an example, just the absorption and improvement of transferred technologies can offer possibilities of significant profit creation. Unlike the common manufacturing industries of the past, the information communication industry and related s/w industries do not require a great amount of capital in technology commercialization, and there are many cases where accumulated product know-how is not required. That is, in the s/w industry and the information communication industry competitiveness in the market can be secured just by technology-in commercialization of the results from R&D.

Even in technology-in commercialization forms of technologies implemented must be different depending on the level of the stages in commercialization. This will be explained in classification of technology implementation in the research result stage, technology implementation in the development results stage, technology implementation in the test stage, and technology implementation in the production & marketing stages. Technology implementation in the research result stage is the most economical method of implementing technology where the results of research are purchased for a technical fee when the company is on a high level in terms of technological capability. A representative example of this is the 1980s purchase of the O/S from Microsoft by a PC manufacturing company in Korea. Engineering, testing, production & marketing were the responsibilities of the technology implementation company, and because they did not have exclusive rights, it was a technology implementation on the premise of market competition.

Technology implementation in the engineering & testing stages is the "Turnkey Plant" method. Mainly the petroleum plants, cement factories, and black & white TV factories of the 60s are the

representative cases. It can be seen as technology implementation for the establishment of a corporation before technology commercialization. Until corporate establishment, there are no problems with production as it is guaranteed in the technology implementation, but guarantees in relation to market growth cannot be obtained. Fortunately, strengthened by the national industry protection policy of the government, it was successful in securing the domestic market, but in the domestic market of today, which has been completely opened, the 'Turnkey Plant' method must be adequately analyzed beforehand as it does not take into consideration the marketability in the economy system.

Technology implementation in the production & marketing stages is mainly aimed at production know-how and management know-how. It is the technology implementation for the reduction of cost in relation to the already operating firm, improvement of productivity, and production of new products.

<Technology commercialization case of KTTC>

I visited K Company, located at the Namdong Industrial Complex in Incheon, for the first time in early summer of 2001. It was for the site inspection to select Innobiz firms sponsored by the Small & Medium Business Administration. Like the importance of first impressions with people, I examined carefully as the phone answering behaviors and impressions are the first barometer for the firm. In the case of the personnel in charge for K Company, not only did he respond politely in relation to the prior request for data materials he also conducted his tasks in a systematic manner, and he treated me faithfully and sincerely on my visitations, so that gave me a good impression.

And while interviewing the CEO, I realized that the bright atmosphere within the company and active performance of tasks by the employees were in line with the management mind of the CEO. I gained confidence in the company when the CEO said "our company develops and produces small-sized products based on our precision processing technology. No matter how insignificant they may be, we develop components requested by our customers within a short period of time. Firstly, if we build trust with companies that we deal with, there are cases where other business opportunities come about. To our employees, I emphasize autonomy. Even if I leave the office early due to appointments outside, our employees work throughout the night, if required, to finish the task at hand by the next day."

The technology possessed by K Company is the KOVAR Ring & Lid technology which is required in manufacturing core components of SAW Filters (surface acoustic waves) used to control frequency in mobile phones and transponders. In the past, it had been entirely imported from Japan, our company became the first in Korea to successfully localize this, and it is an ultra precision technology requiring 3um in processing error & flatness, and in the precision of parallelism.

K Company was selected as a Innobiz company with outstanding results, and in 2001, through the technology commercialization program of KTTC, and at the end of a 2 month technology examination, consultation on business plans, and negotiation with investment organizations, K Company was able to secure a total commercialization investment of \1.5billion including direct investment of \300million and facilities investment of \1.2billion from the Korea Development Bank.

K Company is supplying 90% of the companies that had previously imported from Japan, and has entered a components supply contract with a major Japanese company. Even with the strict quality test of Japanese makers, they received exemptions of the document evaluation because of the fact that they received investments from Korea Development Bank which has obtained public confidence, and they gained the benefit of reducing the certification period.

In conclusion, K Company is a successful case in technology commercialization transforming from a traditional machine manufacturing company to a information communications components company with technology, funding, and consultation being implemented at the appropriate period, and it is thought that they will be a good model for many small & medium venture enterprises.

(3) Oneself technology Commercialization & Technology-out Commercialization

This can be classified into Oneself technology Commercialization where the technology developer directly conducts the additional sale, marketing etc. and Technology-out Commercialization where the results developed from specific stages are commercialized by licensing them out.

< Technology-out Commercialization case of S research center>

KTTC was appointed to conduct consultation in relation to the licensing of the technology possessed by S research center, an environment related subsidiary of A group. Of the technologies of S research center, we classified those with high possibilities and appropriate for small & medium businesses. This technology could simultaneously break up dioxin and NOx with huge amounts of development costs already injected, and was completed to the pilot stage. In the standpoint of S research center, in order not to keep the developed technology idle, an appropriately sized partner was required to jointly develop additional application technology to enable commercialization. Finally, G Company located in Gyeonggi-do requested implementation of environment related technology for their new business. Production and installation of environmental facilities using FRP materials was the main business of G Company, and they were a strong mainstream business with an annual turnover of more than 10billion. During its early days after establishment, they produced industrial and home FRP water tanks, and with the growth of the environmental industry, production of air pollution prevention facilities for chemical plants and semiconductor factories was activated, and this gave them the experience of a successful business transformation. During that time, judging that more business opportunities would be possible rather than concentrating on air pollution prevention technologies including the dust collection technology & catalysis technology with the current facility supply capabilities, they requested implementation in relation to this. We immediately introduced the technology of S research center to G Company, and knowing that the technology subject to examination was developed by a large corporation, G Company showed great interest. Through the many interviews with the technical team the technology implementation possibility was confirmed, after which negotiations on price were entered. At first, the initial payment proposed by both companies differed immensely. It is in this stage where the role of a mediator is most needed. We tried to reach an agreement in the negotiations by inducing mutual compromise, but S research center notified that negotiation would not be possible given the transfer price amount and this lead to a situation where there were concerns of negotiation break down. By lowering the ordinary fee and inserting a clause on joint research we provided actual gain for the implementing company and for the developer, the large corporation, the transfer amount was maintained at an internationally justifiable level, but in consideration of the financial burden for the small business, a divided payment scheme was proposed, and the contract which had dragged on for 2 moths was finally established. Because this transfer, which almost broke down, was successful, the technology implementation at G Company was completed successfully and are applying the implemented technology, and the technology, which was developed by S research center and was difficult to commercialize in-house, was released to the smaller company and commercialized. Through this, related research could be continued and reinvestment of the additional profit from the technical fee income could be gained, so a win-win game was accomplished.

3. Influential Factors in Technology Commercialization

Influential factors in technology commercialization are very diverse in terms of the viewpoints of technology, personnel, management, profit etc. As seen in <Table 7> Lester (1988) proposed areas of influential factors in technology commercialization for the private sector and derived characteristic variables for each.

[Table 7] Influential factors in technology commercialization for the private sector

	Variable
Top management	1) Manager's vision; strategy, sponsorship, management network 2) Organizational culture; internal innovator, compensation for innovation,

	idea request/evaluation, additional motive
Organizational & operational characteristics	3) New products organization based on the integrated function team and the venture team 4) New products development organization; management & support function 5) Strategy/function guide; support of requests, resource allocation order of priority 6) Level of common understanding in relation to the new product development process
Derivation of new product concepts	7) Specialized experience, skill, motive induction 8) Technology/market application
Venture team formation	9) Level of individual expertise, experienced duty performance ability, skill & level of expertise, level of understanding in relation to new products, level of compensation, diversity of team members 10) Role expectations
Project management	11) Development of tactics for the accomplishment of project aims 12) Development of aims, milestone, and measurements 13) Focus on external factors (external support, customers) 14) External technology/market specialists 15) Management communications 16) Reassessment tasks (flexibility)

Jolly (1997) divided the category standards of technology development commercialization possibilities into the stage 1 standard which is in relation to the level of business interest, and the stage 2 standard which is in relation to the commercialization possibility.

[Table 8] Jolly's influential factors for commercialization

Standard		Variables
	Level of market attraction	-63 size -64 growth -65 income level of customer -66 level of customer consumption in regards to innovation
	Leverage in relation to existing technology & infrastructure	-67 technological synergy -68 commercial synergy -69 suitability of future strategy
	Simplicity of commercialization	-70 simplicity of commercialization -71 resolution of pending problems -72 usable support in relevant fields -73 barriers against commercialization
	Uniqueness of application	-74 most cost-effective solution -75 exclusive technological solution
	Scope of proposed problems	-76 method of expanding the scope of the product -77 expansion method for core technology & patent scope

[Table 9] Commercialization related technology infrastructure organizations

Private Sector	Public Sector
-78 industry associations & bodies	-84 research associations
-79 conferences	-85 standard setting organization
-80 educational centers	-86 intellectual property office: patent commercialization center
-81 trade data release organization	-87 research organization, commercialization support organizations: TBI, start-up support center, technology transfer center, techno mart center
-82 technology standard organization	
-83 overseas branch research organization	-88 libraries & databases

Part 3: Understanding the Technology Commercialization Process

When you speak with technology developers, they have great pride in their technology, but the expectation standard of wealth creation through their technology is not so high. It could be because they have engineering backgrounds and are not familiar with the financial mentality and methods, but just as much as this, they understand from experience that success is not easy, because the time required for commercialization is long-term, and numerous risk factors exist in each stage from commercialization to success. They hope that their technology successfully completes the commercialization process and materializes, but there is a great possibility that the principal or the party taking the profits would be someone else. Eventually, the success rate of commercialization will be increased if the following are incorporated; systematic commercialization plan and execution, ample supply of technical and capital support, formation of a specialized or exclusive team, and finally suitable market timing. In this sense, management personnel and personnel in charge of technology commercialization require more scientific understanding and effort, as well as the ability to apply it in the current business.

If technology commercialization is to be managed in stage by stage process classifications, it would be more useful to focus on management that keeps value creation in mind. Whether to choose a special idea or not, and if chosen, when will it be implemented; these kinds of logical processes for adjustment will follow. Within a given framework, technology can be accommodated in another time frame. Generally, the technology commercialization process can take from 1 year to even 20 years. As a result, by utilizing this stage by stage process, all technologies can be dealt with by an integrated method, and through this process, more information on the market and the technology can be accumulated, enabling rational investment decisions, and can eventually raise the success rate of technology commercialization.

1. Technology Commercialization Process Model

Models in relation to the technology commercialization process are largely divided into two types. Jolly's (1997) model which divides the 1 stage-multi faceted model of Cooper (1986), Foxall (1986), Knox (1990), Kokubu (2001), which possesses a linear structure from the idea to market entrance, and the commercialization process into the main activity stage and sub activity stage, and the multi level – multi-faceted model of Yeong-deok Lee (2001).

(1) Kokobu's technology commercialization process

In the technology commercialization process shown in <Table 10> which covers from the R&D stage to the merchandising stage, an evaluation is conducted at the end of each stage to decide whether to proceed to the next stage or to stop, and when stoppage is decided, the possibility of providing externally the opportunity of transferring the R&D results to date is emphasized. At this stage, the reasons for the stoppage may include technological difficulties, uncertainty in commercialization, insufficient development funds, market immaturity, changes in priority etc. Interim R&D results are arranged into technology information and commercial information, and by the creation of added value they are in a condition where they can be distributed as technology merchandise.

[Table 10] Kokobu's technology commercialization process

Stage	Details
Conception & feasibility study	Technological/commercial feasibility study
Basic research	Principle research (patent application for the prospective technology)
Application research	Usage inquiry (patent application for the prospective technology)
Utilization research	Specific usage inquiry (patent application for the prospective technology)
Commercialization research	Design/development/production of specific product

Merchandising model design	Improvement & final production preparation
Actual manufacture	In-house manufacture & consigned manufacture

(2) Cooper's technology commercialization process

In conducting technology commercialization projects, it is a model for raising project operation efficiency & speed through the method of predetermining core tasks per stage and inspecting the progress results, and the feature is its efficient allocation of development support. Because it consists of stages for each process and gates which determine project progress, it is also called the Stage-Gate Process, and because each process regulates even the extremely precise details, as a whole, it takes on an organic characteristic.

1) Idea discovery stage

There are ideas obtained from the basic research which have high risk and non-productive characteristics compared to the high expected income, and ideas obtained from consumers which require understanding of the market and the determination of the company's strengths, weaknesses, and core competencies.

2) Gate 1: Idea screen

Make a check list consisting of questions like is the project consistent with the business policy sought by the firm, is the project feasible, what is the size and attraction level of the market, does the product have strong points, does it contribute to increasing corporate resources etc. and conduct the stage 1 screening based on the yes/no answers.

3) Stage 1: Scoping

As inspection type tasks to determine whether there is value in terms of time and economics, activities such as preliminary market evaluations, preliminary technology evaluations, and preliminary business/finance evaluations are conducted.

4) Gate 2: Second screen

Based on the information obtained in stage 1, reevaluation tasks are conducted in relation to promotion capability, consumer response to the product, and Fatal factors in technology and legal aspect

5) Stage 2: Building the business case

As the final stage before development, it consists of in-depth technology evaluation, concept examination (research of preferences, purchase intention, price sensitivity etc.), finance/business analysis, execution & planning including consumer demand/request analysis, competitor analysis, market analysis, and laboratory tests.

6) Gate 3: Go to development

Before resources are injected, financial analysis is important as the last opportunity to cancel the project, and the final project team must be formed.

7) Stage 3: Development

Development of the actual product is conducted in accordance with the development plan. Tests are conducted on the lab-tested prototype, and the test plan, product shipment plans, and production facility operation plans are formulated.

8) Gate 4: Go to testing

Examine that the progress details are as planned, and reexamine the plan for the next stage.

9) Gate 4: Testing & validation

The overall project survival possibility is examined such as the product & production process, consumer adaptability, and the economic aspects of the project. Additional innovations are performed on internal product testing, product consumer analysis, prototype production, market testing & test sales, business/finance analysis etc.

10) Gate 5: Go to launch

As the final gate in technology commercialization, it is the last opportunity to cancel the project.

11) Stage 5: Launching

12) Post-launch review

[Figure 4] Cooper's technology commercialization process

(3) Jolly's technology commercialization process

In a book called Commercialization of New Technology, Jolly (1997) proposed a 2 stage-multi faceted process model unlike the traditional linear technology innovation model for the commercialization of developed technology. By using the technology commercialization cycle model, Jolly explained technology commercialization by dividing the commercialization process into the main category which is the core activity realizing the value of the new technology and the sub category which is a process of related activities involving stakeholders to satisfy those related to each stage and to accomplish the aims.

Rather than a technological insight being linear and sectional from the idea to market introduction, it is a continual and serial process consisting of 5 sub-processes and a series of activities called bridges which mutually connect each of these processes. In accordance with this, the importance of the stage 2 support activities have been added which are just as important as the stage 1 core activities. Especially, if suitable support activities in relation to the stage 2 activities are not performed, a grey area in commercialization support is said to eventuate. The 5 stages of Jolly's commercialization are as follows.

1) Idea Imaging

Technology commercialization commences from the idea stage. The thing to note in the idea imaging stage is the judgment of whether the idea is worthwhile to seek commercialization. An idea is not something that has accumulated but develops through the capabilities of new technology and endless interaction between market demands.

2) Technology Commercialization Possibility Inquiry & Incubating

As a stage for finding out the possibilities and limitations of technology commercialization, a more in depth research is conducted on the technology, the research results are integrated into the product & process before commercialization, a prototype is produced or a test stage is performed where connection is made with the initial customers in the market, a stage required for effective demand creation and market related analyses are conducted. This stage falls between the idea and merchandising stages, and is performed to increase the supplementation & utility of the R&D and stimulate more interest from the resource provider and stakeholders. The 2 main reasons for most technology commercialization attempts failing in the incubation stage are the changes in market conditions and lack of feasibility in regards to initial needs.

3) Product/Process Demonstrating

This stage is related to product development. Unlike other products, with products that are made based on new technology one must recognize what product is wanted by customers, and whether

the product incorporating that technology is fulfilling its function must be thought about. Product development is a series of activities including product preparation for market introduction from the initial commencement from the design stage, and is a continual process involving preliminary design of the production system, prototype construction, testing & product feasibility analysis, product & production system supplementation, test marketing & validation, production commencement & shipment into the market.

4) Promoting Reception/Accumulation

No matter how good the idea is or how well it has been validated, inventions that are automatically accepted in the market are very rare. 27.5% of new products and process technologies fail due to market factors that are difficult to control. Another 26% are developed with the thought that "there is public demand" but fail because buyers cannot be found or insufficiency in marketability. The strategies in this stage include reception by the market, securing a position in the market enabling adoption by consumers, pricing for early adoption, sales strategy in line with the propensity to purchase, communications for widespread reception etc.

5) Sustaining continuous commercialization & realization of long-term profits

The key to realizing value from new technology is the long-term continuance of the product or process incorporating the technology as a product with value, and a significant portion of the value created must return to the technology developer. The specific methods to achieve this include the protection of technology application, increasing consumption, exclusivity of core technology to secure long-term profits, the continuance of the technology and the firm established with that technology.

The technology commercialization model being proposed by many researchers are common in that they cover the whole range of processes from R&D, production to marketing activities, but there are various differences in the scope of commercialization stages and characteristics between the researchers. These are summarized in <Table 11>

[Table 11] Comparison of models in relation to the technology commercialization process

Schumpeter school & traditional target access method : 3 stages	Bright (1970): stage by stage access	Cooper's (1986) r stage new product intervention	Dupont (1995)	Jolly (1998): segmentation, value creation model
	1. Scientific suggestions needed & opportunity discovery recognition 2. Theory/design proposal	1. Idea creation	1. Idea	1. Idea proposal
1. Conceptualization - basic research - application research	3. Validation of theory & design concept by the research center	2. Preliminary evaluation 3. Technological concept creation	2. Adoption	2. Technology incubation
2. Product development	4. Application demonstration in the laboratory 5. Full-scale production & field testing	4. Development (engineering, design, prototype) 5. Testing 6. prototype & marketability test	3. Project 4. Prototype	3. Product demonstration
3. Market development	6. Commercial implementation & first usage	7. Full-scale production & market entrance	5. Market implementation & commercialization	4. Product reception promotion
	7. Widespread reception (actual profit, common usage, important		6. Product support	5. Product life cycle extension

	influence) 8. Spread			
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(4) Yeong-deok Lee's Technology Commercialization Process

In Yeong-deok Lee's study, Jolly's model was evaluated as being applicable for new technology commercialization in the private sector of developed countries where the overall infrastructure such as technology development & commercialization related indirect community capital, information infrastructure, infrastructure technology, system & policy, technology infrastructure etc. is well established. In case of less developed countries, where technology development & commercialization related infrastructures are not well facilitated, Jolly's model cannot be applied as is, so various amendments are necessary, and especially with the commercialization of government supported development technology, that are not for the purposes of the government itself, he states that large portions must be amended. The details of the amendments suggested in the same study are as follows.

1) R&D Initiating

With government supported R&D in less developed countries, to promote the spread of developed technology, there needs to be a R&D initiating process where R&D is proposed and a proposal drawn up by the joint participation of the user & developer in the R&D proposal & plan setting process before the idea release stage in relation to the proposed R&D technology as suggested by Jolly. In this stage, the user opinion is reflected in the R&D plan establishment in relation to the development subject technology, and at the same time, the user firm jointly participates in the construction of the R&D proposal. Also, with the bottom-up method, the industry opinion is reflected in the discovery of R&D subjects, and the user can actually play a leading role in the R&D execution process. By this, the gap in regards to the R&D aims & roles that can appear between the technology developer and the user can be eliminated.

2) Locating & Producing

After the technology incubation stage, if the production of the prototype using the researched & developed technology and the test marketing on initial customers is successful, factory location for the actual business must be secured and production facilities for mass production must be incorporated. So, in this stage, overall decisions are made in regards to factory location for onsite production, technology & advice required for onsite production, technology alliances with large corporations, securing expert production personnel & education/training, specialized production through outsourcing, alliances & connections with production companies of existing products etc. However, in the case of new firms utilizing new technology, because they have not been able to reach a suitable level in terms of business, significant problems arise in efficiently conducting production activities. Especially, the funding required in these kinds of activities is not the customary R&D related funding, but funding for facilities and operations, so not only is the scale of the funding large, if a situation where there is a lack of funds arises it is not easy to raise funds through loans given that their business record and credit conditions are weak. As a result, within the extreme environmental changes & timing there are many cases where new technology products that have been successful in the sensitive test marketing cannot lead to a full scale production system and fail to enter the market.

3) Constructing a commercialization infrastructure environment

Even if the gaps between the main processes and the sub-processes of commercialization are filled in the case of less developed countries with relatively weak commercialization related infrastructure, it does not mean that the developed technology will definitely be commercialized. Subsequently, to promote this technology commercialization, not only is there a need for the expansion of related corporate activities and the traditional direct community funding, technology infrastructure and

information infrastructure must be facilitated along with the establishments of infrastructures in actual corporate production activity related engineering technology, standardization & testing technology, measurement technology etc. Together with these, systems, policies, and various programs related to these infrastructure establishments must be improved, and bodies & organizations that can efficiently operate technology commercialization must be formed.

2. The Technology Commercialization Process of NTTC (USA)

Understanding the concepts of the NTTC Technology Commercialization Process is beneficial in absorbing the experiences and theories of the developed country like USA. NTTC defines Technology Commercialization as the development of current technology so that it can be utilized more widely than the present usage, and to utilize it in demand markets that have not utilized it before. As the Technology Commercialization Process, it incorporates the Imaging – Incubating – Demonstrating – Promoting – Sustaining theory of Jolly, and the principal point is in the formation of a Commercialization Team and the establishment of a Commercialization Plan as core factors to achieve successful technology commercialization. The Commercialization Team should comprise of personnel with communication skills, commercialization experience, negotiation skills, and knowledge, and must include knowledge in relation to marketing, contracts, and intellectual property. Before the technology commercialization plan, the business plan must be drawn up first. The business plan should describe the business aims and define the resource operation plan & the action plan, and should be drawn up to gain support for the product, raise funding, and to lead the growth of a new venture. The composition items are as follows.

- Summary
- Product & services provided by the industry, firm
- Market analysis
- Economic viability of the business
- Design & development plan
- Production & operation plan
- Management team formation
- Overall management schedule
- Risks, and expected problems
- Financial management plan
- Suggestions from other firms etc.

Technology commercialization plan is a tool to plan for the important technology and develop commercialization opportunities, and is drawn up to propose the technology development direction to the inventor, develop conditions of alliance, and reduce uncertainty & risk. The composition items of the technology commercialization plan are as follows, and <Table 12> describes the details & examples of each item. Fill in the practice section of the table with your idea of the technology commercialization plan.

- Cover
- Summary
- Technology/product explanation
- Developer profile
- Market analysis
- Intellectual property status
- Technology/product evaluation
- Technology commercialization evaluation
- Technological strengths
- Potential partners & alliances

- Competitor analysis
- Selection details for commercialization
- Design & development
- Execution & management plan
- Financial plan

[Table 12] An example of a technology commercialization plan (1)

Item	Major details	Example	Practice
	Name of organization	NTTC	- Wine refrigerator - UV LED - Photocatalyst
	Name of plan/technology	SAR Imagery Compression	
	Personnel in charge	Mary Cook & Matthew Tulip	
	Aim	Commercialization of US patent No. 54225512	
Summary	- Concisely in point form - Summary of each stage of the plan - Describe core emphasis details	- A significantly smaller file than the current program & image storage software - Improvement of image compression technology - Complete appearance & wide spreading of digital information - Patented technology - Licensing/sale/alliance preparation	
Technology/product explanation	Technology name Current status of technology Originality of the technology Reference material Related technologies		
Developer profile	Industry experience Accomplishments Reputation	More than 15 years research experience in relevant fields Trusted & recognized by experts in relevant fields	
Market analysis	Customer functionality Technology usability Technology marketability Market size and growth potential Entrance barriers Geographical considerations	Communications/satellites (cable TV, HDTV, digital TV, internet) Medical (CT, X-ray, MRI) Other (movies, copiers, scanners, fax, camera, document records, virtual museums)	
Intellectual property status	Patent status Level of rights protection Victory probability in legal proceedings Licensing trends in the industry	US patent No. 54225512, registered in June, 1995 Strong patent Many licensing cases within the industry	
Technology/product Evaluation	Future profit flow Risk in relation to the profit flow Expected manufacturing & sales costs Valuation in the market Technical fee	Valued at %0.25 per unit Expected product value over \$10million	
Technology commercialization Evaluation	- Technological strengths, rights, competitive environment, market attractiveness, further developed technology, manufacturing capability, related laws & regulations, market formation period,	- High technological strength, high level of rights with the patent registration, competitive environment average as JPEG & MPEG have patent registrations, market attractive with demand for imagery in the digital community, low requirement for additional development as development is complete, as a zero marginal cost software	

	organizational demands, expected income	manufacturing ability high, low level of laws & regulations, currently mark preparation stage, low requirement for production organization, expected income high with an active licensing market.	
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[Table 13] An example of a technology commercialization plan (2)

Item	Major details	Example	Practice
	- Obstacles factors to commercialization solutions	Limitations of small companies, competition with existing technologies such as MPEG, JPEG etc.	
	- Decisive threats, problem points, assumptions		
Technological strengths	Customers, expected royalty	Wide applicability & target market Ease in technology distribution, royalty profit possibilities	
Potential partners & alliances	Key players/Partners Technological proposal for strategic alliance United alliance proposal	Licensing possibilities with firms involved in images or data processing such as AT&T, Motorola, Phillips, Xerox, Intel, IBM, Microsoft etc. compatibility, licensing, bundle sales, employment of experts, advertising	
Competitor analysis	Level of technology & product competitiveness Level of development competitiveness	Intense market competition Image quality & compression rates are important points of differentiation	
Selection details for commercialization	Company establishment Venture capital Packaging with other technologies		
Design & development	Product development aims Prototype cost calculation Product development plan & budget Equipment, facilities, labor capability costs Manufacturing capability		
Execution & management plan	Exclusive sub-organization Execution budget Management personnel Sponsor		
Financial plan	Investment income Balance sheet & cash flow Spot analysis		

Part 4: Technology Commercialization Systems

Major developed countries are revising the laws and systems for the commercialization of research results and operating support programs. By actively supporting commercialization related organizations, they are making progress with their national technology commercialization policies. <Table 14> shows the comparison of technology infrastructure policies & programs between major countries.

[Table 14] Technology infrastructure policies & programs of major countries

Country	Corporate networks & sub-structures	Corporation & programs
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	France	- Application and proliferation of research results through the promotion policy of contract research between industry & research centers	- Basic technology (electronic components, advanced materials etc.) centered proliferation - Education, training, human resource development programs
	England	- Strengthened cooperative systems between public & private sector, and research organizations - Usage of technology proliferation strategy through technology forecasts	- Connection of technology and education support - Diverse area centered plans - Maintenance of proliferation policy on special technology sectors
	USA	- Emphasis on public & private sector cooperation in technology development programs - Promotion of technology transfer from the federal research center	- Strengthened promotions of technology & businesses based on market principles - Establishment of technology support plans in line with corporate demand
	Germany	- Improvement of existing technology proliferation sub-organization (especially in the direction to promote corporate networks)	- Incorporation of competition between corporations & areas in special cooperation programs (technology development)
	Sweden	- Strengthened corporate networks - Improvement of P/PPs of government departments & industry	- Activation of research personnel exchange between universities and corporations - Promotion of experienced personnel exchange between industries/corporations
	Japan	- strengthened R&D cooperation between corporations (eg, joint research & joint research center operation between corporations)	- Integration of technology innovation policy & evaluation policy - Activation of university research personnel exchange
	Korea	- Strengthened technology mediation organizations - Construction of information infrastructure for small & medium businesses	- Implementation of example foreign technology proliferation cases (eg. AMT, technology center)

1. Overseas Technology Commercialization Systems

Major developed countries set the transfer and commercialization of research results from public research organizations as the first priority policy aim, and are actively conducting systematic commercialization through the incorporation of related legislation. Internet based technology information supply and technology transfer support for commercialization is being constructed centered on information networks. Especially, the US is leading this effort based on its well developed national information network. They have installed and are operating an exclusive facility for the promotion of commercialization, and the scope of activities include evaluation of the capability of the possessed technology, business feasibility, economic feasibility etc. showing that it is becoming very integrated. The support policy for the commercialization of research results is connected to the small & medium business support policy, so commercialization support in relation to small & medium businesses is very active. Especially, regional small & medium businesses can easily access a wide range of information utilizing the information technology, and there are also various financial support provisions through the existing small & medium business support system. In order to enable technology developers (research principals) and those in demand of technology (production principals) to promote the commercialization of research results through quick access, areas are divided and technology transfer centers are established in each area. In the universities and public research centers of major developed countries, parts of the royalty revenues that come with the commercialization of patented technology are provided as incentives to the researchers.

(1) Technology Commercialization Systems of the US

The feature of the US technology commercialization system is that the government initiated exclusive technology transfer organization is focusing on information distribution, and the evaluation of individual technology are conducted by the private sector, research centers, and individual

technology transfer centers within universities. The NTTC, RTTC, and FLC which are the major technology transfer organizations are cooperating with each other in terms of technology transfer information & activities.

On the other hand, DTI (Deltatech International), a private technology commercialization organization has about 100 partners in the major cities around the world and is conducting international scale technology commercialization based on a strong network of legal, finance, university etc. personnel. The feature of this program is that in stage 1, the commercialization plan is provided, in stage 2, plans are drawn up to strengthen competitiveness in the market, and in stage 3 technology commercialization is conducted. During technology commercialization, technology evaluation is simultaneously requested to universities and corporations.

(2) Technology Commercialization Systems of Europe

For England, BTG (British Technology Group) plays the role of the organization in charge of technology transfer commercialization on a national level. BTG was established in 1981 under the Department of Trade & Industry as a public corporation, and was privatized in 1991 listing on the stock exchange in 1995. The major activities conducted involve a comprehensive range of tasks including the supply of research funds for inventors, patent management, technology transfer contracts, technology transfer information distribution etc. and license revenues are being split 50:50 with the inventor.

In the case of Germany, Steinbeis Foundation is the representative technology commercialization organization. It was established in 1971 as a non-profit organization and transformed into a profit organization from 1982, and it currently possesses 450 technology transfer centers and 4000 specialists. It is connecting researchers to the industry in regards to the latest research results by constructing a worldwide network of 40 countries, and its major tasks include consulting services, R&D, education & training, evaluations etc. and in 2001 it recorded a turnover of 176million DM. In the Steinbeis Transfer Center of each area, individual projects are concentrated on, and the duties including accounting, management, & contracts are performed by Steinbeis GmbH (9% overhead cost). Especially, the maintenance decision of all transfer centers is based on strict business judgment, so it is a flexible structure with 13-15 centers being established every year and 5-10 centers closing down.

(3) Technology Commercialization System of Japan

AIST, National Institute of Advanced Industrial Science and Technology transformed 15 research centers including the Tsukuba Research Center, which were under the jurisdiction of the Department of Commerce & Industry, from national organizations to a public council. It has established and is operating AIST INNOVATIONS which transfer and commercializes technology and know-how possessed in-house. It is known that there were about 50 successful technology transfer cases in 2001 with technical fees of approximately 3million YEN per case.

On the other hand, the Technomart Business Division, Japan Industrial Location Center, is based on its origins from the incorporated association, Japan Technomart, which was established in 1985, and its aims are in technology commercialization & technology transfer under the support of the Department of Commerce & Industry. At present, as a business division of the incorporated association, Japan Industrial Location Center, it is being operated in a reduced form. The feature of the Japanese technology commercialization policy is that there is no active involvement by the technology commercialization & technology transfer organizations, and rather, the exhibition type technomart method is favored. The patent distribution advisors and technology transfer coordinators, who have been assigned the technology transfer & technology commercialization duties from the

government, are actively involved.

On the other hand, in accordance with the “university etc technology transfer promotion law (TLO bill) (1998)” enacted by the Department of Education and the Department of Commerce & Industry, to activate university-industry alliance based technology transfer & commercialization, 33 university TLOs (Technology Licensing Organization) approved by the Department of Education & Science and The Department of Economy & Industry are in operation. The royalty revenues gained by the TLOs amounted to approximately 400million YEN in 2002 which is insignificant compared to the US 2002 figure of \$1billion (120billion YEN), however, with the incorporation of national universities in April 2004 along with the encouraging atmosphere for utilization research, the proportion of their roles is on the rise.

2. Domestic Technology Commercialization Systems

(1) Technology commercialization policy

After the late '80s the external indicators of R&D investments grew immensely with the national industry technology budget increasing from \10billion in 1986 to \1trillion in 2003, but in terms of results, policy and effectiveness there has been no verification. Rather than focusing on how much has been injected, the current focus is on technology commercialization centered policy & systems to determine the results with the utilization in industry and the contribution to national wealth and employment creation.

Next, the technology commercialization policy basis of each ministry will be explained. The technology commercialization concept of the Ministry of Commerce, Industry & Energy is the commercialization of developed innovative technology (Dong-gyu Park), and is mainly concerned with strengthening industry & corporate competitiveness through production & marketing activities which is the commercialization in the latter stages of R&D of the entire technology commercialization process. Especially, the construction of commercialization infrastructure including industry support, venture start-up, quality, & standards, on/offline technology markets, technology evaluation etc. is the major area of interest, and with the enactment of the technology transfer promotion law in 1999 and through various technology commercialization initiatives and budget support, it is currently being recognized as the chief ministry in terms of technology commercialization policy within the government.

The technology commercialization concept of the Ministry of Science & Technology has its emphasis simply on the proliferation of researched & developed technology rather than economic commercialization (Jae-ho Hyeon & Jae-geon Oh). It is believed that this is because the role of the Ministry of Science & Technology is academically focused in relation to the support, management, and proliferation of fundamental research & application research, and the expansion effects of the developed technology from the R&D of government funded research organizations are embraced as the eventual policy aim of technology commercialization.

The Ministry of Information & Communication is concerned throughout the entire process from the proposal of R&D subjects to the technology commercialization of the research & development results. The reason for this is that the features of information & communication related technology have short life cycles and low dependence on industrial infrastructure such as equipment, factories, energy etc. and the technology incorporated products make up the major type.

On the other hand, the commercialization support operations of Korea include small & medium business technology support, research results proliferation operations, research center start-up support etc. There are many small & medium business technology support programs but the 'small

& medium business technology property rights concession program' is the most related. This program is to support the activation of small & medium business competitiveness & technology development through the commercialization of relevant technology by actively transferring the research results possessed by government funded research organizations, universities, national & private research organizations etc. to small & medium businesses. The support areas in relation to small & medium businesses through this program include property rights concessions & technical fee exemptions for technology possessed by research organizations, 80% government subsidization of technology support programs, loans for commercialization etc. And, in terms of tax assistance for research result commercialization, there is a system of exempting the taxes associated with technology transfer income. This is a system where the income taxes and company taxes resulting from the domestically developed technology transfer to nationals and foreigners are exempted.

The government is especially enabling small & medium businesses to solve technological obstacles onsite by the utilization of the area university technology development support, and constructing autonomous joint industry-university technology development systems, and for the regional IT universities to evolve into joint research centers for the small & medium businesses within the region, joint area industry-university technology development consortiums are being designated and supported.

Recently, to activate the regional technology market and to enable efficient commercialization of technologies from regional universities, research centers, and corporations, RTTC, Regional Technology Transfer Centers are being established in regional technoparks with a 5 year plan, and they are being cultivated as the strategic points of regional technology transfer.

(2) Technology commercialization related laws

In Korea, there are almost 40 individual laws relating to technology commercialization. Most of them consist of laws in relation to technology development, commercialization support, and individual corporation cultivation. In some cases, they are also briefly prescribed in laws on cultivation & support on particular industry areas, finance related laws, area cultivation related laws etc. <Table 15> shows the major details of promotion & support prescribed in individual laws.

[Table 15] Technology commercialization related laws for each government ministry

Related Ministry	Major related laws
Ministry of Science & Technology	Science & technology promotion law, technology development promotion law etc.
Ministry of Commerce, Industry, & Energy	Laws relating to industry development & formation of industry technology infrastructure, technology transfer promotion law, invention promotion law, government owned patent disposal, management regulations (presidential directive) etc.
Ministry of Information & Communication	Basic law on information promotion, software development promotion law etc.
Other Ministries	Support programs based on technology development related laws of each ministry

The Ministry of Commerce, Industry, & Energy governs the Laws relating to industry development & formation of industry technology infrastructure, technology transfer promotion law, invention promotion law, government owned patent disposal, management regulations (presidential directive) etc. The aim of the industry development law is to contribute to national economy development by promoting the advancement of the industry structure through devising increased industry competitiveness and balanced growth. The major contents of this law include plans containing industrial technology development, technology implementation, technology development results utilization etc. and by establishing annual industry infrastructure technology development programs, alliances will be formed and executed annually with national & private research organizations, technology research associations, specialized production technology research centers, universities,

government funded research organizations etc. and funding for these projects will be facilitated.

The law relating to industry technology infrastructure formation covers a very wide scope including the creation of technology infrastructure for the development of the technology, mining, energy industries, and it is the law enacted with the aim of assisting the national economy development by enacting required regulations for programs to support the contribution to the strengthening of the technology, mining, and energy industries. "Technology infrastructure formation" is widely defined as proliferating & promoting technology development & developed technology by improving & supplementing the personnel, information, and research facility infrastructure and environment to contribute to technology development activities in the technology field (industry, mining, and energy).

The technology transfer promotion law was pronounced in January 2000, and the major contents include establishment & operation of the Korea Technology Transfer Center, designation of technology transfer organizations & specialized technology evaluation organizations, establishment of exclusive technology transfer teams within public research organizations, cultivation of private technology transfer organizations & technology transfer businesses.

The Ministry of Science & Technology governs the science & technology promotion law, technology development promotion law etc. The science & technology promotion law prescribes the details relating to the strengthening of support systems for the establishment & execution of fundamental policies & comprehensive plans in relation to science & technology promotion by which it aims to contribute to economic & industrial development, and the major contents of this law include the establishment of fundamental policies & comprehensive plans for the promotion of science & technology including the promotion of developed technology utilization.

The technology development promotion law aims to contribute to the strengthening of international competitiveness of corporations and the development of the national economy by promoting self-development of industrial technology and the absorption & improvement of implemented technology with which the export of domestic technology is promoted, and regulates the financial support and partial tax exemptions on the improvement & commercialization of technology developments and implemented technology.

The Ministry of Information & Communication governs the basic law on information promotion, software development promotion law etc. The basic law on information promotion is aimed at improving people's lives and advancing the national economy by promoting information systemization, forming the information communication industry infrastructure, and realizing the advancement of the information communication infrastructure, and it includes the establishment of basic plans on information systemization promotion, technology development & utilization required to form the information communication industry infrastructure, execution of projects relating to technology alliance, technology guidance, and technology transfer, and required technical guidance, funding support, establishment & location support etc. for new technology commercialization in relation to superior information communication technologies by designating them as new superior technology.

The software development promotion law promotes software development & usage and by promoting the software industry, it aims to contribute to improving people's lives and steadily developing the national economy.

(3) Technology Commercialization Programs

Corporate technology commercialization programs per growth stage include new technology

incubating projects of the Ministry of Commerce, Industry, & Energy allocated for the incubation of technology for those about to commence business or are in the first year of business, technology innovation development program of Small & Medium Business Administration which supports the commercialization of short-term technology development of small & medium venture enterprises, industry infrastructure technology development program of Ministry of Commerce, Industry, & Energy which has the characteristics of the joint industry-university R&D, component materials development program which adopts a matching fund system connecting development capital & private investment etc. On the other hand, representative programs supporting technology transfer commercialization include technology transfer subsidies of Korea Technology Transfer Center, small & medium business transferred technology development program of the Small Business Corporation, patented technology transfer promotion program of the Invention Promotion Association, patent subsidies of the Korea Industrial Technology Association, technology transfer consortium support program, transferred technology R&D support program etc.

The technology transfer subsidy program is a system which subsidizes part of the technology implementation costs when the transferred technology obtained through government designated technology transfer organizations is to be commercialized, and it subsidizes up to 70% or \50million of the technology transfer contract deposit paid to the technology provider when the technology is transferred from research centers, universities, corporations etc.

The small & medium business transferred technology development program is a system where a part of the additional technology development funds required for the commercialization of technology transferred from domestic & overseas universities, research organizations, corporations etc. are subsidized, and it provides up to 75% or \100million of the total development cost for technologies that can be merchandized within a year.

The patented technology transfer promotion program is to promote superior patented technology transfer & patented technology commercialization by providing loans for a part of the funding required in the process of utilization/commercialization, development etc. of technology transferred from domestic & overseas universities, research organizations, corporations etc. and supports patented technology that can be merchandized within 3 years.

The patent cost support program is to subsidize patent costs for utilization promotion through accumulation prevention and private transfer of superior research results developed by universities, government funded research centers, national & private research organizations etc. The technology transfer consortium support program is to promote commercialization of public technology by supporting technology transfer activities and cultivating joint technology transfer organizations (consortiums) between government funded research centers, universities, and public research organizations etc.

The transferred technology R&D support program is to promote early commercialization public source technology developed by government funded research centers, universities, and non-profit private research entities etc. by supporting additional R&D of transferred public technology, and provides additionally required commercialization costs from the receipt of the public technology to the mass production stage.

Next, there is the technology guarantee system of the Korea Technology Credit Guarantee Fund. This is a system where the government funded Korea Technology Credit Guarantee Fund guarantees the technology possessed by the firm based on a technology evaluation enabling loans to be gained from banks without actual collateral. This is operated in Technology Credit Guarantee Fund branches and Technology Evaluation Centers nationwide.

The industrial technology development loan fund of the Ministry of Commerce, Industry, & Energy is a program where long-term low interest loans are provided to promote the localization of major capital goods and advanced technology products and supplement new technology. Although it has relatively good conditions with 3 to 5 year divided repayments, actual collateral is required so it presents some limitations.

(4) Technology commercialization funding

For individuals or firms to successfully conduct technology commercialization, it is necessary to obtain funding. Apart from self funding, other sources of funding include policy funds of government departments, loans from financial institutions, venture capital, and angel investment funds. Below is a concise explanation of policy funds & investment funds.

1) Policy funds of government departments

Policy funds of government departments are the financial resources formed and implemented through government financial policy and other methods in accordance with government policy needs. That is, they are funds provided at lower interest than standard financial institutions to businesses or businessmen requiring support based on the policies of the government or public organizations.

The types of policy funds include contributory funding and loan support funding depending on the type of assistance. Contributory funding is the policy funds provided from the government to the businessmen with no collateral, no guarantee, and no interest, and is mainly provided for new technology developments. After the completion of development a part of the government funded amount (30%) must be repaid divided over 3 years. These include the industry infrastructure technology development fund of the Ministry of Commerce, Industry, & Energy, information & communication R&D fund of the Ministry of Information & Communication, technology innovation development fund of the Small & Medium Business Administration. In comparison to these, loan funds are policy funds apart from contributory funding that require actual collateral or technology guarantees, and most of these are long-term low interest divided repayment loan funds.

2) Venture capital & angel investment funds

Venture capital (start-up investment firms, new technology financing firms) deal with advanced technology that have bright prospects, and is a financing method where comprehensive support including funding, management, technical assistance is provided to firms with weak capital and management capabilities from the early stages, and investment returns are collected after cultivating the company invested in.

If only the funding aspect is considered, venture capital can be seen as having similar characteristics as financial institutions like banks, but in terms of funding support it can be clearly distinguished from existing financial institutions. While the funding support type of standard financial institutions provides funding support in the form of a loan after securing adequate collateral and charges a predetermined interest, venture capital is funding in the form of unsecured share investments to ventures that have technology but are weak in terms of collateral, and when the venture grows & develops, return on investments are collected by the sale of shares.

These differences can be classified in terms of risk and returns, and if a specified interest is guaranteed to standard financial institutions while not bearing the risk of success & failure with adequate collateral, venture capital can obtain many times more in terms of return in accordance with the management results of the venture enterprise, but there are cases where no returns can be collected on the investment. As a result, even if capital or collateral is inadequate, if there is suitable technology and potential for growth, support can be gained from venture capital firms and not only

can they establish business but they can also obtain a high feeling of accomplishment.

[Table 16] A comparison between venture capital and standard financial institutions

Category	Investment Type	Collateral	Method of Return on Investment	Level of Returns	Risk
Venture capital	Investment	No	Sale of shares after listing	Large difference depending on management results	High
Standard financial institutions	Loan	Yes	Collection of the principal amount after the given period	Specified interest	Low

Investment methods include share investment, convertible bonds which has an option to covert into shares after a certain period, investment agreements which provide funding on agreement of fee payment conditions depending on management results such as sales, profits etc, capital loans which provide funding of short-term operation funds in each growth stage in a similar form as a bank loan with a specified interest, project investments which provide funding for the execution of a particular project through a contract and profits allocated accordingly like motion picture & music productions, technology developments etc.

[Figure 5] Venture capital investment acquisition procedure

- Business outline submission
- Consultation
- Preliminary examination
- Main assessment
- Investment contract
- Investment
- Management technology support
- Telephone
- Direct visitation
- Outline examination of planned business
- Main assessment decision
- Examination of management capability, business technology, management
- Investment assessment (Investment decision committee)
- Investment contract negotiation & contract signing
- Investment in accordance with contract details
- Financial, management, technology support to assist the growth of the firm after investment

Angel investment involves individual investors who appear like angels providing funds required in the early stages of company establishment. This involves the provision of required funding, management advice etc. for venture enterprises facing difficulties in raising funds after establishment, and the lead angel and support angel are the main constituents. The lead angel is usually in his 50s who has succeeded and retired as a manager and takes on a leading role in the support of the venture enterprise, and he/she possesses abundant capital, management experience, and technology evaluation ability, at times participating as a part-time director. The support angel is usually a person in a specialized field such as lawyers, accountants, consultants etc. who supports the entrepreneur with expert knowledge or an acquaintance of the venture enterprise. Indirect support is provided and at times private funds are also invested.

[Table 17] Comparison between angel investment & venture capital

Item	Venture Capital	Angel Investment
Investment stage	Later stages from establishment to share announcement preferred	Seed or early stage preferred
Investment motive	High profitability	High profitability, acquaintance, relations important
Support details	Funding support centered	Provision of funding & various expert know-how
Investment source	Formation of a fund by collecting investors	Personal assets
Qualification requisite	Existence of specified legal qualification requisites	No qualifications required
Level of acceptable risk	Relatively low	Relatively high
Investment profitability	Relatively low	Relatively high
Position of the investment receiver	No distance limitations	Short distance (within 160km) preferred
Release of identity	Open	Anonymity preferred
Meetings between the investor and receiver	Prior notification	High coincidence

(5) Technology commercialization organizations

Technology commercialization organizations in Korea include Korea Technology Transfer Center, KIST, KAIST, Institute of Information Technology Assessment, Electronics & Telecommunications Research Institute, Korea Institute of Industrial Technology, Korea Institute of Science & Technology Information, Small Business Corporation, Korea Invention Promotion Association.

On the other hand, government designated technology transfer organizations include national policy financial institutions such as The Korea Development Bank, and Korea Technology Credit Guarantee Fund, and technology transfer promotion organizations such as Korea Institute of Science & Technology Information, Korea Invention Promotion Association, Korea Health Industry Development Institute, and government funded research organizations such as Korea Institute of Energy Research, Korean Electronics Technology Institute, Korea Electronics & Telecommunications Research Institute, and private technology transfer companies such as Open Technology Consulting Co., Ltd., Bio Holdings Co., Ltd., P&IB Co., Ltd., Korea Bionetwork, Daeil Business Evaluation, and others such as Busan Technopark and the Institute for Advanced Engineering.

Government designated technology evaluation organization overlap with technology transfer organizations and include The Korea Development Bank, Korea Technology Credit Guarantee Fund, Korea Institute of Science & Technology Information, Korea Invention Promotion Association, Korea Health Industry Development Institute, Korea Technology Transfer Center, Korea Institute of Energy Research, Korea Electronics Technology Institute, Korea Electronics & Telecommunications Research Institute, as well as Korea Institute of Science & Technology, Korea Institute of Industrial Technology Evaluation & Training, Environmental Management Corporation, Agency for Technology & Standards etc. A point to note is that there are no private firms included as a technology evaluation organization.

Apart from these, there are 24 exclusive technology transfer organizations in operation including regional technoparks, university subsidiaries, technology transfer centers, regional public technology transfer consortiums, government funded research centers etc.

Of these, regional technoparks are raising future expectations as focal organizations for regional technology commercialization in line with the balanced regional development & regional decentralization trends, and in the case of university subsidiary technology transfer centers, with the recent activation of the Japanese University TLOs, technology transfer & commercialization

atmosphere is being formed in universities such as the establishment of the industry-university Cooperation foundation in Seoul National University, and is receiving attention as a major technology commercialization organization.

The regional public technology transfer consortium is a specialized technology commercialization organization consisting of research centers, universities, and alliances formed by a part of the technology transfer organization support program of the Ministry of Science & Technology to strengthen technology competitiveness of national industries, and its major duty involves the technology transfer & commercialization of technology owned by the consortium by constructing a cooperative system between local governments, the chamber of commerce and industry, and technoparks. There is the capital area public technology transfer consortium with Korea Institute of Science & Technology as the strategic organization, the Daedeok valley consortium with Korea Institute of Science & Technology as the strategic organization, the central area public technology transfer consortium with Korea Institute of Industrial Technology as the strategic organization, and the Yeongnam area public technology transfer consortium with the Research Institute of Industrial Science & Technology (Pohang) as the strategic organization.