

Paper No. 2:

**Bilateral Governmental Cooperation as an Initiative to the Technology Transfer:
Market Potential and Market Formation**

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Bilateral Governmental Cooperation as an Initiative to the Technology Transfer: Market Potential and Market Formation

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Abstract

The market potential is a necessary condition for the successful transfer in the field of climate change mitigation. But to overcome the various barriers related to the formation of new market through technology transfer process, the bilateral governmental cooperation is a useful scheme, which permits to satisfy the economic motivation of relevant actors. To promote this special scheme, an inventory of projects under the UNFCCC needs to be created. Another advantage of the bilateral governmental cooperation is the possibility to linkage to the CDM, which will give the additional incentive to the technology transfer projects.

1. Introduction

As the climate change issue demands some adaptations to the individual countries, the measures for the mitigation as well as the policy framework becomes an important factor. What is more, the international economic system needs to be adapted to the global environmental issues, and the climate change convention occupies one of the central themes in this tendency. In the one hand, the individual country needs his own economic growth and the economic stability, and in the other hand, we need some cooperative action to ensure the security of the global eco-system that can be affected severely by the global warming.

Technology transfer and technology cooperation is at the core of this conceptual conflict between individual motivation and global motivation: the competition in the market and the cooperation in the global action for the protection of the global ecosystem. As we are in the market economy system, we need to satisfy the individualized economic motif in order to satisfy the global aim. Everyone can easily accept that technological approach is no regret policy for the climate change mitigation, but sharing of technology is another part, as the technology capacity constitutes the major factor of national and individual competitiveness. The intellectual property right (IPR) guarantees the ownership of knowledge, technology and know-how in market competition system, as the global action needs cooperative action even in the technology fields (see Convention article 4.5). IPR is an important means to promote the innovation and development of new technologies in various fields and we fully understand that the profit rate is a fundamental factor in the market economy system, while the global action needs some non-commercial based cooperation.

Another factor that we should consider in understanding the technology transfer in the field of climate change is the distinction of the roles between public sector and the private entities. The Government can play a active role in international cooperation even through the profit is not sufficient in global action, while the private sector needs the minimum of economic benefit –

sometimes they need the maximum – for his own action. Here we find some contradiction between the stakeholders related to the global action for the climate change mitigation. How we can coordinate and harmonize between the benefits of global socio-economy system and individual actor? This is another element that makes the discussion and actions related to the technology transfer.

As a matter of fact, the transfer of technology is a relatively new concept in international cooperation, because the global necessity for the protection of environment is a recent concept, while the technological cooperation occurs in business fields everyday. The difference between the commercial based technology transfer and the non commercial based one can be understood in the role of market; where the market works, the commercial and conventional activities are sufficient to make the diffusion of “good” technologies efficiently, while the environmental solution often confronts the barrier of lack of market or “market failure” related to the “externality”. We know that too severe competition often lead to the monopolization of technology that leads to the monopoly profit in some narrow and specialized field and it is another negative aspect of the market. In a global context, the overall cooperation must overcome this monopolization of technology, as the competition is the most effective mechanism of promotion of technological innovation. Without profit motif, the innovation process is rather slow and often falls to the “technological lock-in”, while market itself creates another lock-in because of the lack of commercial profit necessary for the economic activities. In this regard, the role of market in technological diffusion should be understood in double sense. Without market, the technology transfer will stop in the demonstrative and pilot phase. Therefore, the market must be guided to meet the global needs for the mitigation of climate change.

Another fact that should be understood in technology transfer is that the technology is a kind of “learning process” and it is not a commodity like the other conventional goods in the market. Because the technology is related to the knowledge – sometimes the social knowledge -, the learning process should be implicated to the technology transfer, so the economic and technical condition for the receptor should be satisfied. In this regard, the local circumstance is more important factor in technology transfer than in the conventional international exchange of goods. The human factor and infrastructure play an important role in technology transfer that leads us to the necessity of “capacity building”. The formation of market is related not only to the development of economic activities but also to the development of social knowledge as the market also demands some additional social institution related to the “social knowledge”.

This paper focuses on the relation between the formation of market and the technology transfer in climate change mitigation. As the conventional and “commercial” technology transfer happens in most of the international exchange process, we will focus on the additional efforts related to the climate change convention. Between public sector policy and private activities, we will focus more on the public initiative as the role of government and that of private sector is rather a distinguished one, but we will maintain some balanced point of view between these two sectors. The understanding of the market is a fundamental factor in the paper as we will treat the situation where the market does not exist but the market potential exists which is the minimum guarantee of successful technology transfer process.

2. Government Initiated Cooperation: From Market Potential to the Market Formation

In business field, the technology transfer is not an objective in itself. Sometimes it is related to the globalization strategy of localization of production and sometimes the other objectives intervene in the technology transfer. In any case, the market plays an important role in commercial activities. If the market does not exist, then we cannot expect any conventional business activities in international cooperation, but most of the case, the climate change mitigation activities do not have their own markets, because the environmental problems often confront to the market failure. What we can expect in this situation is the distinction between the short-term strategy and the long-term strategy. The concept of “market potential” is based on this distinction. Even if the market does not exist, some additional policy measures and adequate institution can create a market sufficient to attract the business investment and the technological cooperation, when the market potential is sufficient.

If we return to the basic idea of article 4.5 of convention, we can find some solid foundations of technology cooperation which are issued in the process of rule negotiation related to the Kyoto Protocol: our technology transfer is an international cooperation between developed countries and developing and least-developed countries, not any other technology transfer in conventional sense. In general, the economy of developing countries and least-developed countries has more economic potential than that of the developed countries, which leads us to find the possibility of existence of market potential in these countries. As a matter of fact, the technology transfer cannot be understood isolated to the national and international socio-economic context and the local context should be fully studied in order to find the efficient technology transfer process.

In the Amsterdam study (FCCC/TP/1998/1), we have already classified the barriers related to the technology transfer from the financial and economic barriers to the institutional and cultural barriers. But if we study further these barriers, we get to know that the lack of market is the first common element of these barriers; when the market exists and that makes the successful technology transfer in commercial base, we can say that these barriers are already overcome even if the policy does not intervene. The formation of market is a kind of social and economic process of making the market potential into the real market and at the same time, the process of overcoming the existing barriers of various kinds.

We can classify various means to lead the market potential to the market formation. When the market potential is sufficiently large to attract the private investment for the long-term possibility, the private sector can be a first order actor for the formation of market including the technology transfer to the local firms externalized to the “mother corporation”. And another extreme case is the lack of market potential. In this case, the technology transfer cannot happen because the local situation does not permit the new technology be adopted to the receptor country. Between these two extremes, we can assume various situations related to the receptor’s condition of economic and technological factor. When the technological capacity of receptor country is sufficient, the direct cooperation can be a good measure, while the other case, the capacity building must be preceded. When the economic potential is sufficient to the receptor country, then the local government can play more active role by its local financial and economic policy measures. And the technology capacity of receptor is sufficient even if the financial capacity is not sufficient, then the multilateral cooperation framework can work successfully: the financial donor and technology provider. But any case, the situation where the market potential does not exist, the technology transfer cannot be a good option in climate change mitigation, because the receptor’s condition

does not permit the successful diffusion and commercialization of the provided technology. Any way, the technology transfer is a learning process and in this regard, the receptor's condition must be satisfied for the technology transfer that could implicate the mitigation activities.

2.1 Why government lead initiatives for the market formation?

The initial condition for the technology transfer is, in our sense, the existence of the minimum of market potential. The market potential can have various sources: local market, international market and some linked market that means the technology itself becomes the element of another market or sub-market.

If the initial condition is satisfied, then we need the concrete process that can lead the market potential into the real market. As the economic development is another big issue, we do not have the intention to be implicated in this issue, but the concept of sustainable development can offer us some important factors in the discussion of technology transfer. The lack of local market does not allow the economic actor to have adequate actions that can harmonize between the global need and the local economic necessity, and in this situation, the government can be a good focal point in initial development phase of local market.

2.2 Why bilateral government cooperation?

As the technology transfer occurs in various field with various mechanism, we must not limit the possibility of international diffusion of technologies for mitigation of climate change. But as we are more focused on the situation where the market does not exist, the most of conventional investment cannot work here. As the business sector is more interested in the real market instead of the "potential" market, we need some additional efforts that can help to pass the first phase of formation of market.

We can classify the actors related to the technology transfer: the provider of technology, the receptor of technology, and the financing source. Even if the market potential exists, to find the individual motivation of these related actors for the technology transfer and to harmonize their own interests are rather a difficult effort. Why do they provide the technology when the economic interest does not exist? Why do they receive the technology when the provided technology cannot be applied to their situation, as the local market does not exist? And why do they provide their financial sources in the technology transfer process? Even if the article 4.5 is based on the solid argument of mutual benefits, can this article be enough source to activate these various economic actors? That is why we need the bilateral governmental framework to satisfy the diversified actors in one activity: technology transfer. We know that the government can play a role only in the first phase of market formation, because the development of market needs enormous actors to intervene with their own roles. Thus at the first phase, the government can play rather an active role in setting the adequate institutional framework including the role of framework with relevant rule settings.

The multilateral framework like the APEC (Asian-Pacific Economic Cooperation) can provide a good source for the basic framework for the technology transfer. The Eco-tech program of APEC includes the cooperation of sustainable city, sustainable maritime, cleaner production and transition to the sustainable development. In the program of APEC, technologies related to climate change are treated as crosscutting issues, which intervene to the different programs.

Table 1: Joint activities for in Ecotech program of APEC (1996)

Capacity building	86	Trade and investment	5
Industry technology and science	41	Commerce promotion	13
SME	20	Conservation of marine resources	7
Energy	43	Fishery	12
Transportation	13	Agriculture	35
Telecommunication	26	Infrastructure	9
Tour	10	Total	320

At the same level, the IEA and the other multilateral cooperation framework are related to the technology transfer in climate change mitigation. But the institutional limit exists in these multilateral cooperation frameworks, because the harmonization of the interests of the various actors is difficult to be achieved in a multilateral framework. Different to the multilateral cooperation, the bilateral framework is more focused on the concrete field, as the degree of responsibility is higher here. In this regard, more concrete market oriented policy measure can be obtained in a bilateral framework.

2.3 The Interests of Actors in Technology Transfer and the Harmonization in Bilateral Framework

We will see the possible motivation of the main actors to be participated in the technology transfer process.

The provider of technology can expect the expansion of his or her activities in the other countries, especially in the developing countries whose economy has his own dynamics. Asian countries have a most dynamic economic zone in the world and their growth rate is largely superior to the world growth rate. In this regard, the local necessity for the more efficient technologies will grow faster than the other economic zone of the world, while the technology level is not yet sufficient to develop their own technologies in environmentally sound technologies. The initial condition for the market potential is satisfied in these Asian countries, even if they do not have a sufficient market to promote the international cooperation for the mitigation of climate change, including the technological cooperation. As the economic growth allows the economic capacity to invest in the environmental fields, the climate change related market can be formatted in this zone. At least, the private interest of business sector and the global necessity can be coordinated in the Asian zone, because the economic dynamics allows the fast expansion of the economic scale in various fields. The concrete decision of private sector in international investment is based on different sources and factors, so we cannot say the expansion of economy offers the sufficient condition for the technology transfer, but at least, it satisfies the necessary condition for the international cooperation. To satisfy the technology provider, we need more strategic and detailed point of view in the more complicated economic context. Here the initiative of governments plays an important role. They can provide the initial information with their own network and institutional infrastructure like the lobotomy, policy study team, international

coordinator, etc. As matter of fact, the government can provide an institutional signal to promote the international investment of private sector.

The interest of receptor of technology in the local market is more complicated as the technology needs more complex mechanism to be used in the real activities. First of all, the technology needs its own network – technology network – to be adopted in a concrete field. We often forget the fact that various technologies are linked each other and the application of technology needs minimum coordination in the technology level. This is more important in industrial process: the technology that can be applied to the production process must satisfy the technology level of already adopted technological elements. If a specific technology does not satisfy the integrality of the existing production system, then the technology cannot be adopted even if the technology level is largely superior to the existing one. In technology economics, this phenomenon is called as the “lock-in” which means the better technology cannot be adopted because of the existing network. This kind of problem happens often in the cleaner production for the environmentally friendly production. The end-of-pipe system is rather a simple one, because it does not affect the production process, and it is related to the pollution materials directly rather than the internal process of production. As the end-of-pipe technology can be easily separated from the other elements of production, it can be transferred in simpler manner than the cleaner production technologies. For example, the end-of-pipe system of SO_x and NO_x can be good elements of the technology transfer. For these technologies, the main factor is the economic critical point related to the benefit-cost analysis of given technologies. But technologies related the mitigation of climate change are more complicated than the normal end-of-pipe technologies, because the CO₂ does not allow the end-of-pipe treatment like other pollutions that affect the environment. What we need to here is cleaner production technologies that helps to reduce the emission of greenhouse gas in the production process, which makes the technological network more important in the technology transfer. For example, the reduction of energy consumption in the production can be a good measure in the greenhouse gas reduction, but this is rather a complicated one to find “good” technologies that can be adapted to the existing system. Here the technology level and the operation cost are two major elements that must be considered in the first order.

The technology level of receptor country is the most important factor that makes the technology transfer difficult. If the provided technology is too complicated to function with the other elements of production, then this technology cannot create the successful technology transfer case. What is more important is not the “best” technology, but the ‘fittest’ technology to the local circumstance and the situation. The network plays the similar role in other field to the industrial sector. Even for the renewable energy or the biomass, the provided technology must satisfy the network and the norm of the local market. The “path dependency” is one of the major factors that should be considered in selecting the technologies that can be transferred in the light of existing technological – and social – network that works as an integrative system, even if it is not optimal. Different to the economic factor, the technological factor should follow the norm of “fittest” instead of economic optimum. This problem often happens even in the commercial based technology transfer in various fields. The best technology of developed countries often causes the mal-function of local production process, as the system is not convertible. Here we find again the argument of learning process. When one technology is adopted to the another site of developing countries, an innovation must intervene to satisfy the local conditions; not just the learning of the

knowledge of the others is needed but also his own creation of knowledge is needed to satisfy the integrality of existing system given the new element of provided technology.

Given this complexity of provided technology in the local context, the interest of the receptor of technology is rather diversified. After all, we can summarize these problems as the technological barriers to the technology transfer, which are difficult to be separated from the other elements of economic activities, especially in the industrial field. Any way, the technology transfer can help to reduce the R&D cost and in this sense, the new market can be established more easily, because the initial cost related to the technology is very high. Here we find again the conflicts between the national interest and the individual interests in the local market. As the new market that can be initiated by the governmental intervention and the technology transfer help the sustainable development of developing countries and least-developed countries, the country as a whole has the interest in participating the technology transfer process. On the contrary, it is not easy to find the direct interest of the receptors of the technology in the local market, because of the lack of information, financial resource, and the long-run strategy related to their own activity. This kind of conflict often creates a situation where the position of governments and the interest of local firms do not coincide, and sometimes even they are contradictory in regard to the formation of new market. In this situation, the role of government is very important.

The first role of government is to make a decision related to the formation of new market, because the local economic condition does not allow it. This policy-oriented decision is rather an institutional one, and it can be an effective solution where the market economy is different from the market economy of developed countries. Any way, the governmental signal can attract the investment of the local firms who will be the main actor of the technology transfer and at the same time reduce the risk and uncertainty of the market which is not yet well established. Even if the intervention of local government does not automatically guarantee the successful formation of local market, it helps to reduce significantly the uncertainty of new market, because the policy measure is another kind of institution that can be effective in the lack of market.

The intervention of local government offers the more possibility to the international investor related to the technology transfer, although the new market in the developing countries has still so much uncertainties. But for the international investor or the donor of the financial resource, the participation of the local government can be a good means to ensure the minimum guarantee of successful operation of the technology transfer. In this regard, the bilateral governmental cooperation is a good framework to ensure the operation of technology transfer to create a new market and to attract the international investment and participation to the projects with the governmental assurance to be succeeded in the project.

After all, the governmental cooperation can be a good means to create a new market when market potential is sufficient, because each government can have a motivation to participate in the technology transfer with the economic actors in their countries. We can not say that the existence of the market potential is a sufficient condition to make all these technology transfer operations successfully, but it can be an effective means when the local market does not exist.

If additional incentives can intervene in this condition, it can help to promote this kind of operation in the developing countries and the least developed countries.

3. Bilateral Governmental Cooperation in Technology Transfer : The Case of Korea

3.1 Introduction

We have seen that the governmental cooperation in technology transfer can be an effective means to create a new market, when the local market does not exist although the market potential is sufficient. The Republic of Korea is a country who satisfies this condition, even if this country can be classified as a leading developing country. As a matter of fact, Korea does not dispose of enough technologies to create its own market in the field of climate change mitigation, because these technologies need more advanced capacity than the commercial production. In addition, the economic size of Korea does not offer the possibility to have the market enough for the R&D of climate change technologies. However, if we find the adequate provider of technology, then as we can expect the diminution of the R&D cost, the Korean local market can offer the potentiality sufficient for the commercialization, even if it is rather limited compared to the global market. This case can be generalized in most of the developing countries, because the initial cost related to the development of new technology is the first barrier in the commercialization and the creation of the new market in the outside of the developed countries. In order to understand this special operation – half commercialized and half non commercialized – related to the technology transfer of environmentally sound technologies, especially that of climate change mitigation, we must consider the fact that market itself has not capacity to be self-organized, when the reduction of emission of greenhouse gas in the developing countries does not offer any economic incentive or economic motivation in itself. That's why the bilateral governmental cooperation can be an economic incentive in reducing the cost, the risk, the uncertainty and finally the possibility of new market.

In section 3, we will examine the case of TCAPP-Korea, which is working in Korea to create a new market related to the change mitigation. TCAPP is bilateral governmental cooperation for the international technological cooperation in the framework of UNFCCC. The analysis of Korean experience can offer some concrete ideas and elements to understand the effective measures for the technology transfer.

3.2 TCAPP Program of US

The Technology Cooperation Agreement Pilot Project (TCAPP) is designed to help developing countries design and implement the action to attract in clean energy technologies that will meet their economic development goals, while it mitigates greenhouse gas emissions. TCAPP is currently facilitating voluntary partnerships between the United States and the governments of Brazil, China, Egypt, Kazakhstan, Mexico, the Philippines, the private sector, and the donor community on a common set of actions that will advance implementation of clean energy technologies. This program is designed by the initiation of US government like DOE (Department of Energy) with the experts of US public sectors and the business fields.

The goal of the TCAPP can be summarized as follows:

- Foster private investment in clean energy technologies that meet development needs and reduce greenhouse gas emission
- Engage host country and international donor support for actions to build sustainable

- markets for clean energy technologies
- Establish a model for international technology transfer under the UNFCCC.

TCAPP satisfies the framework we have proposed and we can understand it as a bilateral governmental cooperation. TCAPP has its own principles related to the technology cooperation and the elements for the successful operation of technology transfer process. We will see the principles proposed (NREL, “The Technology Cooperation Pilot Project”, Oct. 1999).

a. Technology cooperation must be country driven.

Cooperation priorities on the technology for mitigating climate change should be selected based on the potential benefits to the country as well as the potential GHG emission reductions. Countries should also build on existing programs and institutional roles, as well as previous climate change studies, national communications, or action plans.

b. Large-scale technology transfer can best be achieved through a sustained, coordinated, and strategic set of actions to harness private sector action in sustainable markets for clean energy technology.

The most important role for government is to enable private sector activity, since commercial markets are the primary vehicles for technology transfer.

c. Successful technology cooperation requires collaborations at many different levels.

This includes host country governmental agencies, businesses, nongovernmental organizations (NGOs), and technical experts working together to select priorities and design and implement actions. Country team needs to collaborate with technical experts from the developed country, international business investors, and international donors to secure the international investment and technical support necessary for effective implementation of technology cooperation actions.

And finally, TCAPP offers four elements as the step necessary for the successful technological cooperation:

- 1) country-driven process for selecting priorities
- 2) international coordination and technical support
- 3) business participation
- 4) donor participation.

As the TCAPP remains still at the preliminary phase, we can not have the economic and technical assessment based on the results of the operation, but we have some cases already on working, we will see briefly how this program works in Korea.

3.3 TCAPP-Korea

Korea joined TCAPP in January 1999. The Ministry of Commerce, Industry and Energy (MOCIE) of the Republic of Korea designated Korea Energy Management Corporation (KEMCO) to lead the implementation of technical TCAPP activities for Korea. NREL (National Renewable Energy Laboratory) of the United States is the leading implementation body of the TCAPP work in Korea for the U.S., in partnership with the U.S. Environmental Protection Agency (EPA), the United States Asia-Environmental Partnership (US-AEP), the U.S. Agency

for International Development, and the U.S. Department of Energy.

In July 1999, KEMCO and NREL signed the Memorandum of Understanding (MOU) to implement TCAPP-Korea. KEMCO intends to provide appropriate Korean expertise to collaborate with NREL and other U.S. experts in achieving the objectives of this agreement. The role of NREL is to provide technical support and guidance to KEMCO for the implementation of the project, particularly focusing on involvement of the international private sector.

The purpose of this project is to find opportunities for international cooperation to accelerate investment in clean energy technologies which will address development needs and reduce greenhouse gas emissions in Korea.

3.4. Process for establishing priority technologies for Korea

Since 1988, the Korean government has supported the R&D activities of energy technologies in the field of energy conservation, alternative energy, and clean energy technology. The government is also actively promoting the demonstration and dissemination of R&D results for commercialization. Despite these efforts, there are numerous barriers such as low competitiveness, lack of funds availability, low level of technology and inefficient institutional systems. To overcome these barriers, Korea established 10-year energy technology development plan in 1997 and has entered the stage of implementation.

The general approach of TCAPP is to (1) identify the priority of energy technologies which supports the sustainable development priorities and simultaneously reduces greenhouse gases, and to (2) identify the barriers to apply and disseminate those technologies and design actions to overcome these barriers.

Korean experience in the field of clean energy technology development and dissemination shows that the barriers of technologies with high GHG mitigation potential are not only complex to be defined clearly but difficult to remove. In addition it is not the public sector but private companies that actually exchange clean energy technologies and know-how. It would be very difficult to garner active participation of private companies that are not confident in their real benefit from this project on the basis that the project will have significant GHG reduction potential or on the possibility of making considerable contribution to sustainable development of the national economy.

TCAPP-Korea should try to establish successful examples and operating mechanisms so that private companies that wish to exchange technology can voluntarily come to KEMCO and NREL for assistance instead of making most of the effort to compile lists of technologies for cooperation.

Therefore we are to select priority technologies foremost on the feasibility of the actual execution of the new cooperation project. That is, we are to propose international cooperation project related to removing rather simple and clear barriers at first and to enlarge the scope incrementally as our technology cooperation capacity builds up.

To select the priority technologies, KEMCO utilized the experience of planning and implementing the 10-year Energy Technology Development Plan and held a scope meeting in March 1999 to consult the interagency steering committee of TCAPP-Korea. Technology Research Committees established for 20 priority energy technologies selected during the development of the 10-year Energy Technology Development Plan acts as an advisory group, providing additional technical support to facilitate this endeavor.

The four Criteria of TCAPP-Korea for the selection of priority technologies are as follows:

- 1) The technology must be near to Market (Market potential) : The technology near to commercialization (pre-commercialization stage, *pre-standardization stage*)
- 2) The application of technology needs some intervention by public institutions : public oriented technology
- 3) TCAPP Korea must succeed in creating a demonstration case : Trigger-effect to create a new market with advanced technologies
- 4) Given the various barriers related to technology transfers, TCAPP-Korea, as a means to conduct meaningful cooperation and welcome the “know-how” of soft technologies such as energy management system. There are many cases in which new facilities for energy efficiency already introduced but they seldom reach the designed operational efficiencies due to incomplete transfer of technical and managerial skills. We are interested in the ‘software’ that means scientific and engineering knowledge as well as managerial and operational skills.

3 priority technologies were selected under the criteria for the development of cooperation framework regarding barriers, GHG mitigation potential and market potential study: energy management (including advanced energy auditing and ESCOs), methane recovery from organic wastes and waste energy recovery using heat pumps.

3.5. Activities in each of the priority technology areas

Regarding energy management, TCAPP-Korea WG1 was comprised in June 1999 to find the opportunity of international cooperation. Three ESCO companies and three KEMCO staffs participated in the working group and prepared the concept paper that contains needs for cooperation, GHG reduction potential and market opportunity, barriers and possible actions to address them, and the scope of the cooperative activities.

Joint meeting, energy auditor exchange, and three joint projects were suggested in the concept paper. The expected role of each participating organization is as follows: Korean ESCOs find out and coordinate prospective cooperation projects. Foreign ESCOs provide technological support and search for international funding sources in cooperation with NREL. KEMCO provides co-financing in consultation with the government. NREL and KEMCO facilitate communication between private companies and try to get supporting funding from U.S. AEP (Asia Environmental Partnership) and other sources. If the result of energy auditing is favorable and funding sources are arranged, ESCOs of both countries implement the joint project.

KEMCO sent the concept paper to NREL and NREL distributed it initially to 10 companies seeking their responses and comments.

3.6. Future plans

If NREL and KEMCO receive favorable responses from international business community on the concept paper of TCAPP-Korea WG1, joint meeting was held in Seoul in September 1999 for detailed discussion on the joint projects and the exchange program.

Regarding methane recovery from organic waste and waste heat recovery using heat pumps, KEMCO is using similar methodology as for the WG1. KEMCO is asking guidance of the Technology Research Committee and other experts about their experiences and opinions on the needs for international cooperation in each technology area. In cooperation with the experts, KEMCO will prepare a concept paper and distribute it to international business community through NREL.

In the end of 1999, KEMCO summarizes the activities and the concept paper of each technology area to prepare the technology cooperation framework and the work plan for further cooperation.

As TCAPP-Korea is in its initial stage of implementation, it is not easy for us to tell whether TCAPP is a good model for technology cooperation.

We are to underline the flexibility to succeed in TCAPP projects. Between the Phase I and Phase II, we can put various steps, which depend on the concrete circumstances of each country and each technology. Each project and each technology could have its own form and characteristics of cooperation. So we must design the specific form for each project. Each project should be designed in most effective approach possible to satisfy its own characteristics. The example is a demonstration case, a workshop, exchange of information and international partnership, etc.

3.7 Lessons Learned in TCAPP-Korea

TCAPP-Korea is based on mutual cooperation of each business sector with the participation of business sectors, so called the "partners". Even if the action for the mitigation of climate change does not have adequate market in the developing and the least developed countries, we can find some additional benefits through the technology transfer like energy efficiency projects.

The Korea has focused on the creation of new market and the ESCO is a typical case whose market has just begun in Korea. In Korea, the auditing skill and the management scheme related to the ESCO activities are still insufficient and co-auditing can help to enhance the technology level of new market. This new input can help to create a new market, because the activities of Korean ESCOs are limited to buildings and some isolated components like green lights, clean motors and industrial burner, etc. The auditing and energy saving projects in industrial fields are a recently

new market and in this field, the local actors do not have enough technologies or the accumulated experiences, which are essential in soft industries like ESCOs.

This field can offer the opportunity not only to the local actors but also to the US business sectors, because the partnership made by the governmental cooperation framework allows the foreign firms to participate in the Korean emerging market of ESCOs. With some strategic consideration of the Asian market of ESCO, this field can attract many financial donors and technology providers with their own experiences. Any way, the Korean ESCO satisfies the basic condition for the successful technology transfer. What we must remind here is that the governmental cooperation is not limited in public exchange process of governmental level, but it must implicated the private partners, because the formation of the market is the key factor that ensures the successful operation of technology transfer.

4. Mechanism Analysis for Technology Transfer for the UNFCCC

The article 4.5 of Convention is based on the solid argument and good sprit for the future, but not on the solid economic base, because the technology is now at the core of international competition. With the globalization of last few years, the technology plays a major role of competitiveness factor more and more, so the sharing of technology or technology related information is tend to be based on the commercial interest and the strategic decision of each economic actor. In this regard, to make an active participation of private sector in the technology transfer is the key factor for the effective international efforts for the diffusion of advanced technologies. It is sure that technology in itself does not offer any additional effect to the mitigation of climate change, because it is effective when related to the specific activities like production, consumption or the activities related directly or indirectly to the emission of greenhouse gas. How can we satisfy the private economic actors who need economic profit to participate in the technology transfer and the global necessity for the protection of the earth from the global warming? We can find the answer of this question from the formation of new market through the technology transfer and the governmental cooperation is one effective means to achieve this goal. The governmental cooperation is not the only measure that can make work the technology transfer: the CDM (Clean Development Mechanism) can be a good means for the new technology to the host country; the conventional FDI (Foreign Direct Investment) is another mean to deliver the technology to the host of the foreign investment; and finally, we can count on the international licensing or franchising that is based on the commercial exchange process of technology. But, if we understand the economic difficulties of the developing and the least developed countries, this commercial based and conventional process of technology transfer are not sufficient to promote the environmentally sound technology in the economically restrained market of greenhouse gas reduction.

Here we find the necessity of intervention of the third actor like international institution. If we can find a mechanism related to the technology transfer, it can help to promote the environmentally sound technology in non annex-I Parties and it will help to mitigate the climate change in a cost-effective way.

4.1 Promotion of Bilateral Governmental Cooperation by Official Listing-Up

Bilateral cooperation and multilateral cooperation in technology transfer are two different

frameworks to make an governmental cooperation. These two share basically the same idea that governments can be helpful in sharing the technology in mutually beneficial ways. The bilateral cooperation can be effective in coordinating the different interests of the economic actors of each country. On the contrary, the multilateral cooperation can be an effective means to make a project in a very uncertain field, because the risk and the responsibility can be shared to the various member countries. In reality, the bilateral framework can be more efficacy manner, because the implication of responsible actor is easier in this case. What is more, if we can design some special mechanisms for the incentive related to the technology transfer, then the bilateral one is more practical, because the identification of a contributor is simpler in bilateral framework.

As the negotiation of the rules related to the Kyoto Protocol approaches to the final time, the importance of technology transfer becomes more sensitive one, because the Convention is changing the world with some real effects in business world and in policy framework. In this regard, we need to find more effective means to ensure the compliance of each countries, including the efforts of non annex-I Parties to reduce the greenhouse gas.

At the first instance, the lack of information of existing various programs related to the technology transfer must be overcome to promote the technology transfer. Many programs aim to build the basic capacity through exchange programs, education centers, and aids for the foundation of local focal points like institution or laboratory. But to ensure the successful settlement of the provided or shared technologies, the main program of technology transfer should aim at the formation of market, even if the market potential does not exist in a local country. Many cases show us that the technology transfer in the developing and the least developed countries ends in a pilot project to test the new facilities or new components. If this operation is not related to the creation of new market, the operation of technology transfer can not have durable effects, because the local circumstances cannot absorb new or “too advanced” technologies. In other word, the technology that will be transferred should be selected in a strict manner with some special considerations of the state of the local market, technology level and the industrial structure. In any case, the market formation must overcome many explicit and implicit barriers that can not be easily identified.

If we propose some special schemes for the promotion of the technology transfer, then the first element is the listing-up of bilateral governmental programs. This listing-up will help the non Annex-I parties to refer when they plan for the new projects related to the climate change related activities. And we will need some additional information related to the possibility of creation of new market. Some programs will aim to the capacity building and the other programs will aim more directly to the commercial sector, private sector or some potential building activities like installation of facilities. What is important in bilateral cooperation is the local market oriented “design” of the program preceded by the market study of the local experts supported by the provider’s guidance. We need to select the field that has market potential and carefully design to create a new market in the receptor country.

The listing-up can also help the developed countries, because the well-designed program can help their partners of the developing and the least developed countries. Sometimes, the good programs are difficult to find the good partners, because in many cases if the market is still remained small, the economic actors are still SME. Therefore, they do not have enough information of the activities and partners outside their countries. In this case, the listing-up of the

international framework like UNFCCC can enhance significantly the information level for the actors in a small market. If a small firm is interested in a specific technology that can be effective in its local market, then their government can be a good agent to link the activities to the developed countries. As a provider of technology participates in this process not just as merely a provider of technology but also a “partner” in the creation of new market, he or she can take his or her advantage in technology transfer. Once more, the participation of each government reduces significantly the risk of the project. For example, if the institutional barrier or juridical barrier exists in the local country, then the local government can take some measures for the creation of new market. The official engagement of the government can be a minimum of guarantee, not maximum, to overcome these kinds of barriers related to the technology transfer and formation of new markets.

Finally, this listing-up can help the international investors to find out the potential operations of technology transfer. Well-structured listing-up information provides not only the state of various programs, but also the possibility of new market that can be very profitable. Here once again the participation of each government helps to reduce the uncertainty of the projects.

4.2 Do we need additional incentives for the bilateral governmental cooperation?

As we have seen, the bilateral cooperation of technology transfer can be a very effective mean not just in non commercial based activities, but also in the business field. What is more important here is that the successful market formation satisfies most of the economic actors involved. In this sense, the formation of new market through technology transfer is a kind of “win-win game” where there are no losers. It is win-win game in double sense: the provider and the receptor obtain the economic benefits by the new market; and the economic development and the conservation of the environment can be harmonized.

But we need to pay more attention to the hypothesis that we have used to design this operation: the formation of the new market. If this operation can not arrive to convert the “virtual” market into real market, the actors do not have the means to satisfy their economic motif, and as we know well, there are so many difficulties and barriers in the creation of new market, considering the risks and uncertainties of commercialization of technologies. And when the providers consider their partners as a potential competitor in the global market, even in the local market, the technology transfer cannot arrive to the successful cooperation. That means the items related to the highly competitive market in the global economy is difficult to be transferred (publicly owned technology or public-supported technology can be transferred between governmental sectors as they are not directly related to the business sector).

Considering the risk related to the new market and the costs that are necessary in the technology transfer, we expect some additional incentives to compensate this risk. But, the economic and environmental effects of the technology are very difficult to be assessed, and this incentive will raise many unpredictable complication of the process. In this regard, it is difficult to design a special incentive scheme for the technology transfer.

Even if the direct incentive design is difficult to be established in the international framework, we can rely on the other scheme like CDM. The linkage between the CDM and the technology

transfer is a little bit delicate, as these two are based on the “additionality” as well as the business oriented fields. If the direct linkage between CDM and the technology transfer are difficult to be made, the bilateral governmental cooperation can be compensated in the framework of CDM, because the bilateral framework permits us to identify the provider and the receptor, like investor and host in CDM, and the total effect of emission reduction can be more easily assessed with the formation of the new market through technology transfer.

In this sense, if the designer of the technology transfer in bilateral governmental cooperation would like to insert some additional incentives to the related actors of the process, then we can design this process as a kind of CDM, in which the CER (Certified Emission Reduction) are offered as an incentive to the climate change mitigation action. We should remind that there are basic differences between the CDM and the technology transfer, but at least in the framework bilateral governmental cooperation, these two different operations can share the same incentive scheme that is based on the reduction effect of greenhouse gas.

In order to convert the technology transfer operation into CDM, we will need some additional rule for the change into CDM, because the indirect effect related to the market formation is difficult to be identified and to be assessed in correct manner. But the formation of new market already offered the business opportunity to the related actors and the incentive to compensate the minimum risk of the project will be sufficient. Thus, the incentive for the direct effect of the reduction will be a good scheme for the economic actors involved.

4.3 Hard Innovation and Soft Innovation: A Recommendation for the Bilateral Governmental Framework

As we have seen in the precedent sections, the bilateral governmental cooperation aims to build a new market in the developing and the least developed countries where the market itself can not lead the technological innovation, even if the market potential exists in various way. In this regard, the technology that will be provided should be selected in a very careful manner for the successful operation of the transfer process. In this regard, the good technology for the local country is not the best one but the fittest one to the technology level, management skill and the industrial structure.

The technologies can be classified in various categories, but we will classify them into “hard technologies” and “soft technologies”. The hard technology is based on the material, physical and scientific innovation, while the soft technology can be comprehended as the knowledge related to the management, operation skill and the other social knowledge, which is essential to the successful operation of specified facility. In general, the skillful labor is difficult to be found in the developing and the least developed countries, and in this sense, the soft technology is also a very important factor to be transferred as well as the hard technology.

If we understand the technology transfer as the learning process, as the commercialization of this new element, then the transfer process must be composed of the series of learning process, which will eventually make a series of innovation, especially the soft innovation. After all, the soft innovation is a key factor that helps the successful stabilization of the technology offered from exterior agent. The measure related to the soft innovation is classified into two categories: 1) direct transfer of know-how and “tacit knowledge” through exchange program or training center,

etc; 2) indirect measure through the project, where the related experts co-work and share their tacit and uncodified knowledge and know-how. The governmental programs can assist the first category of soft innovation, because the individual actors do not have the sufficient capacity and the related infrastructure for this kind of activities. Sometimes the government can support this process by linking it to the international framework related to the exchange programs. The second category, which we can call “implicit soft innovation”, can be fulfilled by the business actors themselves, because the successful cooperative project offers many chances for the various soft innovation by overcoming many unexpected barriers of the project.

After all, the technology transfer for the formation of new market should be designed with very careful manner, and most of all, the importance of the soft technology should not be ignored, because in general cases, the receptor in the developing and the least developed countries do not have it. We should remind the fact that the technology has also social and contextual basis as a network system, and the transfer to the foreign country who does not share the same basis of socio-economic factors should be accompanied by many unassessed soft innovation. And the participation of the government and the active roles of the related actors can offer the minimum basis to satisfy this condition, which we can expect only in the bilateral governmental cooperation framework.

5. Conclusion

We have seen that the bilateral governmental framework is a helpful scheme to make a successful operation of the technology transfer for the climate change mitigation in formation of new market in the developing and the least developed countries. It is not the only possible process for the technology transfer, but it is very effective scheme that can help to overcome many local and global barriers for the international diffusion of “good” technologies in a cost-effective manner.

And the bilateral framework gives the possibility to link to the CDM, as the identification of the contributors to the project can be made easier manner in bilateral framework.

We do not think that the technology can be transferred to the other countries without adequate cost and sufficient investment, but the possibility of the new market offers the basic economic incentives to the related actors. What the Convention can offer to each government and each actor to promote these kinds of operations are as follows:

1. listing-up of these programs;
2. international linkage of relevant actors like financial donor and other international exchange programs, etc;
3. rule harmonization of the CDM for the additional incentive schemes of the technology transfer.

The further discussion will be needed as well as the further governmental and private actors to promote the cooperation schemes in this field.