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Technology Transfer under Multilateral Environmental Agreements: Analyzing the Synergies

Zainal Abidin Sanusi

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Abstract

The development, transfer, adaptation and diffusion of technology and the building of related capacity is crucial for achieving sustainable development. However, technology and the transfer process itself have evolved from linear to dialectical which imply additional layer of constraint and challenges. Environmental technology, in the same development pattern, has shifted from mere environmental concern to higher stage where environmental performance consideration will be fully integrated with economic, social and other operational issues.

These developments reinforced by economic liberalization and increasing concern for sustainable development forced the established governance or actors to presume new role. The multilateral agreement which previously mitigated and facilitated the process are now weakened as seen through their reactive approach rather than proactive. Their linear styles are no longer suitable for present dialectical technology development. These incompatibilities between technology transfer and its governance are becoming more revealing that a necessary solution is urgently needed. This research is an attempt to contribute to the search for such solution by investigating into the synergies between MEAs and the elements of enabling environment necessary for facilitating, promoting and enhancing the technology transfer for sustainable development.

The findings suggest that MEAs with different area of technology focus, may vary in some aspect of implementation but there are common elements necessary for all MEAs to facilitate and enhance TT for sustainable development. These elements are; funding mechanism, interaction/coordination mechanism, capacity building mechanism, information/network management mechanisms and technology transfer modalities. The concept of enabling environment applied in the research is analyzed differently from the context of enabling environment as commonly perceived in international environmental agreements. The difference is to be highlighted through discussion on enabling environments as also largely determined by MEAs rather than a host country's responsibilities. Thus, justifies the significant roles that MEAs can play by providing and supporting the creation of the enabling environments.

TT under MEAs is naturally a broad and complex underdeveloped research area. To avoid any misrepresentation of reality, a comparative analysis of the development and progress across major MEAs is hoped to provide a more accurate perspective and enrich body of knowledge on the subjects.

Abbreviation

CBD - Convention for Biological Diversity

EST – Environmentally Sound Technology

GEF – Global Environmental Facilities

ICCTT – International Code of Conduct of Technology Transfer

IPCC – Intergovernmental Panel on Climate Change

ITPGRFA – International Treat on Plant Genetic Resource fro Food and Agriculture

UNCCD – United Nation Convention to Combat Desertification

UNFCCC – United Nation Framework Convention on Climate Change

UNCED – United Nations Conference on Environment and Development

SBSTTA – Subsidiary Body on Scientific, Technical and Technological Advice

1. Introduction

Technology transfer (TT) is one of the key "means of implementation" of international process for sustainable development. The technology transferred can function as a positive measure to achieve the objectives of multilateral environmental agreements. TT is solidly rooted in Agenda 21 of UNCED and considered indispensable for making progress in implementing recommendations. As such most major MEAs all contains significant clause dealing with technology transfer. The Report of the Secretary General for the preparatory process of World Summit on Sustainable Development, Implementing Agenda 21 for example, identifies technology transfer as one of the ten key areas in which progress is needed. But the same report also noted that since the Rio summit the progress in addressing the constraints to transfer environmentally sound technology has not been very encouraging (UN 2002). Various studies have been conducted in searching for the explanation. At least there are two major factors suggested as primary reasons; ineffectiveness of the MEAs and failure to address the dynamic of technology transfer.

In addressing the former, there have been several attempts of governing and regulating the process of international technology transfer. For such purposes, there are two major initiatives introduced:

- International Code of Conduct for Technology Transfer (ICCTT)
- Series of various International Summit and MEAs addressing transfer of technology as part of their agenda (CBD, UNFCCC etc.)

In the period of 1970s and 80s where there is intensive industrialization process taking place, various concerns were raised over the technology being transferred from developed countries to developing countries. The two main concerns were a) contribution of the technology to the indigenous technology capability development and b) impact of the technology usage into the environment in the host countries. In the midst of these concerns, ICCTT was introduced with

an aim to improve the terms and conditions (TAC) of TT. However, there was various conflicts of interest appeared between developed and developing countries that in the end led to the failure of effort to establish the code of conduct. The struggle to promote the interest of developing countries in the subject of TT however, is still being continued in various international agreements introduced later such as in UNFCCC, UNCBD etc. In line with the current needs, these MEAs focus has shifted from TAC to a more concrete implementation structure such as financing mechanism and capacity building.

For the second factor (failure to address the dynamic of technology transfer) the main argument is that MEAs do not sufficiently recognize the difference between TT of EST from those technologies for commercial based. TT for EST mostly has stronger emphasis for public concern. Second, those technologies primarily originate from private firms while MEAs are largely entered into by government entity. Therefore, such TT requires a more delicate and interactive approach while maintaining its flexibility. Third, which is the major factor, is the fact that technology transfer has evolved from linear to dialectical pattern. (Krattiger, 2004). TT is now becoming more interactive between downstream and upstream and interwoven between public and private sectors – which imply additional layer of constraint and challenges.

As a consequence of this technological change and increasing concern on sustainable development, environmental technologies are going through the same pattern of change too. From its first stage of end of pipe technology it has moved to pollution prevention technologies through reduced consumption of raw materials and energy or waste generation and now the third stage where environmental performance consideration is fully integrated with economic, social and other operational issues.

These changes urge for more dynamic governance of TT. The present MEAs which previously mitigated and facilitated the TT process are now weakened as seen through their reactive approach rather than proactive. Their linear styles are no longer suitable for present dialectical development. The incompatibilities between these two subjects are becoming more revealing that a necessary solution is urgently needed.

In order to be able to suggest solutions or recommendation addressing the above two factors, there are three issues need to be identified; first, to what extent does MEAs address the issue of TT - what are the roles and limitations? Second, since TT for EST are usually embedded in a nature of voluntary spirit (as against for profit), it is natural to expect that without incentive and necessary enabling environment such TT will not take place. Therefore, the question is to what extent do MEAs contribute to the creation of these enabling environments? Third, there are at least 500 agreements available now governing a very diverse area of technology. Some are successful and some are left as just an agreement. What are the lessons can be learnt from each other?

1.2 Definition of Technology Transfer and Contextual Implication

Definitions of technology and technology transfer have attracted intensive debate. As in any academic research, conceptual and technical definitions of the terms used throughout the research are very important to determine the direction and the limitation of the study.

In general context, technology transfer is usually defined as a process of movement of knowledge necessary to handle, produce and develop a certain product. Since significant parts of technology is tacit and embodied in people and organizational routines, then the efficient technology transfer means the transfer of not only information, but also the

capability to master that technology. Because it is a process, there must be some stages involved that need to be recognized accordingly. These stages are divided into adoption, adaptation and diffusion and they are a continuum process.

Within the context of MEAs, the technology referred to is usually environmentally sound technology (EST). In general, EST is defined as technology that includes the following criteria: local capacity building aspect, socially & environmentally friendly, culturally relevant TT and indigenous technological needs. Some MEAs have even specific definition of technology such as UNFCCC for example, which define technology as a broad set of process covering the flows of know-how, experience, and equipment for mitigating and adapting to climate change amongst different stake holder such as government, private sector enterprise, financial institutions and NGOs. While the CBD includes technique for in situ conservation such as integrated pest management, as well as technologies for ex situ conservation such as preservation and storage technologies used in the gene bank as part of the definition.

However, it is not the intention of this paper to engage in such complex terminological discussion. Therefore, this paper adopt the following as working definition - technology as an instrument of both – soft (knowledge) and hard (physical) and also as dynamic element/process. Transfer is defined as a process for deepening, further usage of the knowledge for innovation and also includes the transferee accessibility and ability to share of the benefits of the technology.

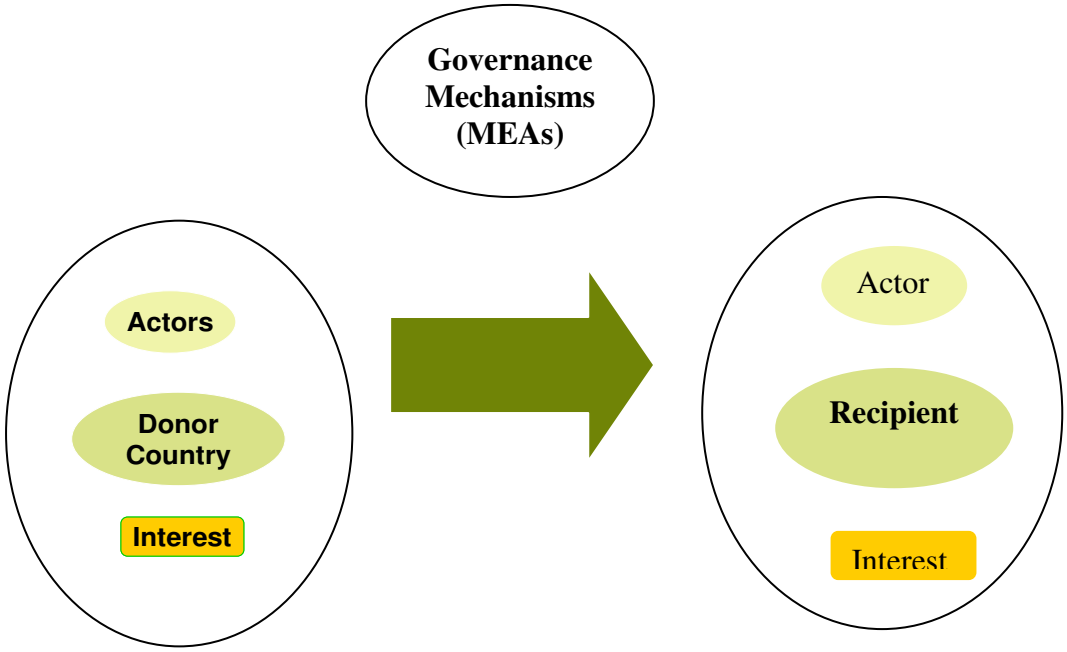
2. Eclectic Approach for Analyzing Technology Transfer under MEAs

There are abundance of studies conducted on these two subjects of technology transfer and MEAs using various approaches. Given the broad nature of the subject and the complexities of technology transfer issues, to find an appropriate approach is a challenge itself. In general, the issue can be approached from 3 different perspectives:

- Technology donor/transferor side
- Technology recipient/transferee side
- Governance mechanism - MEAs

These different perspectives can be illustrated from the following general structure of international technology transfer process.

Figure 1: General Structure of International Technology Transfer



Based on this structure, there are at least 3 scenarios that can be extracted to explain why TT do or do not take place as desired. Scenario 1: MEA is well in place but both the donor and recipient are not supportive to it. Scenario 2: MEA is well in place, the donor is supportive to

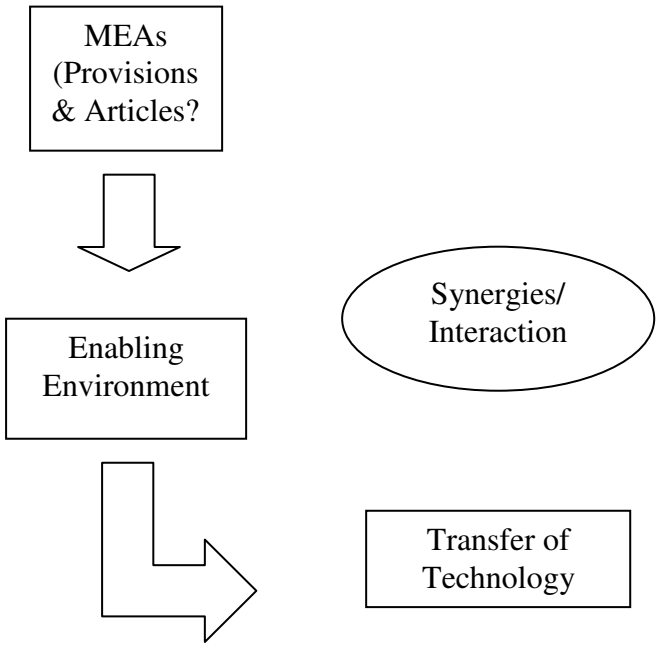
it but the recipient are not supportive (or ready) to receive the transfer. Scenario 3: MEAs is in place and the recipient is supportive to it and ready to receive technology but donors are not supportive and not willing to transfer. The focus of the research is on how to improve the TT by using MEAs to prepare the recipients by supporting and facilitating the creation of enabling environment environments.

The idea of enabling environment, within the context of multilateral forum, started to gain high attention when it was mentioned specifically in Chapter 34 of Agenda 21. The Article outlines that among the possible means for facilitating technology transfer include information networks, government policies, institutional support for developing new technologies, international cooperation, collaborative R&D, and long term collaborative arrangement for FDI and joint venture. But these statements give very general ideas and not accorded by the necessary operationalization procedures. Identifying and analyzing the effective operationalization process is what this paper attempt to do.

The effectiveness of the enabling environment depends on two factors: a) appropriate and adequate provisions of MEAs to provide guideline and authority for further implementation and b) an appropriate and adequate supports in host country. The former refers to how extensive do MEAs address the TT issues. The later, on the other hand, refers to activities of government at national and international levels that aim to create an institutional, administrative, legislative and policy environment conducive to private and public sector technology transfer and the adaptation of transferred technology. Such government activities may, *inter alia*, focus on: national institutions for research and technology innovation, legal and institutional underpinnings of technology markets both at national and international level. (This structure is referred to as National Innovation System (NIS) in this paper)

By analyzing the linkages between MEAs and the enabling environments, the research hopes to identify the strength and weaknesses of each MEA and then suggest some methods to strengthen the synergies. This analytical framework is illustrated by the following **Figure 2**.

Figure 2: Analyzing Synergies between MEAs Framework and Technology Transfer



Having recognized the two factors identified as major reasons of the under optimized TT under MEAs, the research adopts comparative institutional approach (CIA) as framework of analysis. This CIA approach perceives coordination as an important element of the framework. As such, it provides the necessary conceptual framework to analyze the interaction process, which then serves as the ground theory to further investigate the core issue of synergies.

2.1 The Significant of Comparative Approach of Technology Transfer under MEAs

The research is carried out on a comparative basis across five selected major MEAs as follows:

- Convention on Biological Diversity
- UN Framework Convention On Climate Change
- UN Convention to Combat Desertification
- International Treaty on Plant Genetic Resources for Food and Agriculture
- Basel Convention on Hazardous Waste

These conventions are selected for the following reasons; first, there is possible existence of analyzable arrangement for TT among the MEAs. Second, these MEAs represent diversity in different technology focus. Third, the existence of comparable elements. Forth, the possible replication of the successful mechanism.

Among the few previous studies conducted on TT under MEAs, most of them focused on a single MEA which may give a distorted picture of the overall reality. Through cross analysis, the research hopes to provide the review of the overall MEAs for a more accurate and better understanding of the impact of MEAs on TT. Such understanding can then be used in further research to demonstrate the extent to which TT across MEAs may be contributing to development of human and institutional capacity in developing countries and building expertise and ability to deal with environmental, social, economic and development challenges.

3. MEAs and Technology Transfer Provisions: Analysis of Their Characteristics

The role and limitation of MEAs on TT are mainly determined by the extent they address the issue. The extensiveness and comprehensiveness can be observed through the provisions they have with regard to TT and its related issue such as capacity building, funding mechanisms etc. which then may be effectively translated into actions or kept as being minimally acted upon. Review of the TT provisions is summarized in the following **Table 1**.

Table 1: Selected MEAs and Their Technology Transfer-related Provisions

ITPGRFA	UNCCD
Article 5.1 General Each Contracting Party shall, subject to national legislation, and in cooperation with other Contracting Parties where appropriate, promote an integrated approach to the exploration, conservation and sustainable use of plant genetic resources for food and agriculture and shall in particular, as appropriate: (e) Cooperate to promote the development of an efficient and sustainable system of *ex situ* conservation, giving due attention to the need for adequate documentation, characterization, regeneration and evaluation, and promote the development and transfer of appropriate technologies for this purpose with a view to improving the sustainable use of plant genetic resources for food and agriculture; **Article 8** Technical Assistance The Contracting Parties agree to promote the provision of technical assistance to Contracting Parties, especially those that are developing countries or countries with economies in transition, either bilaterally or through the appropriate international organizations, with the objective of facilitating the implementation of this Treaty. **Article 12** Facilitated access to plant genetic resources for food and agriculture within the Multilateral System 12.1 The Contracting Parties agree that facilitated access to plant genetic resources for food and	**Article 6** Commits developed country to promote and facilitate access by affected country Parties, particularly affected developing country parties, to appropriate technology, knowledge and know how **Article 12** Regarding international cooperation, states that cooperation should take place to ensure the promotion of enabling international environment including in the filed of TT **Article 18** Transfer, acquisition, adaptation and development of technology - Facilitate access on concessional and preferential terms, as mutually agreed, taking into account the need to protect IPR - Facilitate technology cooperation among affected country Parties through financial assistance or other appropriate means - Extend technical cooperation with affected developing country Parties - Create domestic market conditions and incentives for TT The parties shall according to their respective capabilities and subject to their respective national legislation, protect , promote and use in particular relevant traditional and local technology, knowledge, know how by ; - Making inventories of such technology - Ensure that such technology, knowledge, know how and practices are adequately protected and that local populations benefit directly on an

agriculture under the Multilateral System, as defined in Article 11, shall be in accordance with the provisions of this Treaty. **Article 13** Benefit-sharing in the Multilateral System (b) Access to and transfer of technology (i) The Contracting Parties undertake to provide and/or facilitate access to technologies for the conservation, characterization, evaluation and use of plant genetic resources for food and agriculture which are under the Multilateral System. Recognizing that some technologies can only be transferred through genetic material, the Contracting Parties shall provide and/or facilitate access to such technologies and genetic material which is under the Multilateral System and to improved varieties and genetic material developed through the use of plant genetic resources for food and agriculture under the Multilateral System, in conformity with the provisions of Article 12. Access to these technologies, improved varieties and genetic material shall be provided and/or facilitated, while respecting applicable property rights and access laws, and in accordance with national capabilities (ii) Access to and transfer of technology to countries, especially to developing countries and countries with economies in transition, shall be carried out through a set of measures, such as the establishment and maintenance of, and participation in, crop-based thematic groups on utilization of plant genetic resources for food and agriculture, all types of partnership in research and development and in commercial joint ventures relating to the material received, human resource development, and effective access to research facilities (iii) Access to and transfer of technology as referred to in (i) and (ii) above, including that protected by intellectual property rights, to developing countries that are Contracting Parties, in particular least developed countries, and countries with economies in transition, shall be provided and/or facilitated under fair and most favorable terms, in particular in the case of technologies for use in conservation as well as technologies for the benefit of farmers in developing countries, especially in least developed countries, and countries with economies in transition, including on concessional and preferential terms where mutually agreed, *inter alia*, through partnerships in research and	equitable basis - Encourage and actively support the improvement and dissemination of such technology, knowledge and know how and practices - Facilitate, as appropriate, the adaptation of such technology, knowledge to wide use and integrate them with modern technology **Article 19** Capacity building, education and public awareness through full participation at all levels of local people: By strengthening training and research capacity in the field of desertification and drought By adapting relevant EST By providing appropriate training technology in using alternative energy source **Basel Convention** **Article 10** The parties shall upon request make available information, whether on bilateral or multilateral, with a view to promoting the environmentally sound management of hazardous waste Cooperate in monitoring the effect of management of hazardous waste on human health and the environment **Article 10 (Para 2)** International Cooperation – Cooperate actively, subject to the national laws, regulation and policies, in the transfer of technology and management systems related to the environmentally sound management of hazardous waste. The shall also cooperate in developing the technical capacity among Parties, especially those which may need and request technical assistance **Article 14** The parties agreed that according to the specific needs of different regions and sub region, regional and sub regional centers fro training and technology transfer regarding the management of hazardous waste and other waste and the minimization of their generation should be established. The Parties shall decide on the establishment of appropriate funding mechanisms of a voluntary nature

development under the Multilateral System. Such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. (c) Capacity-building Taking into account the needs of developing countries and countries with economies in transition, as expressed through the priority they accord to building capacity in plant genetic resources for food and agriculture in their plans and programme, when in place, in respect of those plant genetic resources for food and agriculture covered by the Multilateral System, the Contracting Parties agree to give priority to: (i) establishing and/or strengthening programme for scientific and technical education and training in conservation and sustainable use of plant genetic resources for food and agriculture, (ii) developing and strengthening facilities for conservation and sustainable use of plant genetic resources for food and agriculture, in particular in developing countries, and countries with economies in transition, and (iii) carrying out scientific research preferably, and where possible, in developing countries and countries with economies in transition, in cooperation with institutions of such countries, and developing capacity for such research in fields where they are needed.	
CBD	**UNFCCC**
Article 16 Access to Transfer of Technology -recognized that technology include biotechnology and both access to and transfer of technology among contracting parties are essential elements for the attainment of the objectives of the convention and undertakes subject to the provisions of this article to provide and/or facilitate access for and transfer to the Contracting parties In terms of technology subject to patents and IPR, such TT must be provided with the needed protection and each contracting parties shall take all the administrative, legislative and policy measures for this purposes Exchange of information – facilitate the process from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of	**Article 4** All parties, taking into account their common but differentiated responsibilities shall promote and cooperate in the development, application and diffusion, including transfer of technologies, practices and process that control, reduce or prevent anthropogenic emission of greenhouse gases not controlled by the Montreal Protocol - Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system - Promote and cooperate in the full, open and prompt exchange of relevant scientific,

developing countries. Such exchange shall include exchange of results of technical scientific and socio-economic research, as well as information on training and surveying program, specialized knowledge, indigenous and traditional knowledge **Article 18** Technical and Scientific Cooperation – in promoting such cooperation special attention should be given to the development and strengthening of national capabilities, by means of human resource development and institution building Also work on and encourage cooperation on technologies including indigenous and traditional technologies Promote establishment of joint research program and joint ventures for technology development **Article 19** Handling of Biotechnology and Distribution of its Benefit Each contracting party shall take legislative, administrative or policy measures to provide for effective participation in biotechnological research activities Shall take all practicable measures to promote and advance priority access on a affair and equitable basis to the result and benefits arising from biotechnologies based upon genetic resources Shall consider the need for and modalities of protocol setting out appropriate procedure, including, in particular, advanced informed agreement, in the filed of safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity **Article 20** Financial resource The fact that economic and social development and eradication of poverty are the first and overriding priorities of the developing countries must be considered. Shall take full account of the specific needs and special situation of least developed countries in their actions with regard to funding and transfer of technology.	technological, technical, socio-economic legal information related to the climate system and climate change - Promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process **Article 5** Research and Systematic Observation Parties shall support international and intergovernmental efforts to strengthen systematic observation and national scientific and technical research capacities and capabilities **Article 6** Education, training and public awareness In carrying out their commitments under Article 4, paragraph 1(i), the Parties shall: (a) Promote and facilitate at the national and, as appropriate, subregional and regional levels, and in accordance with national laws and regulations, and within their respective capacities: (i) The development and implementation of educational and public awareness programme on climate change and its effects; (ii) Public access to information on climate change and its effects; (iii) Public participation in addressing climate change and its effects and developing adequate responses; and (iv) Training of scientific, technical and managerial personnel. (b) Cooperate in and promote, at the international level, and, where appropriate, using existing bodies: (i) The development and exchange of educational and public awareness material on climate change and its effects; and (ii) The development and implementation of education and training programme, including the strengthening of national institutions and the exchange or secondment of personnel to train experts in this field, in particular for developing countries **.** **Article 11** Financial mechanism 1. A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined. It shall function under the guidance of and be accountable to the Conference of the Parties, which shall decide on its policies,

	programme priorities and eligibility criteria related to this Convention. Its operation shall be entrusted to one or more existing international entities. 2. The financial mechanism shall have an equitable and balanced representation of all Parties within a transparent system of governance. 3. The Conference of the Parties and the entity or entities entrusted with the operation of the financial mechanism shall agree upon arrangements to give effect to the above paragraphs, which shall include the following: (a) Modalities to ensure that the funded projects to address climate change are in conformity with the policies, programme priorities and eligibility criteria established by the Conference of the Parties; (b) Modalities by which a particular funding decision may be reconsidered in light of these policies, programme priorities and eligibility criteria; (c) Provision by the entity or entities of regular reports to the Conference of the Parties on its funding operations, which is consistent with the requirement for accountability set out in paragraph 1 above; and (d) Determination in a predictable and identifiable manner of the amount of funding necessary and available for the implementation of this Convention and the conditions under which that amount shall be periodically reviewed. 4. The Conference of the Parties shall make arrangements to implement the above-mentioned provisions at its first session, reviewing and taking into account the interim arrangements referred to in Article 21, paragraph 3, and shall decide 23 whether these interim arrangements shall be maintained. Within four years thereafter, the Conference of the Parties shall review the financial mechanism and take appropriate measures. 5. The developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels.

Source: Author's compilation from convention's text

The above Table and previous studies suggest several salient characteristics that provide significant understandings necessary to analyze the role and limitations of MEAs in

facilitating technology transfer (Hofmann 1999, UNCTAD 2001, UNCTAD b) 2001). These characteristics are also the comparative elements among the MEAs, which reflect their approach, framework, and strategies and subsequently resulting in the varying degree of technology transfer that took place under their jurisdiction.

a) Level of Addressees and Assignments of Responsibilities

The contracting parties are being addressed at different levels. Some MEAs have clear distinction in referring to them such as developed, developing & less developed country parties. But there are MEAs which are less specific like the Basel Convention which refers to them as "all contracts parties" (Basel Convention Article 10.3). It can also be seen in the text that the more recent MEAs include and give stronger emphasis to actors of civil societies such as non-governmental organizations which are now becoming increasingly more important actors. The significant of these level addressees reflects the specificity of the convention in assigning different responsibilities in technology transfer issues. There are three major characteristics worth discussed.

b) Degree of Coverage on Technology Transfer

MEAs can also be differentiated based on the extent and the coverage they have on technology transfer. In one group, there are MEAs, which define technology with specific and elaborative provisions. The provisions are designed to deal with TT and capacity building for specific targets and the consequent obligations are to be met by one or several categories of addressees above. An example for this kind of provisions can be noted in the above provisions of UNFCCC, CBD and ITPGRFA. In this respects, one study argues that the specificity of the provisions on TT among these MEAs, with probably an exception to CBD, can be attributed to the political interest of the develop countries in the MEAs (Hoffman

1999). The developed countries are argued as seeking collaboration and concession from developing countries to address global environmental problem, which have significantly been caused by unsustainable practice in their own countries. Through the negotiation process, in respond to these conflicts, strict reciprocity was built into some MEAs making the implementation of agreed obligations by developing countries dependent upon the effective implementation by developed countries of the financial co-operation and transfer of technology provisions. This is also a reflection of the changing paradigm of MEAs focus in governing TT.

However, these MEAs, despite being elaborative in comparison to other, they are still vague – for e.g. CBD - paragraph 2 Article 16 stipulates that access and TT is to be provided to developing countries under fair and most favorable terms including concessional and preferential terms. While these will only apply when mutually agreed and where necessary in accordance with the financial mechanism established by Article 20 and 21. This loose statement allows various interpretations which cause difficulties in not only implementation but also compliance monitoring.

In another group, there are MEAs that define technology in a general and tenuous nature such as those of the Basel Convention and CCD. This group of MEAs does not address TT as a focal area as far as the provisions are concerned. But they define technology in terms of capacity building. As such, it is interesting to note that despite being less specific, they focus more on the capacity building process to the extent that some of them are more successful than the other group of MEAs. For example, the regional and sub regional center for training and technology transfer under Basel Convention had played very significant role as an integrated approach toward achieving the convention objectives in terms of TT.

c) Method of Implementations

MEAs also differ from each other in terms of method of implementations. The legal implications of the provisions affect the subsequent implementation of the identified provisions. Specifically, the implementation or execution of the provisions is greatly influenced by status of the provisions either voluntary or legally binding in nature, by the hortatory or mandatory character of the relevant provisions, and by the wording used to define and the conditions applied to the obligation at stake. These executions can be categorized into conditional and unconditional which can be further detailed into at least two types (UNCTAD, 2001):

i) in-built mechanisms
Some MEAs have in-built mechanisms either in the form of international cooperation, which may require the intervention of international or in the form of special institutional set up for implementation of the provisions. An example for this method of execution is illustrated by the provisions in UNFCCC. According to the convention, the addressees are developing countries whose capacity to fulfill the obligations concerning the phase-out of ozone depleting substance depends upon effective implementation of the financial cooperation and transfer of technology. This implies reciprocal responsibilities between the contracting parties. Such provisions are examples of clear case of conditional execution.

ii) national measures
Many technology related provisions rely on national measures, particularly home country measure in developed countries for their implementation. The adoption of measure by all contracting parties is provided, for instance, by articles 16.3 and 4 of CBD which require the adoption of "legislative, administrative and policy measures, as appropriate" to provide access to, the transfer of and the joint development of technology. Another example for this is the arrangement in the UNCCD. The National Action Programs is a focal point of assessment and guidance for the execution to achieve the objective of the convention. These kinds of provisions are unconditional and direct but are always subject to the terms "best endeavor" of which in many cases left unexecuted or weakly put into operation.

These three characteristics are inferred within the context of the existing provisions. A more extensive analysis of the operationalization of these provisions suggests interesting observations, which further explain the reasons for variance among the MEAs. Some MEAs with strong institutional set up have developed much beyond the provisions in term of

facilitating technology transfer. Through the follow up meeting like Conference of Parties (COP) or the convention review process, MEAs have updated their strategies and approach in line with the current trend especially the increasing concern on sustainable development. But some MEAs are left far behind in addressing the current issue of technology transfer and the broadening framework of environmental concern. The next section addresses these issues by analyzing the trend of development and changes of the general TT under MEAs.

4. Development of Technology Transfer under MEAs: Understanding the General Approach and Implication of the Synergies

One of the fundamental issues that raise conflict in MEAs emerges from the fact that MEAs are designed to address two naturally conflicting needs, development and the environmental concern. The case of technology transfer is an precise case of compromising both needs. Therefore, the development experience of technology transfer taking place within the framework of MEAs can be observed as series of attempts of negotiation and implementation to resolve the conflict of both needs.

In general, there are three stages of progress observable from the TT development experiences. The first generation, marked by Stockholm Conference (1972) focused more on improvement of terms and conditions (as mentioned in the Introduction section). During this period, the developing countries fought to establish new or improved standards governing technology transfer, while the developed countries were only willing to codify those legal and contractual practices which already existed in their countries (Surendra 2000). Among these MEAs, the technologies being transferred also focused on the environmental problem prevention with method of finance mainly based on aid such as ODA etc. Technology transfer was also seen as one of the important grant to comply with the objectives of the convention.

The second generation of MEAs is usually associated to those conventions developed out of the Rio Conference in 1992. One important characteristic of these MEAs is that they are more specifically dealing with technological implication of specific environmental target and the consequent obligations. During these period, the environmentally sound technology (EST) started to gain popularity. The method of financial support could be observed as combination of both aid and commercial based technology transfer which started to gain attention. Once the commercial aspect is included in the arrangement, the engagement of trade related governance (WTO/TRIPS) become inevitable and gradually become more intensified.

The present trends of TT, marked by Johannesburg World Summit on Sustainable Development (2002) are generally characterized by EST with much more broader definition with increasing emphasis on the sustainable development aspect. The sustainability of the previous funding mechanism started to be questioned which resulted in several innovative funding mechanisms mostly on commercial basis started to be introduced. The number of actors involved is also increasing with more engagement of civil society.

Throughout these three stages, the subject of synergies has also gone through shifting process. While in the first stage of TT under MEAs, issue of synergies was rarely heard if not mentioned at all, the second generation started to address the question of inter-linkages among the MEAs as means to better improve the performance of technology transfer under these MEAs (UNU-IAS 1999, 2001). At present state, the way how MEAs addressing TT issue is still insufficient. Creating and strengthening the general synergies among MEAs will not necessarily lead to improvement of either technology transfer of the function of MEAs for such purpose. There is an urge for better understanding of how each element that contributes

to the creation of synergies - the enabling environment (EE) - in each MEA interacting not only among them but also with the local recipient countries innovation systems.

5. Analysis of Synergies between MEAs and Element of Enabling Environment

As previously mentioned, enabling environment usually refers to the creation of an institutional, administrative, and legislative and policy environment conducive to private and public sector technology transfer and the adaptation of transferred technology. However, these statements are very general that obviously requires further details on the nature of content, structure and most importantly the operationalization process. Since MEAs and the elements of enabling environments are interdependent and interrelated with each other, the synergies among them are very imperative to the success of technology transfer. These elements are, within the same capacity, functioning as critical factors for effective national innovation system as well. While different MEAs may have different focus of technology and dependent on the host countries innovation system, some elements are common to all. Those elements that are identified as fulfilling both criteria are; funding or financial mechanisms, interaction and coordination mechanisms, capacity building mechanisms, information and network management mechanisms and appropriate technology transfer modalities.

Since these elements are manifestations of the conventions' objectives, it is also very essential to note that the whole framework and strategies of the MEAs in supporting the creation of these enabling environments are largely influenced by the objectives set forward on technology transfer. The objectives of the MEAs analyzed are summarized in the following **Table 2**.

Table 2: MEAs and Objectives of Technology Transfer

MEAs	Objectives on Technology Transfer
UNFCCC	Toward greater adoption of EST in developing countries - "take all practicable steps to promote, facilitate and finance , as appropriate, the transfer of, or access to EST and know how to other Parties, particularly to developing countries to enable them to implement the provisions of the convention - TT as focal subject
CBD	Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources including by appropriate access to genetic resources and by appropriate transfer of relevant technologies - TT as focal subject
UNCCD	The convention commits the signatories to promote "transfer, acquisition, adaptation and development of technology - TT as less focal issue
BASEL CONVENTION	Continue the development and implementation of environmentally sound low waste technologies recycling with view of reducing minimum generation of hazardous waste taking into account limited capabilities of developing countries to manage hazardous waste - TT as less focal issue
ITPGRFA	Conservation, utilization and fair equitable sharing of benefits with the aim of enabling all countries to make full use of plant genetic resource for the benefit of their agricultural development - TT as focal issue

It can be observed in later discussion how those MEAs that address TT as focal issue are differ from those which do not.

a) Financing Mechanisms

Financial aspect of MEAs is the most critical element in each MEA. This is clearly shown by the fact that each MEA have rather elaborative provisions addressing this issue. The main objective of this financial mechanism is to outline ways to mobilize resource through concentrating them on clear goals, encourages donor coordination, increase total funds and facilitate agreements between donors and recipient. The framework provided by the MEAs in addressing financial issue mostly aim at both compliance assistance and capacity building purpose.

Analysis of provisions on financial mechanisms reveals that the MEAs can be grouped into two. In one group, Basel Convention and CCD do not really outline any specific commitment on the transfer of financial resource for environmental purpose. In another group are UNFCCC, CBD and ITPGRFA which have outlined a more precise provision for funding and further encouraging toward innovative mechanisms.

As far as institutional source for funding mechanism are concerned, most MEAs essentially rely on existing global funds such as GEF. The Basel Convention however, mainly sourced their fund from Global Mechanism which has recently intensified their support given the slow process of technology transfer under the convention. While the ITPGRFA, being a newly ratified Treaty, is yet in search of its own financial source while still being dependent on FAO funding source. Further detail comparisons among these MEAs are summarized in the following **Table 3**.

Table 3: Comparison of MEAs and Their Financing Mechanisms

MEAs	Financing Mechanism
UNFCCC	Extensive provision and well translated into operational framework Mechanism are developing from ODA based to commercial and innovative mechanism Main international source - GEF
CBD	Extensive provisions and well translated into operational framework but nature of technology dealt with generally require more focus on commercial funding/engagement of private sectors Financing/funding capacity very much dependent on governance of intellectual properties Main international source - GEF
UNCCD	General and loose provisions Major sources – Global Mechanism GEF (with recent inclusion of land degradation as GEF focal area) Funds through contribution by member countries Gradually moving to more commercially based mechanism Bilateral funding on project-based
BASEL CONVENTION	General and loose (non-binding and best on "best endeavor" basis) Provisions do no provide adequate mechanism to facilitate TT Dependent on each regional centre funding mechanism and each country allocation Main international source – no access to international fund such as GEF
ITPGRFA	Moderately extensive provisions but yet to be translated into workable framework Closely related to FAO funding Funding strategy of setting up fund using benefit arising from access to plant and genetic resource from the Multilateral System

From the above Table it shows that MEAs vary in their strategies in operationalizing their funding provisions. The difference may be attributable to the strength and weakness of the MEAs themselves. For example, UNFCCC has gained popularity and support due to the public nature of the technology that it dealt with attracts various interests and large number of stakeholders. Thus, it allows UNFCCC to have much wider options of funding mechanisms. In contrast, MEAs like UNCCD is not as popular as UNFCCC although the technologies are equally for public purposes.

Across the five MEAs some trends can be outlined with regards to the funding mechanism. One, there is an increasing innovative domestic and international financial mechanism. This

case can be illustrated by the CBD, UNFCCC and ITPGRFA. Two, there is a decreasing pattern of ODA which force for mobilization of domestic's resource. This is especially the case for the UNCCD. The third trend is an increasing flow of FDI and engagement of these FDI/private sectors. This case is illustrated well in CBD and the UNFCCC. While all MEAs are trying to make use of available source, the traditional source - international fund agencies – are forced to increase their efficiency. The competitions for international fund are also becoming more intensified. These forced MEA to seek for more innovative mechanisms.

While searching for these new means, what is equally important is for the MEAs to improve their framework and method of implementation to be updated with the needs for technology transfer. Some study suggests that there is little evidence that MEAs would have triggered an increased inflow of financing to transfer of EST if the implementation is strictly left to the mechanisms. This implies that MEAs need to do more to provide better environment for promoting financial assistance to its conventions and subsequently to the needing parties.

b) Interaction/Coordination Mechanism

A key to facilitating technology transfer is to provide mechanism by which the critical stakeholders can communicate their needs, and promote and deliver their products and service. This is exactly another critical role that MEAs are capable of to provide in supporting technology transfer. Given their nature, the authority and the legislative implications they have, these MEAs, as an institution, can serve both as platforms for interaction and also as coordination mechanisms.

In terms of provisions on institutional set up for TT, there is a distinct character among the MEAs. While each MEA has Secretariat to run the convention, difference exists whether they

have specific committee to undertake the development of technology transfer issues beyond the provisions. UNFCCC for example, has set up an Expert Group on Technology Transfer to specifically ensure that its TT objectives are met. This group working closely with the established committee of Intergovernmental Panel on Climate Change provide very effective platforms in linking the MEAs TT strategies and the necessary local effort so that necessary environment can be created at the local levels. The TT platforms for CBD has also developed and rather advanced comparatively. The other three MEAs have moderately established venue to foster interaction among the stakeholder of TT. To certain extent it may be explained by the absence of specific working group on the subjects. UNCCD for example, though it has Committee on Science and Technology assigned to tackle TT issue, but the dynamic of technology, as previously explained, require much more interactive institution. The same line of argument applies to ITPGRFA. But Basel Convention has a unique character that it can be said as the closest to the ideal environment needed for TT. The strength of this convention is that it has a number of regional centers around the world capable of identifying the local needs - the most important factor for successful TT. These differences are summarized in the following **Table 4**.

Table 4: Comparison of MEAs and Their Interaction/Coordination Mechanisms

MEAs	Interaction/Coordination Mechanisms
UNFCCC	Established and advanced Interaction platforms progress much beyond provisions Mainly led by IPCC Supported by Expert Group on TT
CBD	Established but less advanced than FCCC Primarily influenced by decisions of SBSTTA
UNCCD	Less established Committee for the Review of Implementation of the Convention Committee on Science & Technology Decentralization method
BASEL CONVENTION	Established but framework mostly focus on regional level (through regional centre)
ITPGRFA	Moderately advanced framework Main actor – Governing Body within the structure of Multilateral System

While each MEA are thriving for providing more conducive platforms, various efforts are also introduced for the same purpose at translateral level. Several agencies have been established for this purpose such as:

i. Interagency Coordination Committee (IACC)
ii. Interagency Environment Coordination Group (IAECG)
iii. Commission for Sustainable Development (CSD)

However, despite these efforts of promoting interactions, some argue that they failed to recognize the dialectical and dynamic nature of technology and the transfer process itself and meeting the interaction needs. For example, some of the agency being established is labeled as only pooling the stakeholder instead of serving their need to interact with each other. Some even criticized the agencies as being redundant such as the function of CSD and the UNEP. Evaluating the process, this paper argues that in fostering and facilitating technology transfer what is necessary is a platform that is not only specific but addresses the previously problematic area of linking the international nature of MEAs with the national response and structure. This is possible, for example, by linking the framework to the local Agenda 21. Commission for Sustainable Development, which is presently exercising the linkage effort between MEAs and local context, is a manifestation of a new approach in governing TT under MEAs.

c) Capacity Building Mechanism

Providing access to capacity building activities and the program itself are another critical element to enhance the technology transfer process. The necessary elements for capacity building include requirement for technology acquisition, skill development for each level of TT - adoption, adaptation and diffusion.

Comparative analysis of the related provision among the MEAs suggests several observations. In general, it is found that UNFCCC and CBD are more specific and more advanced in addressing the issue. The UNCCD and the Basel Convention, given their less emphasis on TT issues in terms of objective, have slightly general provisions on capacity building issue.

Further analysis on experience of various technology transfers programs under these MEAs suggests mixed assessment on the achievement of the capacity building activities. The UNFCCC stands as the most comprehensive with structured execution and planning method based on technology needs assessment scheme. As a result, it has a wide and variety of capacity development activities in which include training workshops/study tours on specific technologies and application/assistance with business planning/training on standards, testing methodologies, certification procedures/training on project development and business planning/education and outreach programs about specific technologies/training on financing. In an almost equal manner, CBD also has a comprehensive approach based on two specific methods; i) preparation of technology needs, barriers and opportunities and related needs in the building capacity and; ii) dissemination of assessment and related experience at national and international level. The UNCCD, although less comprehensive, has a different structure of capacity building mechanism. It decentralized the activities into Regional, Sub-regional and National Action Program. UNCCD through it latest Session of Committee for the Review of the Implementation of the Convention Meeting (Bonn, 2-11 May 2005) has outlined a very comprehensive suggestion for upgrading its capacity building programs. But the programs proposed still do not emphasize the critical function of technology assessment needs which has shown to be an important success factor for the same programs in UNFCCC.

Basel Convention has an almost similar structure with UNCCD. But Basel Convention is an interesting case to be pointed out. Despite having general provisions on the subject, it has established regional and sub-regional center for training and technology transfer. The centre conducts national and regional workshop on legal, institutional and technical implementation issue on regular basis. While ITPGRFA is found to have quite extensive provisions providing impressive framework for capacity development. But an assessment on its achievement is too early at this end given its newly ratified status. Summary of the strength and weaknesses of each MEA are highlighted below in **Table 5**.

Table 5: Comparison of MEAs and Their Capacity Building Mechanisms

MEAs	Capacity Building Mechanisms
UNFCCC	Extensive provisions on capacity building method Translated into developed framework with structured execution method based on technology needs assessment Diverse areas of capacity development
CBD	Extensive provisions Framework emphasizes on integrating the capacity development agenda into national level
UNCCD	Less extensive provisions Development based on both issue and geographical areas Development activities less coordinated as outlined independently based on NAP/RAP/SRAP but issue are tackled through Thematic Program Network Started to emulate establishing an international training centre
BASEL CONVENTION	Very general and minimal provision on capacity building but impressive capacity building activities Implementation scheme and issue decentralized to Regional Centre for Training and Technology Transfer. Centers provide: Provision of manual for the implementation Instruction manual on the control system for trans-boundary movement of hazardous waste Development of model national legislation on trans-boundary movement Establishment of regional and sub-regional centers on training and technology transfer National and regional workshop on legal, institutional and technical implementation
ITPGRFA	Rather extensive provisions but not fully developed outside treaty Major frameworks: a) establishing and/or strengthening programme for scientific and technical education and training b) developing and strengthening facilities for conservation and sustainable use of plant genetic resources c) carrying out scientific research and developing capacity

These observations suggests that by having specific and elaborative provision outlined in the MEAs themselves do not necessarily lead to an effective creation of enabling environment without serious commitments on the implementation process.

d) Information/Network Building Mechanisms

The rapid progress of technology and the transfer process itself forces each MEA to always upgrade their information and ensure that its network building mechanism is very advanced. For such purposes, MEAs should outline the necessary framework that contribute to the development of national, regional and international systems for gathering and dissemination of relevant information on TT and technical and scientific cooperation including establishment of effective networks of electronic database. This is a very critical component especially to overcome the reactive and generic nature of the MEAs.

All MEAs address the needs to support and encourage the exchange of information among the contracting parties but again they are outlined in a generic manner except in ITGPRFA which has rather elaborative provisions on the subject. However, in terms of operationalization all of the MEAs have made use of the information communication technology development (ICT). For a very basic instance, there are various website and portal that are linked to these MEAs.

A comparative analysis of the MEAs understudied found that UNFCCC and CBD have advanced mechanisms which are not only well structured but also easily accessible. The UNFCCC TT: Clear and CBD Clearing House Mechanism (CHM) are two mechanisms replicable to other MEAs. The CHM helps the exchange of information and facilitation of TT and technical and scientific cooperation, providing access to information on national

technological needs, available relevant proprietary technologies, and also information on best practice. The TT: Clear also provides the same kind of information. The UNCCD has an information network which provides access to the best practices as reported in the National Action Programs (access is possible through the Global Mechanisms website which dedicated to support the convention). Basel Convention is unique in this aspect. Although there is no widely recognized major source of information at the convention level, but its Regional Centers have specific information which are more adapted to local needs than other conventions. However, given the regional nature of the centre, building the network remains as a major challenge. ITPGRFA, as mentioned earlier, is the only one that has provisions on resource network and framework for global information system. But the outcomes are still early to be evaluated. The significant features of these MEAs in these aspects are outlined in following **Table 6**.

Table 6: Comparison of MEAs and Their Information/Network Building Mechanisms

MEAs	Information and Network Building Mechanisms
UNFCCC	General provision on encouraging exchange of information but structured and advanced management and network system Major source of information and network centre - TT:Clear
CBD	General provisions supporting access and sharing of information Major source of information and network centre – Clearing House Mechanism
UNCCD	General provision encouraging exchange of information Abundance information but weakly coordinated framework and access by needing parties very difficult (e.g. access to NAP) Major source of information and network centre – none with wide recognition and access
BASEL CONVENTION	General provisions provides for exchange of information on suitable waste management technology and management system but the accumulated information in this regards is difficult to access Major source of information and network centre – dependent of each regional centre At convention level - none with wide recognition and access
ITPGRFA	Elaborative provision on resource network and framework for global information system but still vague for operationalization Multilateral System to serve as information center but accessibility framework is yet to be widened

A general observation based on coarse survey of the website of these MEAs reveals that there is abundance of information available but this information is not streamlined to serve the actual need of technology transfer especially the end-users. Although information and the networks can serve as a support agency to reduce the asymmetrical relation among the stakeholders, this function is underutilized by some of the MEAs.

e) Appropriate Technology Transfer Modalities

Each technology has its own network of agent interacting in each specific technology area under a particular institutional infrastructure for the purpose of generating, diffusing and utilizing technology. Within this context, although transfer modalities are not directly "an environment" to be created by MEAs (like in the previous four elements), but facilitating the selection and provision of an appropriate modality is very important to ensure success of technology transfer. MEAs can play role by supporting the actors that drive the modalities. The modalities can be of various options including inter-governmental cooperation, cooperation and networking, private public partnerships, small scale enterprise, targeted training, direct public investment, financial incentives, enabling policy measures and education (UNCCD 2005). For comparative purposes, these modalities can be categorized into three different pathways; government-driven – where technology transfer is initiated by government to fulfill specific policy objectives; private sector-driven which involves transfers between commercially oriented private-sectors entities and community-driven where technology transfers involve community organizations with a high degree of collective decision-making (Carman, 2000)

Survey of the conventions' text suggests that there are no specific provisions in any of them that directly address this question of modalities. However, as in many cases of international

agreements, implementation of the agenda requires interpretations from the general framework outlined. Thus, assessment should be made on either the modus operandi or the outcomes. Such analysis reveals that there is a general trend among the MEAs toward private-sector driven pathways with UNFCCC and CBD are comparatively well ahead than others with more innovative modalities such as the Clean Development Mechanisms.

Further detail analysis of TT experience reveals that there are at least four observable modalities; one - an integrated approach with provision of finance, training, investment and technological knowledge. A good example for this is the Regional Training Center under the Basel Convention. Two, technologies that are sponsored by the public sector. Three - clearing house and transferring patent rights as illustrated by CBD. Four - joint implementation and activities implemented jointly mostly involved FDI which can be found under the UNFCCC. A survey of the literature on method of transfer based on several case studies suggest this fourth modality has the most potential to serve as the most appropriate model that can fulfill the need to be specific and localized which are the principal need of sustainability.

The most important element of the modalities is to recognize the different needs and stages in technology transfer process. In meeting such needs, UNFCCC and CBD are comparatively more developed with their technology needs assessment scheme which identifies the adaptation, adoption and diffusion stage accordingly. Basel Convention, through its Regional Center, has a strong adaptation capacity but again as in the case of information diffusion, the same dissemination of information/technology issue stands as a major challenge. UNCCD found to have the weakest capability in recognizing the different stage of TT. The following **Table 7** provides summary of these comparisons.

Table 7: Comparison of MEAs and Their Technology Transfer Modalities

MEAs	Technology Transfer Modalities
UNFCCC	Combination of government/private sector and community driven pathways with emphasis on private sector involvement Relatively clear distinction and recognition of different needs and stage of TT
CBD	Combination of government/private sector and community driven pathways with increasing focus on private sector involvement Relatively clear distinction and recognition of different needs and stage of TT
UNCCD	Mostly government and community driven with recent intensification of private sector's involvement Weak recognition of needs and distinction in stages of TT
BASEL CONVENTION	Mostly government driven pathways and dependent on the modalities of the research centre Regional centers have strong recognition of adaptation needs of TT Diffusion stage constraint by limited access to technology
ITPGRFA	No clear trend of pathways but nature of technology and critical needs of capacity building suggest both government and private sectors play essential role

6. Policy Implication - Applying Coordination Framework toward Strengthening the Synergies

The above analysis hope to have substantiated three arguments; first, through the survey of their provisions and articles, MEAs do address TT issue but at varying level of extensiveness. Two important factors contribute to the difference are the objective set by the convention on TT issue – either as focal or non-focal – and the type of technology that the convention are dealing with. The second argument is to demonstrate that MEAs, extending from their provisions and framework, have contributed to the creation of enabling environments for technology transfer but in a relatively loose synergies. Major factor contributing to such situation is identified as weak interaction between the actors involved and among the elements of enabling environment themselves. The changing nature of technology transfer led it to worse making the MEAs to become more reactive and linear. Third argument is that different MEAs have different strategies and experience in the fives critical element of enabling environments. As such each MEA have different strength and weaknesses that are useful for emulations.

These analyses hope to add to the body of knowledge on TT under MEAs by providing comparative perspectives and understandings so that one can come out with better policy recommendations that are necessary for improving governance of MEAs in general.

There have been various suggestion and policy recommendation forwarded toward improving TT under MEAs. However, what seem to be lacking is recommendations that address the means to strengthen the synergies between MEAs and the enabling environments. The recommendations required, rather than detached from each other (as in many previous suggestions), need to be structured in one policy framework or concerted objectives.

This report, having identified weak interaction as one of the major problems contributing to the under optimized issue of TT, argues that the issue as primarily attributable to coordination failure among the actors involved in the process. Applying the coordination framework in approaching interaction issue of success and failure of TT is well justified based on coordination failure and economic coordination theory (Roseintein-Rodan 1943; Hayek 1945; Hirschman 1957; Myrdal 1958; Schenk 2003; Sanusi 2004). A central argument is that the issue of coordination emerges when there are various levels of interaction among technology institutions such as inter-firms and intra-firms, inter-government and intra-government and between firms and governments at different level of intensity. However, the complexity is not due to the number and variety of organizations, rather it is the variety of coordinating interaction that causes the complexity. Putting this concept in the context of this study, it is the various levels and intensity of interaction between MEAs, donor countries/agencies, recipient countries/agencies and other relevant actors that negatively affect the TT.

Applying this framework, the study has identified several problematic areas. The most fundamental issue being the weak or minimal interactions among the five elements of the enabling environments. Such weak level of interaction subsequently leads to many other problems. Two, the norms and principal relating to technology transfer development, especially in an open technology market, is not being translated into the MEAs framework adequately. This is very obvious in the case of searching for appropriate financial mechanisms. While in an open technology market, the appropriate approach will be a market enhancement approach which emphasizes both role of private and government sector, some program introduced to promote TT under the MEAs is denying one or another. Three, the most critical aspect of TT- recognition of its process as a continuum is still not been addressed adequately and appropriately. The existing provisions of MEAs seem to approach the process as one single stage. Although when it comes to implementation, some MEAs such UNFCCC and CBD have already started to recognize the continuum nature of TT, they are still insufficient. Fourth, linking the framework of MEAs and national innovation system is still not widely and comprehensively carried out across the MEAs. This is a perfect illustration of how interaction is still underutilized despite its strength. Fifth, because of coordination failure there is misunderstanding about the importance of governance of end results and governance of the process needed to get the results in regulating or even facilitating the technology transfer process.

The above issues can be addressed in various means and some possible solutions may already being carried out to deal with them. What is more imperative is to ensure the actions taken are encompassed in a systematic, strategic approach to ensure that the solutions are sustainable. For such purpose, rather than suggesting specific recommendation which may turn to be an endless list, the report suggests the following policy guidelines; the first stage is

to set up the technology transfer priorities for each convention in a more structured way. The ideal situation would be inclusion of identified priorities in the convention text or adoption as Decisions in their meetings. This is especially necessary for the capacity building mechanism, funding mechanisms and interactions/coordination mechanisms. A major element to be included in the priorities consideration is the recognition of technology transfer as a continuum process. The second stage will be drafting of program linking the five elements of enabling environment accordingly.

At the same time MEAs, must realize and strengthen their position and capacities as platforms for direct and indirect means of coordination. The role of direct coordination is served through the provisions and articles as outlined in the convention text. The other role indirect coordination function should be executed through translating the provision into enabling environment in national innovations systems.

7. Conclusion

In conclusion, this paper does recognize that all MEAs have their own peculiarity in their framework as reflected in the above analysis on the various provisions. The peculiarity and difference may be attributed to the objectives and nature of the technology being addressed by the MEAs. But as far as technology transfer is concerned, there are certain common factors that determine the success of the process – the above discussed five element of enabling environment. By addressing these elements, MEAs, through their provisions and succeeding framework can enhance the existing synergies. This research has provided, to certain extent, the options of successful practice and critical needs for addressing the subject of technology transfer.

While some study may have addressed the subject using single MEA as a case study, but such scope may give a distorted picture of overall achievement. Identification of synergies in each MEAs and further comparison with other MEAs would give more comprehensive ideas to improve the contribution of MEAs. A more detailed study using this framework by taking various cased studies of TT will complete the true picture of MEAs contribution to TT and allow us to judge the contribution of MEAs in a more justified manner.

Given the very broad, complex and dynamic nature of the subject, simplifying the variance under one scale and try to come out with solutions is indeed a very challenging job. Depending on the approach taken, any arguments forwarded are always subject to disagreements. However, it is the great hope of the study that it has at least provided some strong and substantial grounds for future research. Two areas of research can obviously benefit from this research. One, a comprehensive comparison of a single element of enabling environment such as the funding mechanism across several MEAs and two a more empirical based analysis looking at various technology transfer cases either in one MEA or across all to draw lessons for another technology transfer project.

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