

## **Committee on Development and Intellectual Property (CDIP)**

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ECONOMICS OF IP AND INTERNATIONAL TECHNOLOGY TRANSFER

*commissioned by the Secretariat*

1. The Annexes to this document contain (i) a Study on the Economics of IP and International Technology Transfer, undertaken in the context of the Project on Intellectual Property and Technology Transfer: 'Common Challenges – Building Solutions' (CDIP/6/4 Rev.), by Dr. A. Damodaran, Professor, Indian Institute of Management, Bangalore, India, and (ii) a Peer Review of the above Study by Dr. Francesco Lissoni, Bocconi University, Milan, Italy.

2. *The CDIP is invited to take note of the information contained in the Annexes to this document.*

[Annexes follow]

**Note: The views expressed in this study are those of the author and do not necessarily reflect those of the WIPO Secretariat or any of the Organization's Member States**

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## **BACKGROUND AND EXECUTIVE SUMMARY**

1. At the Eighth Session of the Committee on Development and Intellectual property (CDIP) of the World Intellectual Property Organization (WIPO) held in Geneva during November 14-18, 2011, a Paper on the Project on Intellectual Property and Technology Transfer was considered (WIPO, 2011). The said project paper, after taking into account, concerns relating to access to and transfer of technology between different actors at the national and regional/international levels, noted the importance of addressing the issues through a calibrated plan of action. The project paper stated that the draft UNCTAD Code of Conduct on the Transfer of Technology needs to be pursued through 'legitimization of specific domestic policies to promote the transfer and diffusion of technology', and addressing 'the rules governing the contractual conditions of transfer of technology transactions', and finally looking at 'the special measures on differential treatment for developing countries, and the measures that would strengthen international cooperation' (WIPO op.cit, para 6).

2. To pursue the agenda on technology transfer, the project paper proposed preparatory work and activities which involved literature review of existing work undertaken by WIPO and other organizations and commissioning of studies and case studies that are peer-reviewed. It was proposed that the studies needed to include 'a series of economic studies on IP and International Technology Transfer'. The economic studies would focus on areas that have received less attention in available economic literature and would focus on identifying possible obstacles and suggesting possible ways in which technology transfer could be enhanced.

3. The work relating to the economic studies was entrusted to the author of this Volume. Since the Terms of Reference of these studies were not clearly specified in WIPO (2011), the author held detailed discussions with the WIPO officials concerned with the Agenda. Given the international policy focus of WIPO activities and the importance accorded to IPRs and Technology Transfer in the WIPO Development Agenda, it was felt that the economic studies may boil down to key compartments of international macro-policy level relevance that would steer the WIPO Development Agenda in the ensuing years. Sustainable financing systems that catalyze technology transfer of low-carbon technologies provide affordable and effective medicines to the poor in developing countries suffering from grave communicable diseases and promote sustainable livelihood systems for poorer communities, are the key to the future evolution of the WIPO Development Agenda. Hence it was felt that studies that focused on these aspects would provide major policy support to the WIPO Development Agenda. Accordingly the following five themes were identified for expansion:

- Operationalizing Article 7 of WTO TRIPS: State of Art, Constraints and Prospects
- Innovation, Financing Mechanisms and Transfer of Technologies
- Strategizing Innovative Enabling Conditions for Transfer of Technology to Developing Countries
- Case Study for the Drugs and Pharmaceutical Sector
- Case Study for Climate Change Technologies

4. The present volume carries papers on the first three basic themes. The summary of the three papers are as follows:

## **A. OPERATIONALIZING ARTICLE 7 OF WTO TRIPS: STATE OF ART, CONSTRAINTS AND PROSPECTS**

5. One of the key and contentious issues in the WIPO Council and related trade and environment forums has been the issue of technology transfer from developed to developing countries in relation to public goods or goods with high social and community relevance. This paper discusses the inter-relationship between Intellectual Property Rights and technology transfer in relation to public goods of key 'public relevance'. The paper argues that this issue needs to be seen at two levels: the normative and the non-normative levels. While the former represents the ideal system of 'what ought to be', the latter reflects 'what is the actual state of affairs'.

6. The paper notes that the inter-relationship pattern (between IP protection and technology transfer) for global public goods such as life-saving drugs differs from that of global environmental goods (such as climate and biodiversity).

7. The paper begins by discussing the provisions of WTO TRIPS that emphasize the inter-linkage between IPRs, innovation and technology transfer / dissemination. Article 7 of TRIPS emphasizes that the protection and enforcement of IPRs should contribute to the promotion of technological innovation and dissemination of technology to the mutual advantage of producers and users of knowledge. The paper outlines the inter-relationship in relation to drugs and pharmaceuticals, biodiversity and climate smart technologies, which are public goods of critical importance to developing countries. The paper proceeds to discuss the importance of technology transfer to WIPO's development agenda.

8. The scope, modes, process and impacts of transfer of technology are discussed in the paper with reference to empirical economic studies that have examined the role of foreign direct investment (FDI) and mergers and acquisitions in facilitating technology transfer. The paper summarizes the principal barriers to technology transfer and proposes multilateral measures to overcome barriers to technology transfer to give greater credence to Article 7 and 66(2) of the WTO TRIPS.

## **B. INNOVATION, FINANCING MECHANISMS AND TRANSFER OF TECHNOLOGIES**

9. One of the limitations of the literature on 'Innovations, IPRs and Transfer of Technology' has been in its inadequate focus on the impact of financing mechanisms and systems on the three elements. This is despite the fact that it is widely accepted that finance forms one of the major constraints in promoting innovation through R&D as well as in making technologies accessible to end consumers. Even if the technology is transferred to the end consumer, the issue of absorption of the technology remains, which in turn calls for enabling infrastructure that requires financial resources. As a matter of fact, it is argued in the paper that designing good financing systems enables innovations, customization and successful application of transferred technologies in developing countries.

10. The paper examines the rationale of financing innovations and technology transfer and proceeds to probe the patterns of inter-relationship between financing systems, innovations and transfer of technologies at two levels – the 'international level' in relation to TRIPS and the WIPO Development Agenda and at the 'sector level' with reference to how the inter-relationship plays out in the case of drugs and pharmaceutical industry and climate technology markets. The paper advances key priorities for financing innovations and technology transfer for the two public goods focused upon, namely, drugs and pharmaceuticals and low carbon technologies.

### **C. STRATEGIZING INNOVATIVE ENABLING CONDITIONS FOR TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES**

11. The paper seeks to provide an operational focus to the issue of technology transfer by discussing policy strategies that can stimulate innovation and provide facilitating conditions for wider diffusion of sound technologies and products across society. Apart from synthesizing recommendations from the first two papers, it advances overarching strategies that can make it possible to achieve technology transfer from developed countries to developing countries. The authors argue that, apart from enlightened regulations, an SME driven innovation strategy in knowledge intensive sectors can go a long way to ensure that social access to promising technologies and technology products takes place. Government Policies and inter-Governmental Collaboration initiatives for developing and diffusing technologies relevant to public goods are critical - so are pricing policies that respect the ability of different strata of society to pay for life-support systems such as potable drinking water, life-saving medicines and nutrients. Finally the paper argues that there is a need to have in place systems for information exchange to reduce costs of innovation and R&D and establish multilateral financing mechanisms to promote R&D, innovations and transfer of technologies in critical sectors of relevance to public goods.

12. The following enabling conditions are suggested to enable innovations and technology transfer:

- (a) Stimulating optimum competition environment and strategic use of patents and related IPRs.
- (b) Introducing effective regulatory devices and building complementary capabilities.
- (c) Facilitating negotiations for technology transfer.
- (d) Facilitating FDI policy and non-equity modes (NEMs) of business of overseas origin.
- (e) Setting up of joint R&D systems through public private partnerships.
- (f) Setting up market making functions that link appropriate buyer to appropriate seller.
- (g) Encouraging joint need assessment for drugs and environmental technologies to facilitate joint R&D programs.
- (h) Setting up an efficient multilateral funding mechanism to facilitate transfer of technology.
- (i) Encouraging public institutions in developed countries to buy out essential drugs for supply to least developed countries, by applying the second order Price Discrimination principle.

13. The three papers mentioned in the preceding paragraphs carry issues that can assist WIPO to implement its Development Agenda. Apart from covering WIPO literature on the subject, the papers also bring forth evidence from studies that have not previously been discussed at WIPO. The solutions recommended by the papers advocate a blend of market based and regulatory instruments within the framework of TRIPS, in order to render technology transfer 'effective' and 'sustainable'.

14. There are two Appendices that separately accompany these papers viz 'Intellectual Property Rights and the Drugs and the Drug Industry' (Appendix 1) and 'Transfer of Climate Smart Technologies' (Appendix 2) that include detailed sectoral analysis of technology transfer issues in relation to IPRs. These papers buttress the arguments developed in the three theme papers.

## D. SYNTHESIS OF RECOMMENDATIONS

### PAPER 1: OPERATIONALIZING ARTICLE 7 OF TRIPS: STATE OF ART, CONSTRAINTS AND PROSPECTS

Compulsory Licenses: Under the TRIPS agreement, there is considerable flexibility provided to WTO Member States on the grounds for issuing compulsory licenses:

- (a) Use of other TRIPS flexibilities including exemption from patentability;
- (b) Technology pooling through a collective approach;
- (c) Global system to share know-how and trade secrets;
- (d) Understanding of initiatives on publicly funded technologies;
- (e) Parallel importation, exemptions and competitive behavior;
- (f) Overcoming patent laws and procedures;
- (g) Rigorous criteria to assess the novelty and inventive step of patent applications to pharmaceuticals should be applied and provisions in Patent Acts which provide for 'evergreening' patents should be removed;
- (h) Government to Government commitments in developing countries to set up joint R&D with developed countries by twining public institutions to develop innovative products/ technologies;
- (i) Market making functions: linking appropriate buyer to appropriate seller;
- (j) Encourage joint assessment of public health needs which will become the basis for developing joint R&D programs for creation of generics;
- (k) Encouraging public institutions in developed countries to buy out essential drugs for supply to least-developed countries through Second Order Price Discrimination;
- (l) Setting up a multilateral fund for operationalizing a and b for drugs and pharmaceuticals.

### PAPER 2: INNOVATION, FINANCING MECHANISMS AND TRANSFER OF TECHNOLOGIES: NEED FOR AN INTEGRATED VIEW

- (a) Establish a publicly-funded global financial mechanism to promote innovation and transfer of technology;
- (b) Finance implementation of WIPO Development Agenda;
- (c) Provide other avenues of support such as the development of SMEs and NEMs;
- (d) Finance technology transactions exchanges;
- (e) Finance development of Information/ data base on Technology failure risks to alert research communities to focus their resources on R&D activities that minimize risks.

### PAPER 3: STRATEGIZING INNOVATIVE ENABLING CONDITIONS FOR TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES

- (a) Stimulate optimum competition environment through enabling policies;
- (b) Stimulate strategic use of patent and related IPRs;
- (c) Put in place sound and effective regulatory devices;
- (d) Build complementary capabilities in terms of capacities and R&D support systems;
- (e) Facilitate negotiations for technology transfer to ensure efficient, effective and result based technology transfer;
- (f) Have in place facilitating policies in relation to foreign direct investment (FDI) and non-equity modes (NEMs) of business of overseas origin;
- (g) Provide Government commitments in both developed and developing countries to set up joint R&D systems through public-private partnerships;
- (h) Set up market making functions that link appropriate buyers to appropriate sellers and thus promote an efficient technology market;
- (i) Encourage joint need assessment for drugs and environmental technologies to facilitate joint R&D programs involving partners from North and South;
- (j) Set up an efficient multilateral funding mechanism to facilitate financial transactions connected to transfer of technology;
- (k) Provide information base to prevent technology failure risks;
- (l) Encourage public Institutions in developed countries to procure essential drugs for supply to least developed countries by applying second order price discrimination principles.

### APPENDIX 1: CASE ON INTELLECTUAL PROPERTY RIGHTS, TECHNOLOGY TRANSFER AND DRUG AND PHARMACEUTICAL INDUSTRY

- (a) Ensure sufficiency of disclosure in patent applications, particularly in the case of the so-called Markush claims, so as to ensure that the granting of patents with such claims does not become a constraint for research on new compounds or an undue restriction to competition;
- (b) Similarly, claims on second indications of pharmaceutical products, which are equivalent to methods of treatment, should be deemed non-patentable due to lack of novelty and industrial applicability;
- (c) In order to improve the transparency of the patent system, the international non-proprietary name (INN) of drugs, when known at the time of filing of a patent application, should be mandatorily disclosed in its title and abstract;
- (d) Compulsory licenses and government use are important tools that governments can and should use when required to ensure access to affordable medicines;
- (e) Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should be allowed in narrowly defined, exceptional cases. Polymorphs and isomers (when the racemic mixture was already disclosed) should not be patentable;

- (f) As patents are unlikely to promote local innovation in pharmaceuticals, governments should consider options other than the patent system to encourage it, particularly with regard to diseases that disproportionately affect the population of developing countries;
- (g) Resolve the problem of production for export from markets that provide patents to countries that do not grant pharmaceutical patents (and therefore do not grant compulsory licenses);
- (h) Find ways to make the Doha Declaration on TRIPS and public health operational at the regional and national levels;
- (i) Countries should be encouraged to make full use of the Doha Declaration in the process of adjusting national intellectual property laws to become compliant with TRIPS. This will require substantial advice and technical assistance from institutions like WIPO and WTO. While the spirit of the Doha Declaration is to tailor intellectual property laws to national needs;
- (j) Finally, a proper regime of differential pricing needs to be worked out, through detailed empirical investigations on how this is possible within the present capacity utilization dynamics of pharma firms that have invented the medicines in the first place.

#### APPENDIX 2: CASE STUDY: TRANSFER OF CLIMATE FRIENDLY TECHNOLOGIES: ISSUES, TRENDS AND SUGGESTIONS

- (a) Develop patent landscape, to provide clarity in ownership claims on issued patents, identify overlaps in complementary technologies, and provide ownership details;
- (b) Set up 'voluntary patent pools' whereby patent holders, including firms, universities and research institutions, would deposit their IP for particular adaptation and mitigation needs;
- (c) Undertake public measures such as publicly financed fiscal supports for local technology needs and adaptation, while at the same time raising the global costs of using carbon-based energy resources and improving the climate for investments in poor countries, This is to enable improve flows of environmentally-sustainable technologies (ESTs) across borders;
- (d) Government funding for R&D must result in at least a partial ownership of resultant patents. This is to enable governments concerned to influence technology flows to developing countries;
- (e) Governments may compile an inventory of publicly funded technologies to prevent non-patent protection, such as trade-secrets, cartelization etc. and to improve the pace of innovation.

## **1. PAPER 1: OPERATIONALIZING ARTICLE 7 OF WTO TRIPS: STATE OF ART, CONSTRAINTS AND PROSPECTS**

### **1.1 BACKGROUND**

1. One of the key and contentious issues in the WIPO Council and related trade and environment forums has been the issue of technology transfer from developed to developing countries in relation to public goods or goods that have a high social and community relevance. The inter-relationship between Intellectual Property Rights and Technology transfer in relation to public goods of goods of key 'public relevance' needs to be seen at two levels: the normative and the non- normative levels. The former represents the ideal system of 'what ought to be' while the latter reflects 'what is the actual state of affairs'.

2. The inter-relationship pattern (between innovation, IP protection and technology transfer) for global public goods such as key lifesaving drugs and pharmaceuticals that have critical significance to global public health differs from that of global environmental goods (such as climate and biodiversity).

3. This paper commences by discussing the provisions of WTO-TRIPS that emphasize the inter-linkage between IPRs, innovations and technology transfer / dissemination in relation to drugs and pharmaceuticals which are public goods of critical importance to developing countries. The paper proceeds to discuss the importance of technology transfer in WIPO's development agenda.

4. The scope, modes, process and impacts of transfer of technology are discussed with reference to empirical economic studies, the role of Foreign Direct Investment (FDI) and Mergers and Acquisitions in facilitating Technology Transfer is discussed next. The paper summarizes the principal barriers to technology transfer and proposes multilateral measures to overcome the barriers to technology transfer. The recommendations include those made by experts besides some recommendations that have not been in circulation.

### **1.2 THE OVER-REACH OF WTO - TRIPS**

5. The 'public nature of both categories of 'public goods' vis-à-vis the private control over their possession and use is highlighted by the WTO- TRIPS, which while being a treaty for protection of Intellectual Property Rights provides many provisions that provide for exceptions to these 'private' rights in the larger interests of addressing critical public interests (Damodaran, 2010a). One such provision is Article 7 of the WTO-TRIPS that deals with the linkage between IPRs, innovations and technology transfer and dissemination

6. Article 7 of the TRIPS states as follows:

"The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations."  
(WTO, 1994)

7. Article 7 is a broad exposition of the need for balance between private proprietary rights and the responsibility of reaching the advantage of an innovative technology or its product to the public in the larger interests of social and economic welfare.

8. Two other Articles of the TRIPS that are more specific and deal with the exception to the rule of private proprietary IP Rights, particularly in situations where public welfare is involved, fortify the broad character of Article 7. These Articles are Article 8 and Article 66.2 of the TRIPS. Article 8 spells out national obligations for ensuring that IPRs work for communities and public welfare, while Article 66.2 enunciates the obligations of developed countries to transfer technologies to least developed countries.

9. Thus Article 8 establishes principles that:

“Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic development, provided that such measures are consistent with the provisions of this Agreement.”

“Appropriate measures, provided that they are consistent with the provision of the Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.” (Ibid)

10. Article 66.2 of the TRIPS Agreement, on the other hand, states:

“Developed country members shall provide incentives to enterprises and institutions for the purpose of promoting and encouraging technology transfer to least-developed country members in order to enable them to create a sound and vital technological base.” (Ibid)

11. There are two operative issues as far as Article 8 is concerned; creation of demand side conditions in the realm of public health and nutrition, so that Governments of countries faced with grave public health problems and suppliers of drugs, nutrients and related products, gauge the gravity of the situation and the extent to which access constraints need amelioration in terms of supply of drugs and essential nutrients.

12. Article 66.2 on the other hand rests on the idea that Governments in developed countries could possibly provide a favorable environment to provide incentives to enterprises and institutions to promote transfer of technology to least developed countries. In this regard, the WTO Doha Decision on Implementation-Related Issues and Concerns, adopted by the WTO Ministerial Conference in November 2001, states that:

“11.2 Reaffirming that the provisions of Article 66.2 of the TRIPS Agreement are mandatory, it is agreed that the TRIPS Council shall put in place a mechanism for ensuring the monitoring and full implementation of the obligations in question. To this end, developed country members shall submit prior to the end of 2002 detailed reports on the functioning in practice of the incentives provided to their enterprises for the transfer of technology in pursuance of their commitments under Article 66.2. These submissions shall be subject to a review in the TRIPS Council and information shall be updated by Members annually.” (WIPO, 2009).

13. Empirical evidence suggests that enforceable patents can increase inward flows of technologies to middle-income and large developing countries but probably have little impact in the least-developed countries. Thus, the TRIPS Agreement at the WTO by itself will have little impact on technology acquisition for poor countries. Negotiators recognized this and introduced Article 66.2, which obligates the developed countries to provide positive incentives for International Technology Transfer (ITT) to the least developed countries. This study makes numerous suggestions for improving these incentives by policy changes in recipient countries, source countries, and the global trading system.

14. An International Centre for Trade and Sustainable Development (ICTSD) study titled “Does TRIPS Art. 66.2 Encourage Technology Transfer to LDCs? An Analysis of Country Submissions to the TRIPS Council (1999-2007)” (Moon Suerie, 2008), focuses on public policies or programs that developed countries undertake to encourage their enterprises or institutions to engage in technology transfer, rather than on market-based technology transfer that largely occurs through private channels.



15. In WIPO (2011), the importance of the distinction arises from the following three reasons:
- (a) Measuring private technology transfer will be very difficult in the absence of a unified reporting mechanism.
  - (b) Market-based flows from the most advanced economies to the least-developed are likely to be minimal in the absence of policies that offer additional incentives; and
  - (c) The legal obligation in Article 66.2 is on governments rather than on private firms.

16. Many points have been advanced about the manner in which the dimensions of Article 8 and 66.2 can be operationalized. These include measures to tease out the supply lines of drugs and nutrients at affordable costs, aided by Government regulations in developed and developing countries to render the supply side effective. It is stated that 'Least-developed countries want this requirement to be made more effective. In Doha, ministers agreed that the TRIPS Council would "put in place a mechanism for ensuring the monitoring and full implementation of the obligations" (ibid). Also it is mentioned that 'various decisions under TRIPS have raised the question of technology transfer and reiterated the commitment of WTO member countries to implement Article 66.2, in relation to the 2003 and 2005 decisions on TRIPS and Public Health'. (Ibid)

17. Separately under the aegis of the United Nations Framework Convention on Climate Change (UNFCCC), climate change negotiators have been working on the modalities of linking the technology transfer provisions of the UNFCCC with the WTO-TRIPS Agreement' (ibid).

### 1.3 WIPO AND THE RATIONALE FOR THE TRANSFER OF TECHNOLOGY AGENDA

18. While many steps have been taken to implement the WTO-TRIPS agreement in the realms of IP protection and enforcement, similar efforts have not been employed to realize the technology transfer potential of the TRIPS (WIPO, 2009a). This explains the rationale for the aspect of technology transfers to be highlighted by WIPO in relation to the global challenges of development, climate change and food security (WIPO 2009). WIPO considers effective use of intellectual property for economic, social and cultural development as a key concern (ibid). Forty-five recommendations adopted by the WIPO General Assembly in October 2007 contain a number of recommendations that relate to the transfer of technology (ibid). It is also the mandate of the WIPO to expand the scope of its activities aimed at bridging the digital divide, in accordance with the outcomes of the World Summit on the Information Society (WSIS) and also taking into account the significance of the Digital Solidarity Fund (DSF) (ibid). Of central concern to WIPO is how to improve access to new technologies in the light of development, livelihood and environmental goals.

19. In addition WIPO (2009a) lays down the following seven issues as also forming the mandate of WIPO:

- (a) Recommendation Number 25 (Cluster C): "Exploring intellectual property-related policies and initiatives necessary to promote the transfer and dissemination of technology, to the benefit of developing countries and to take appropriate measures to enable developing countries to fully understand and benefit from different provisions, pertaining to flexibilities provided for in international agreements, as appropriate.
- (b) Recommendation Number 26 (Cluster C): 'To encourage Member States, especially developed countries, to urge their research and scientific institutions to enhance cooperation and exchange with research and development institutions in developing countries, especially LDCs'.

(c) Recommendation Number 27 (Cluster C): 'Facilitate intellectual property-related aspects of ICT for growth and development: Provide for, in an appropriate WIPO body, discussions focused on the importance of intellectual property-related aspects of ICT, and its role in economic and cultural development, with specific attention focused on assisting Member States to identify practical intellectual property -related strategies to use ICT for economic, social and cultural development'.

(d) Recommendation Number 28 (Cluster C): 'Explore supportive intellectual property-related policies and measures Member States, especially developed countries, could adopt for promoting transfer and dissemination of technology to developing countries'.

(e) Recommendation Number 29 (Cluster C): 'To include discussions on intellectual property-related technology transfer issues within the mandate of an appropriate WIPO body Cooperate with other IGOs to provide to developing countries, including LDCs, upon request, advice on how to gain access to and make use of intellectual property-related information on technology, particularly in areas of special interest to the requesting parties'.

(f) Recommendation Number 31 (Cluster C): 'Undertake initiatives agreed by Member States, which contribute to transfer of technology to developing countries, such as requesting WIPO to facilitate better access to publicly available patent information'.

(g) Recommendation Number 32 (Cluster C): Have within WIPO opportunity for exchange of national and regional experiences and information on the links between IPRs and competition policies."

20. Apart from these mandates 'The Committee on Development and Intellectual Property (CDIP)' was established by the WIPO General Assembly in 2007 to (i) develop a work program for implementation of the adopted recommendations; (ii) to monitor, assess, discuss and report on the implementation of all recommendations adopted, and for that purpose it shall coordinate with relevant WIPO bodies; and (iii) discuss IP and development-related issues as agreed by the Committee, as well as those decided by the General Assembly. Consequently, implementation of the above recommendations has been monitored, assessed, discussed and reported at the CDIP (WIPO, 2009a).

#### 1.4 TRANSFER OF TECHNOLOGY (TOT): SCOPE, MODES, PROCESS AND IMPACT

21. In terms of its scope, 'transfer of technology refers broadly to a series of processes enabling and facilitating flows of skills, knowledge, ideas, know-how and technology among different stakeholders such as university and research institutions, international organizations, IGOs, NGOs, private sector entities and individuals, as well as international technology transfer among countries' (WIPO, 2011).

22. As a process technology transfer" is the process by which commercial technology is disseminated. Technology transfer should be distinguished from technology diffusion. The latter is better seen as another benefit that the transfer of technology may bring to a host economy. This can be achieved by the fact that the introduction of a technology into a host country creates an awareness of that technology. That awareness may spill over into the economy as a whole (WIPO 2011, Ff 2).

23. The draft TOT Code has listed the following five transactions:

(a) The assignment, sale and licensing of all forms of industrial property, except for trademarks, service marks and trade names when they are not part of transfer of technology transactions;

- (b) Included in know-how and technical expertise are feasibility studies, plans, diagrams, models, instructions, guides, formulae, basic or detailed engineering designs, specifications and equipment for training, services involving technical advisory and managerial personnel, and personnel training;
- (c) The provision of technological knowledge necessary for the installation, operation and functioning of plant and equipment, and turnkey projects;
- (d) The provision of technological knowledge necessary to acquire, install and use machinery, equipment, intermediate goods and/or raw materials which have been acquired by purchase, lease or other means; and
- (e) The provision of technological contents of industrial and technical co-operation arrangements. (UNCTAD, 2001).

## 1.5 ADAPTATION AND CUSTOMIZATION

24. The technology recipient may be able to obtain existing public domain technology from the bigger pool of knowledge and adapt such technology to his or her own needs. Where a technology is transferred through a voluntary agreement between the technology holder and the technology recipient, it also enhances cooperation and collaboration between two parties. Indirectly, at the macro level, the transfer of technology enriches the technological basis of a given society or country, widely believed to act as a catalyst for national economic growth (WIPO, 2009a)

## 1.6 BENEFITS OF TECHNOLOGY TRANSFER: PARTNERSHIPS AND GROWING POOL OF KNOWLEDGE

25. There are many reasons why technology transfer is encouraged and is considered desirable.

- (a) The required technology is available and accessible in a less risky, more efficient and more economic manner.
- (b) The complexity of technology used in a product requires a company to cooperate with others, which have expertise in other technical fields.
- (c) In certain fields of technology, competition within the sector is so strong that new products with new functions and designs appear in the market regularly in a short cycle.

26. To keep up with the speed of technological development and global competition, acquiring new technology from others may allow companies to go beyond their own R&D to find the best technologies, and integrate them into the company's own settings. Consequently, while many companies have been integrating both mechanisms into their innovation processes, namely, in-house innovation and technology acquisition from others, the latter is used increasingly strategically with a view to the strengthening the company's overall business model. Many private companies have explored open and collaborative innovation mechanisms. The strategic cooperation between the transferor and the transferee of the technology may bring mutual benefits to both parties by utilizing the expertise of the other. Patent savvy companies like Microsoft, IBM, Philips, Samsung, and Microsoft have embraced open innovations to keep up with fast changing needs and to achieve innovation in an efficient and cost-effective manner (Damodaran, 2013).

## 1.7 TRANSFER OF TECHNOLOGY: ENABLING MODES:

27. WIPO (2009a) lays down the following modes by which technology transfer is achieved:

### 1.7.1. Mergers and Acquisitions:

28. Transfer and acquisition of technology can take place with the transfer of ownership of properties, such as a purchase of production lines, or through acquisition of a factory or a merger and acquisition (M&A) involving more than one company. In many instances, tangible assets inherently involve both implicit and explicit technological knowledge. In the case of M&A, transfer of intangible property, such as patents, would normally occur together with the transfer of tangible property. This would allow the new patent owner to obtain exclusive rights to prevent others from using, making etc. the patented invention without the new owner's consent. Joint ventures and collaborative research support the exchange of knowledge, know-how and expertise of researchers participating in the collaboration, and stimulate the creation of new ideas through such exchange of knowledge. (Ibid)

### 1.7.2. Foreign Direct Investment (FDI)

29. This involves direct and unilateral investment made by a technology holder. For example, foreign direct investment (FDI), such as a company establishing an R&D laboratory in another country, may affect technology spillover to researchers and engineers in the other country. For a firm considering investing in another country, FDI has the advantage of keeping the technology within the affiliated firm (ibid).

### 1.7.3. Tacit channels:

30. Knowledge and know-how may be transferred through observing what others do or learning by watching. As far as international technology transfer goes, one research paper suggests that learning by doing and subsequent labor turnover is an important channel of international technology transfer. It considers that the international movement of people has a potentially much larger role to play in fostering international technology transfer (ibid).

### 1.7.4. Matching Conditions for Transfer of Technologies

31. Mere acquisition of a patent per se, may not play much of a role in transferring new technological knowledge to the new patent owner, since the technological information relating to that patent has already been published by the patent office concerned (ibid). On the other hand, actual "use" of the patented technology by the new owner may lead to him or her understanding the relevant technology better and gaining technical know-how related to such technology. In other words, it is in the interest of the patent licensor that the licensee acquires all knowledge, including tacit knowledge that may not be obvious from the patent document, to utilize successfully the patented technology on a commercial scale and in a profitable manner. Therefore, trade secrets and know-how contracts often go hand-in-hand with a patent license.

### 1.7.5. Technology licenses

32. Play a crucial role in joint venture agreements and collaborative research agreements, which are also important ways to transfer technology in a win-win environment (ibid).

### 1.7.6. Safeguards

33. It should be noted that if the exploitation of the patented invention infringes another valid patent that claims a broader scope of technology covering the said invention, the consent by the owner of such broader patent is required in order to exploit the off-patent invention (WIPO 2009a) Public domain technologies may be transferred through technical publications and literatures or through products that exhibit their embedded technologies. For example, studying may transfer technology and examining technologies used in the acquired product (so-called reverse engineering) (ibid). Such a form of transfer, however, requires an absorptive capacity on

the part of the transferee to explore, understand and imitate the embedded technologies. There is usually a learning curve that increases the absorptive capacity by means of repeated “trials and errors” (ibid).

#### 1.7.7. Absorptive Capacity:

34. Technology and knowledge transfer requires absorptive capacity on the part of the transferee to understand and adapt the technology for his or her own purpose, often in the specific setting of the transferee. Therefore, a number of reports stress the crucial importance of the development of the transferee’s capacity through education and R&D and the development of appropriate institutions. (WIPO, 2009a).

#### 1.8. EVIDENCE ON TOT

35. In general, a bigger pool of technology is available internationally than nationally, international procurement of technology is a natural solution to obtain new technology and to foster new innovation based on the acquired technology, particularly with a view to increasing competition at the global level (WIPO, 2009a). Due to a disparity in technological capacity among countries, at the macro level, technological knowledge generally flows from a higher technological capacity country to a lower technology capacity country, i.e., in a simplistic manner, from a party in a developed country to a party in a developing country. Such a description, however, may be too simplistic and static (ibid).

36. Arora (2009) states technology transfer can filter through a number of channels. The major modes of transfer are imports of goods and services, especially of capital goods, foreign direct investment (i.e. via multinational corporations (MNCs)), licensing and joint ventures, foreign trade, and movement of people.

37. Maskus (2004) also points out that technology can be involuntarily transferred, via imitation.

38. The technology holder does not participate in this transfer, and in many cases, may actually seek to restrict it. This point is worth noting for, as also discussed later, and although the presumption is that IP protection may retard such transfer. Though, there is an intriguing possibility that patents may facilitate such transfer. For example a study on the global flow of biotechnology related innovations by the U.S. International Trade Commission in 2008 found conclusively that “patents and other types of intellectual property facilitate increasingly frequent collaborations by providing the foundation for the transfer of technology. The publication of patent applications and patents are in and of themselves one of the most powerful mechanisms of technology transfer (Global Intellectual Property Center, n.d.).

39. A second source of transfer is exports by recipient country firms: it is plausible that exports are a means of learning not only about demand conditions but also technology. Many large firms control supply chains. Firms in developing countries that participate in such supply chains may receive a variety of training and technology from their customers. A third major source of transfer is the diffusion within the recipient country of the transferred technology. This diffusion can itself take place through purchase of goods or licensing, but is more likely to take the form of movement of people or direct imitation or both. However, trade secrecy (and related employment rules) could play an important role in retarding diffusion of technology by preventing possible know how spillovers arising from movement of people/workers.

40. Here one comes across statistics as pointed to by Arora (2009). In the past 20 years there is serious evidence of technology markets having picked up. Cross-border receipts and payments for disembodied technologies have picked up. Robbins (2006), using data from the International Investment Division of the US Bureau of Economic Analysis, estimated that US corporations purchased international industrial-process licensing and R&D and testing services totaling 12 billion US dollars in 2002, while they received 23 billion US dollars from foreigners for these items. Robbins estimated that US corporations received 67 billion US dollars in revenues

from licensing industrial processes. Total R&D in the US in 2002 was about 280 billion US dollars and that performed by industry was 192 billion US dollars. Thus, transactions in technology account for a little less than 25 per cent of total US R&D and about 33 per cent of the R&D performed by industry (Arora, op.cit).

41. Thus, markets for technology are large and substantial, and the evidence suggests that they have grown faster than total R&D over the last decade or so. Interestingly, Robbins' (2006) estimates also indicated that more than half of the transactions involving US firms either as sellers or buyers of technology have an international counterpart (Arora, op.cit).

42. This fact points to the continued growth of international technology markets. Other evidence also points in the same direction. Using data from the World Bank's World Development Indicators, Athreye and Cantwell (2007) found that international patent licensing and royalty receipts have surged since the mid-1980s. From around 10 billion US dollars in 1984, international patent licensing and technology receipts grew to more than 80 billion US dollars in 2002 (on current prices), (Arora, 2009).

43. Over 120 countries reported receiving such royalties and more than 130 countries reported making such payments in 2002 (Arora, op.cit). Similarly, Mendi (2007a) analyzed data from the OECD's Technology Balance of Payment (TBP) database. The TBP database covers technology transfers in the form of licensed patents, know-how, trademarks, and the like, but excludes licenses of software or designs (along with advertising, insurance, and, more typically, commercial transfers). Mendi (2007a) found that between 1970 and 1994 the total volume of international receipts and payments for technology deals in 16 OECD countries (comprising the leading European countries, the US and Japan) have increased more than 10-fold. Receipts increased from about 3.6 billion US dollars to 46 billion US dollars, using purchasing-power-parity exchange rates, and payments increased from about 3.1 billion US dollars to 33.9 billion US dollars (Arora, op, cit).

44. Hoekman et. al. (2004) extend insights by adducing data on the flow of technology trade among high income OECD countries and between high income OECD countries and (i) upper-middle income countries; (ii) lower-middle income countries; (iii) low income countries; and (iv) sub-Saharan states, respectively, and compared the data between 1971 and 2001 (ibid). They found that upper-middle income countries constituted the fastest-growing market for technology-intensive exports from OECD countries and, at the same time, they had become suppliers of technology intensive products together with lower-middle income countries. While middle-income countries collected royalty income of \$12.7 billion from OECD countries in 2001, the amount collected by low-income countries was \$2 billion. Another researcher reported some specific cases where a technology holder in a developing country transferred his technology to a party in a developed country (ibid, cited by Arora, op.cit).

45. It is generally agreed that access to technologies required for development is crucial to developing countries. A number of international agreements contain provisions that express commitments by developed countries to incentivize companies and institutions in their territories to transfer technologies to developing countries. International technology transfer has been a recurring topic on the international agenda (ibid). In particular, from the 1970s to the 1980s, the issues relating to the transfer of technology were debated through negotiations concerning a Draft Code of Conduct at the United Nations Conference on Trade and Development (UNCTAD) and a revision of the Paris Convention at WIPO, both of which were unsuccessful (ibid). While many would agree that the transfer of technology is a cornerstone for the stimulation of innovation and development, less agreement is found with respect to how that can be achieved. Some scholars note that the transfer of technology landscape has greatly changed and that understanding the process of technology transfer has undergone significant changes during the past three decades (ibid).

46. Box 1 carries empirical evidence from more studies regarding transfer of technology, FDI and Patents in various parts of the world. The evidence points to the fact that patents is only an instrument for protection of inventions but is also as an element in company's appropriability strategies and in conjunction with FDI and technology import contracts. Also while some studies showed a positive association of strong patent laws with technology transfer, others did not indicate a similar dispensation.

**BOX 1: Patents and Technology Transfer: Evidence from Empirical Studies**

Andres Lopez (2009) argues that the role of patents in appropriability standards is complex. Patents appeal to larger than smaller firms and SMEs that adopt aggressive patent strategies often do so, not for exploiting their innovations, but for licensing or selling their patents. Also Andres Lopez (2009) argues that patents are used by most firms in conjunction with other appropriability strategies, often for reasons other than protection of innovations. Given this complexity, the impact of patents on technology transfer needs to be carefully assessed. Many empirical studies have adduced evidence on the inter-relationship between the two variables and their association to FDI, Licensing and Technology Import Contracts these have been comprehensively reviewed by Arora (2009). The findings of the studies reviewed by Arora in the ensuing paragraphs.

Maskus (2004) provides a comprehensive overview of the literature on IPRs and technology transfer. Arora, Fosfuri and Gambardella (2007) explored international technology licensing in its relation to technology transfer. Maskus, Saggi and Puttitanum (2004) provided a survey of the theoretical and empirical literature on patents and technology transfer through direct foreign investment and licensing (Arora, 2009).

The relationship between Patents and Technology transfer is part of the larger issue about the economic and social impacts of Patents. It is well stated that patents as protective devices tend to increase monopoly power and social welfare loss, which in turn is induced by deadweight loss. Stronger IPR protection may promote 'higher price for technology rather than higher "quantity" or quality of technology' ( Arora, 2009). Some studies, on the other hand, investigate whether the recipient firm increases its own technology activities, indicating an increase in the extent of technology transfer, rather than merely a price increase investigating whether the recipient firm increased profits or productivity or, better still, whether it introduced new products or lowered its costs ( Arora, op.cit). Smith (2001) related US exports, sales of foreign affiliates and licensing fees to the Ginarte-Park patent index in several developed and developing countries and found significant evidence that stronger patent protection would increase affiliate sales and licensing payments, the result driven by the countries with strong imitative capacities (measured by a high percentage of engineers and scientists in the population)(Arora, op.cit). Xu *et al* (2005) (cited by Arora,2009) carried out a similar study of international technology diffusion through trade and patenting in a sample of 48 countries for the period 1980–2000. They used the Ginarte- Park index and found that rich countries benefit from domestic technology and foreign technology embodied in imported capital goods; middle-income countries enjoy technology spillovers from foreign patents (patents filed in the country by foreigners) and imported capital goods; developing countries benefit mainly from foreign patents. Bascavusoglu and Zúñiga (2002) used as their dependent variable the receipts in technology services flows exported by French firms to 19 countries over the period 1994-2000 and found a positive, although weak, effect of the degree of patent protection at the country level on the amount of such receipts. Patent protection seems to matter most for countries with strong imitative abilities and for industries with a medium level of R&D intensity.

These studies lead to the argument that strong patent protection promotes better technology transfer and diffusion.

The related question that has been probed is which mode of technology transfer (FDI vs. licensing) has better impacts on technology transfers.

FDI is intuitively appealing insofar as the following facts cited by Arora (2009) denote: Foreign direct investment is a major source of technology flows across countries. Seven hundred multinational corporations accounted for 46 per cent of the world's total R&D expenditure and 69 per cent of the world's business R&D in 2002 (UNCTAD,2005). Indeed, the R&D budgets of the largest firms exceeded the entire R&D spending of virtually all developing countries. A recent comparison showed that in 2003, the R&D spending of firms such as Ford, Siemens, Pfizer and Chrysler was around 7 billion US dollars each, greater than the combined R&D expenditures of all CIS states, or the newly admitted EU member states (see Javorcik, this publication).

Arora,(2009) cites the study by Eaton and Kortum (1996), regarding productivity growth and technology diffusion in the OECD countries which concluded that smaller and less-technologically advanced OECD countries derived most of their productivity growth from having foreign inventors patent in their economies. On the other hand, McCalman (2001) who applied the Eaton and Kortum approach to a sample of developed and developing countries has found that patent harmonization (which has *de facto* resulted in a strengthening of patent protection) leads to an increase in patent value (as reflected in the contribution to economic growth) ( Arora, op.cit).

As Arora (2009) notes, it is possible that changes in IPRs may increase or decrease the total amount of technology transfer, in the process changing its share through FDI or licensing or imports. The final challenge, is the answer to the question as to the extent or form of technology transfer on contractual provisions. Maskus and Penubarti (1995) found that import volumes were positively and significantly affected by increases in this patent index across most manufacturing categories, particularly in large and middle-income countries. , Smith (1996) showed that patent rights strongly and positively affected the inflows of knowledge, measured as R&D expenditures undertaken on behalf of affiliates. Again, this finding applied only to recipient countries with strong imitative abilities; the impact was absent in countries with weak imitative abilities.

On the other hand, Primo Braga and Fink (1998) found no statistical relationship between patent rights, measured by the Ginarte-Park index, and international FDI flows or stocks. Blyde and Acea (2002) estimated the relationship between patent rights (measured with the Ginarte-Park index) and imports and FDI into Latin American countries. They found that imports were higher for higher values of the Ginarte-Park patent index for developed countries but were insensitive to patents in the developing countries. However, bilateral inflows of FDI from OECD countries were higher for higher values of the Ginarte-Park index, even after controlling for institutional variables ( Arora, op.cit).

Ferrantino (1993) used data for 1982 on US exports and sales of overseas affiliates of US firms to identify the cross-country determinants of both exports and sales of multinational affiliates of these firms. The author suggests that US firms export higher than expected volumes to their affiliates in countries that have weak IP regimes to limit technology leakage to their rivals abroad by confining production within the US. Javorcik, who explored differences in reliance upon patents across industries, takes a somewhat different approach. She found that firms in industries relying heavily on IPR protection are (*ceteris paribus*) more likely to invest in transition countries with stronger IPR protection (Javorcik (2004)). This is an example of exploiting the differences in IP regimes across industries and countries.

**Sources : Lopez (2009) and Arora ( 2009)**



## 1.9. BARRIERS TO TOT

47. Arora (2009) states that the case for transfer of technology from developed countries to developing countries is compelling on account of the need to correct the economic disparity between the two categories and the intuitive appeal of achieving this at lower costs. Barriers to technology transfer can be categorized into the following: (a) Supply Side restrictions that cause an inventor not to transfer patented technology to a potential user in a developing country, for want of adequate remuneration or fear of unauthorized spillover of the protected technology in the recipient country on account of weak IP laws in the latter. This may arise from two situations: (i) The royalty rates or license fee for use of the technology is unaffordable to the recipient (ii) The inventor withholds the technology from the recipient despite being promised an attractive royalty/ license fee. The latter happens when the inventor has a stake in having a monopoly over the production of the invented product/technology or for other strategic reasons of appropriability. A set of instances involving India and China in relation to Climate Smart Technologies is provided in Box2.

48. Thus Andres Lopez (2009) argues that patents are used by most firms in conjunction with other appropriability strategies, often for reasons other than protection of innovations. This may include the complex inter-relationship between the variables of FDI, Licensing and Technology Import Contracts as reviewed by Arora (2009). A few studies indicate positive association, while a few others indicate no association amongst the three variables.

49. Arora (2009) notes, it is possible that changes in IPRs may increase or decrease the total amount of technology transfer, in the process changing its share through FDI or licensing or imports. The final challenge, is the answer to the question as to the extent or form of technology transfer on contractual provisions. Contracts that carried Patent licensing regimes entailed effective transfer of technologies than those without them. ( See BOX 3)

50. Maskus and Penubarti (1995) found that import volumes were positively and significantly affected by increases in this patent index across most manufacturing categories, particularly in large and middle-income countries. Smith (1996) showed that patent rights strongly and positively affected the inflows of knowledge, measured as R&D expenditures undertaken on behalf of affiliates. On the other hand, Primo Braga and Fink (1998) found no statistical relationship between patent rights, measured by the Ginarte-Park index, and international FDI flows or stocks. Blyde and Acea (2002) estimated the relationship between patent rights (measured with the Ginarte-Park index) and imports and FDI into Latin American countries. They found that imports were higher for higher values of the Ginarte-Park patent index for developed countries but were insensitive to patents in the developing countries. However, bilateral inflows of FDI from OECD countries were higher for higher values of the Ginarte-Park index, even after controlling for institutional variables ( Arora, op.cit).

51. Demand side constraints arising from inability to utilize the transferred technology, for larger spillover effects, on account of absorption constraints due to inappropriateness of the protected technologies to the developing country context. Citing Romer(1990), Arora points out 'while technical progress requires investment in research and development, technology, once developed, can be applied broadly and at a lower expenditure of resources than were required to develop it in the first instance), the larger issue is .of the appropriateness of the technologies developed in the 'North' to the 'South' (Arora, op.cit). This then is a major barrier to effective transfer and diffusion of technology from the North to South.

52. Strengthening IPR regime in a developing country is considered a panacea for supply side constraints. However there are many issues on what steps / features constitute strengthened Patent Laws. There are two trends to be noted here. The first trend is to strengthen a patents system in a developing country by minimizing research and public use exemptions. Correa (2011) observes in such a situation, 'a strict IPRs regime can discourage research and innovation by locals in a developing country. However there is evidence to the contrary. Thus

Ryan (2010) in his study of Brazil describes how the introduction of product patents in the country in 1996, led to Sao Paulo's bio-medical technology entrepreneurs making risky investments in innovation promoting activities<sup>1</sup>.

53. It is likely that where most patents in the country are held by foreign inventors or corporations, local R&D can be stifled since the monopoly rights conferred by patents could restrict the research by local researchers. The other situation is where a Patent Regime is strengthened in terms of providing possibilities of protecting inventions that lack depth in comparison to the state of art. This in practice means the criteria for 'novelty' and 'inventive step' is not rigorously laid down and 'cosmetic inventions' are rewarded with patents. The problem can be obviated by preventing patents on such cosmetic inventions or by having better disclosure standards<sup>2</sup>.

54. Apart from creating demands for compulsory licensing, this discourages possibilities of break-in by local companies who feel crowded out by cluster patents around say, 'a promising biological compound'<sup>3</sup>

55. Correa op.cit refers to the instances of adverse impacts by way of 'crowd-out' experienced by local firms in Brazil, Colombia and South Africa. As he states, 'The results obtained regarding domestic patenting are particularly surprising for Brazil, a country with a large and solid R&D infrastructure. Only one patent out of 287 was identified as owned by a Brazilian manufacturer. In the case of Argentina, only 15 out of 951 patents were obtained by nationals (eight companies, one research institute and 5 individuals) in 2000-2007. In Colombia only two patents in the pharmaceutical field were granted to domestic applicants in the studied period (related to recipients and not to a particular active ingredient). In South Africa, 10 patents were registered by local companies, research institutions or individuals in 2008.'(Correa op.cit).

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<sup>1</sup> This finding underscores the point that patent regimes, if carefully structured, can lead to increase in incentives on the part of local entrepreneurs in developing countries.

<sup>2</sup> It has been argued that a high inventive step precludes disclosure of essential information on the state of R&D in industries because in the absence of a patent, small inventions are not disclosed and each inventor has to necessarily personally arrive at all the required complementary expertise to be able to get a patent. Hence low level of disclosures lead to duplicate R&D costs and can be avoided through the grant of patents based on a low inventive step (Meniere, 2005). The counter to this argument is that a lower standard of inventive step is dys-functional for both cumulative (sequential) innovations (such as biotechnology, where disclosure of previous 'state-of-the-art' is important) and complementary inventions (where each invention is a step towards a new technological frontier

<sup>3</sup> Correa, 2011, supplements this point with the following examples. 'Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should be allowed in narrowly defined, exceptional cases. Polymorphs and isomers (when the racemic mixture was already disclosed) should not be patentable. the number of patents over simple changes in chemistry/formulation of existing pharmaceutical products (e.g. polymorphs, combinations, dosage forms, isomers) has continuously increased. In many of these cases, the need to grant a compulsory license would have not existed, if the patent offices had applied a more rigorous standard of patentability. Thus, lopinavir in combination with ritonavir ('Kaletra') for which a compulsory license was requested in Colombia, is a combination which does not show a new and non-obvious synergistic effect and would not be considered patentable if rigorous standards were used to assess the inventive step. The same would apply to the combination of lamivudine and zidovudine ('Combivir'); a patent on this combination was subject to compulsory license in Malaysia. Indeed as Correa proceeds to note, even where there are laws that prohibit such patents, there are instances where patents have been given to 'cosmetic innovations'. In Argentina, a large number of patents have been granted on salts, compositions, isomers, polymorphs, esters and ethers, including claims on therapeutic indications and doses that are not patentable under Argentine law In Brazil, the study of the patents relating to anti-retroviral (ARVs) showed that a number of them had been granted on 'compounds' and formulations despite the intervention of ANVISA, Correa,op.cit.,p 11.

India is an exception to this rule of 'crowd-out', despite introduction of TRIPS compliant Patent Laws during 1999-2005, on account of its inherent R&D strengths in the drugs and pharma sector<sup>4</sup>.

56. As Correa op,cit mentions "Patent offices should develop, in consultation with health authorities, guidelines to examine such applications so as to ensure the patents are only granted where genuine contributions to the state of the art are made." Referring to such Patent laws in developing countries in the context of the drugs and pharmaceutical sector, Correa (2011) states 'As incremental innovations prevail in most sectors, the patent system has increasingly moved away from its objective of stimulating genuine invention towards a system for the protection of investment in developing incremental innovations, whether truly inventive or not. As a result, for some analysts, "the time has come not for marginal changes but for wide-open thinking about designing a new system from the ground up.'

57. "As patents are unlikely to promote local innovation in pharmaceuticals, governments should consider options other than the patent system to encourage it, particularly with regard to diseases that disproportionately affect the population of developing countries."( ibid).

#### **BOX 2: Patents as Barriers to Transfer of Technology: The Case of Climate Technologies**

The barriers to transfer of climate friendly technologies arise from the number and density of patents on components, equipment's and know-how, infirmities and 'tying' resorted to in License agreement Models that are non-patent based, relatively poor information on ' low cost suppliers , absence of emerging economies that are interested in South- South Technology Transfer arrangements in the patents landscape when it comes to critical renewable energy technologies. Khor (2012) adduces the following evidence from five research studies on technology transfer in relation to climate friendly energy based technologies with reference to India and China.

Ockwelle *al.* (2007) looked at Light Emitting Diode (LED) lighting technology and the main barriers that India faced in the transfer of such technology. The study concludes: "Another barrier relates to the IPR issue associated with LED manufacturing. It is a highly protected technology. As there are various processes involved in manufacturing LED chips, each process is patented and requires huge investment. At present, the cost of investing in both chip manufacturing and resolving IPR issues is substantially high compared to importing the chips."

The study also indicates significant IPR issues faced by Indian manufacturers in biomass technology and in manufacturing hybrid vehicles since there are many patents associated with the equipment and technologies. On "biomass technology" the study found that IPRs, though it is "not a very important issue" in this sector in the context of India, has created "some friction between the European and Indian manufacturers of briquetting machines" as "small-scale industries such as briquetting machine manufacturers are typically 'copycat' businesses based on reverse engineering

A study by Barton (2007) on three sectors (solar photovoltaic, biofuels and wind technology) found that despite patents being prevalent in these sectors, competition between the various types of energy kept prices and costs relatively low. However his study did not rule out IPRs being a possible barrier, and he warns of "serious plausible patent issues likely to arise from the new technologies" and the risk of broad patents which may complicate the development of new, more efficient or less expensive technologies, as well as anti-competitive practices if the small number of suppliers cooperate to violate competition-law principles. On Barton's study, Ockwell (2008)

<sup>4</sup> In India, the only developing country where domestic patenting in pharmaceuticals is significant, the innovative capacity to reverse-engineer and improve on existing processes and products pre-existed the introduction of product patent protection. In order to improve the transparency of the patent system, the international non-proprietary name (INN) of drugs, when known at the time of filing of a patent application, should be mandatorily disclosed in its title and abstract.'( Correa, op.cit)

states: "It is notable that for all of the case studies he examines, uncertainty is expressed as to the likelihood of developing country firms gaining access to the most advanced technologies in these industries".

In the case of photovoltaic<sup>8</sup> technology, Barton suggests that access to the newer thin-film technologies (which is subject to much more extensive patenting than the older silicon-slice technology) is likely to be difficult. Similarly patent holders of new methods, enzymes or microorganisms important in the case of biofuels may be hesitant to make these technologies available to developing country firms. Barton also identifies wind technologies as an area where existing industrial leaders are hesitant to share their leading technology for fear of creating competitors. On wind technologies, Ockwell (2008) argues that only smaller companies in developed countries which are likely to gain more from licensing and lose less from competition are willing to sell licenses for use of their technologies. In support, Ockwell refers to a study by Lewis on how leading wind technology manufacturers in developing countries like Suzlon (India) and Goldwin (China) acquired access to wind technology by license purchases but from second-tier developed country firms which had less to lose in terms of competition and more to gain in license fees. Leading firms in developed countries have been reluctant to license their technologies to potential developing country competitors.

TERI, (2009) cites the case of Chinese Yantai Integrated Gasification Combined Cycle (IGCC) demonstration power plants, in which Chinese companies failed to get technology from foreign companies "due to high cost and reluctances to transfer the key technologies on the part of patent holders". After prolonged negotiations, the project was stopped.

TERI (2009) also points out that the IPRs create a barrier not only in terms of direct costs (i.e. royalties or license fees) but also increased spending by the recipient company, either due to refusal of technology transfer or unreasonable conditions put in the technology transfer agreements. For instance a Malaysian company Solartif managed to get access to foreign technology only on condition of buying machines from the technology holder. (TERI, 2009).

A recent study (Zhuang, 2011) on whether patented wind technologies have been transferred to developing countries shows how wind companies in China have faced problems relating to IPRs.<sup>12</sup> Citing data from Lee (2009), the study points out that Germany, US and Japan owned around 60% of wind technology patents approved in 1998-2007, while Denmark, Spain, UK, France and the Netherlands together accounted for another 23%. China may be the largest owner of patents in emerging economies for wind technology but its share of claimed priority patents was only 1.5%.

There has been a major boom in China in companies that manufacture wind power equipment. However, to produce a piece of complete wind power equipment, China has to buy foreign design and technologies related to core components, such as gear boxes, which generally contribute to the largest part of the price.

The requirements for China to access patented wind-energy technologies are also very strict. Zhuang (2011) cites a survey by Zhou et al. (2010) that on average Chinese companies have to pay high licensing fees for the technology and 5 per cent royalties per piece of equipment when the final product is sold domestically; however, higher royalty fees usually apply when the final product incorporating foreign patent(s) is exported.

Technologies transferred in respect of wind power are not the most advanced. China and India often have to obtain technology from second or third tier wind power companies who had less to lose in terms of international competition, and more to gain with regard to license fees.

China has not acquired the corresponding technological capacities. Most applicants for renewable energy-related patents have been foreign enterprise subsidiaries in China; China's top three applicants for wind power patents are all developed country enterprises. During the past twenty years, the gap in wind turbine technology between China and developed countries has not been narrowed.

Shashikant (2010) also points out that opportunistic & anti-competitive lawsuits taken by patent owners can hamper access to climate technologies. IP holders are known to use legal suits to preserve their market monopoly, or to place themselves in a position to be able to extract significant royalties from the opposing entity that has used or intends to use the protected technology.

**Source: Khor (2012)**

### **BOX 3: Patents, Technology Import Contracts and FDI**

Patents to some extent explain the why or 'why not' of technology transfer, However Patents are only part of the story. Foreign Direct Investment(FDI) , the non-Patent conditionalities in Technology Import Contracts also have their share in explaining technology transfer. With reference to evidence garnered from research studies that focus on both developed and emerging economies, an OECD study concluded that the index for patent rights tends to be positively associated with inward FDI, holding other factors constant. Such a relationship holds for developed, developing and least-developed countries though quantitatively the association is strongest in developed countries (Walter Park et al, 2007).

Arora(2009) in an extensive review of literature cites the following findings and points:

#### **Patents and Content of Technology Import Contracts**

Nagaoka (2005) analyzed how the price of technology imported by Japanese firms depended on the strength of patent protection, and found that high royalties are more likely to be observed when the licensing contract also includes patents. In short, stronger IPRs help increase the share of a technology's value the licensor can appropriate.

Arora (1996) used a sample of 144 technology-licensing agreements signed by Indian firms to test the empirical relevance of patents. He employed the provision of three technical services –training, quality control, and help with setting up an R&D unit – as empirical proxies for the transfer of know-how. He found that the probability of technical services being provided was higher when the contract also included a patent license or a turnkey construction contract. Mendi (2007b) used a sample of technology import contracts by Spanish firms in 1991.

#### **Patents and the Mode of Transfer (FDI vs. Licensing)**

Smith (2001), in the study cited earlier, found that US firms are more likely to export or invest indirect manufacturing facilities rather than license technology in countries with weak patent regimes. Similarly, Nicholson (2002) and Puttitanun (2003), both of whom used data on the number of various kinds of contracts (exports, FDI, licensing) found that increases in the patent index significantly raised both FDI and licensing, but also that the mode of transfer tended to shift towards licensing. Puttitanun (2003) analyzed decisions on entry mode by US firms in 135 industries and 62 countries in 1995 and showed that while stronger patent rights increase total entries by multinational firms, they especially enhance the location advantage of FDI and licensing vis-à-vis exports. However, strong patent protection is associated more with increases in FDI than licensing. Javorcik (2004) used data on FDI projects to Eastern Europe and found that weak patent protection shifted the composition of FDI away from technology intensive industries, and away from production towards distribution.

Eapen and Hennart (2002) analyzed whether technology was transferred through joint ventures or licensing for a sample of Indian firms. Their final sample consisted of 126 Indian firms of which 75 were local partners in joint ventures with foreign firms and 51 were licensees of foreign firms. They found that whether the technology is patented in India or not their measure of patent protection did not influence the choice between licensing and joint ventures.

Yang and Maskus (2001) found that license fees for industrial processes paid by unaffiliated foreign firms to US firms in 26 countries in the years 1985, 1990 and 1995 were higher for higher values of the Ginarte-Park index. On the other hand, Fink (1997), using German data, found a very weak relationship between the strength of patent protection and the level of technology licensing.

Using the same dataset as Mendi (2007), Mendi (2005) analyzed a sample of contracts that included technology transfers to Spanish subsidiaries of overseas firms in 1991. He found that know-how is more likely transmitted within multinationals than between unrelated firms, but there is no difference in the transfer of codified knowledge.

Arora and Ceccagnoli (2005) showed that stronger patent protection increased patenting, but that it does not increase licensing by large firms. Small firms, and firms lacking commercialization capability, are more likely to license in response to stronger patent protection. In other words, stronger patents may favor FDI when the technology is owned by large firms that are able to invest globally. If the technology is owned by smaller firms, this will increase licensing. It is plausible that mature technologies diffuse through informal channels (perhaps embodied in plant and equipment), whereas more advanced technologies require mechanisms such as licensing or FDI. An obvious, and understudied, research question is the impact of IP protection on the transfer of technologies with varying levels of sophistication and complexity. This is particularly true with nascent technologies associated with Carbon Capture and Storage (CCS) which are considered to be 'low carbon clean coal technologies' particularly suitable for a number of developing and emerging economies (including India, China, Indonesia, South Africa) which have energy sectors predominantly driven by coal.

In thinking about technology transfer to emerging economies, it is very important to distinguish between technologies intended to serve the domestic market (of the recipient country) vs. technology intended to produce exports for developed countries. If the technology being transferred is for producing goods and services for the export market, what matters is the patent protection the technology holder enjoys in the export market. In other words, consider the case where a new chemical process is being introduced into a country, where it will be used to produce plastics for export. If the process were illegally copied, typically the technology holder would be able to block exports into the most important export countries, provided the technology holder enjoyed patent protection in those countries. This implies that transfer of technology should be relatively insensitive to patent protection in the developing country; for instance, there are substantial export markets where the technology is not patent protected. Of course, as a practical matter, the technology holder may greatly prefer to prevent competition by preventing its use in production in one country rather than protect its importation in a number of markets.

**Source: Arora (2009)**

#### 1.10. EXISTING RECOMMENDATIONS:

58. Some of the salient points highlighted in WIPO (2009a) include a detailed analysis of various limitations on technology transfer as well as a set of recommendations in order to facilitate transfer of technologies from the developed countries to developing countries. The main elements of the recommendations centre on improvement in Patent Laws and Procedures, Licensing Agreements, IP ownership sharing, PPPs and transfer of technology issues between Industry and Universities and public Institutions, potential of TRIPS flexibilities and supportive environment for Patents.

59. Following are the recommendations contained in WIPO (2009a):

1.10.1. Patent application Related Issues:

60. Four provisions of WTO TRIPS Agreement (not normally mentioned in discussions on ToT) may be also relevant to the effective and efficient technology transfer. Article 29.1 of the WTO TRIPS concerning the disclosure requirement, Articles 30 and 31 concerning exceptions and limitations to the right, and Article 40 regarding anti-competitive practices in contractual licenses. (Chapter VII of WIPO, 2009a)

61. Dissemination of accurate Information relating to patent owners and related licenses are indirectly relevant to the transfer of technology as the patented information is transferred not only tacitly but also through licensing agreements transfer of rights (ibid) . Ambiguity in the ownership or unclear limits to the scope of patent protection only creates uncertainty and potential disputes, and thus becomes a barrier to the effective transfer of technology (ibid).

62. In case of patents when inventions are jointly done, the right to patent belongs to the inventors jointly. Sometimes, national laws provide, a special provision for employee's inventions where an invention is made in the performance of an employment contract, or an employee used materials or other resources of the employer. In such cases, national law provides the rights of the patent to the employer unless stipulated in a prior contract.

63. In case of Universities and Public Research organizations, (3) Coming to Universities and Public Research Institutions, it is seen that the trend is to allow public research institutions and universities to claim ownership of inventions created by their researchers, with an appropriate mechanism to remunerate the inventor researchers and taking into account the public dimensions so that the public research results would best serve the public interests (ibid)

64. In cases of joint R & D, parties also need to consider in advance their needs to license future intellectual property to third parties and how different national laws may affect such needs. Furthermore, in cases where parties to joint R & D are from different countries, they may need to take fully into account the differences concerning ownership of patents in different jurisdictions.

65. In research projects between private companies and Universities, due to the different priorities of the parties, questions of ownership and the right to use future intellectual property could be complicated.

66. Ambiguity of the claims leading to ambiguity of the scope of patent protection increase uncertainty regarding the value of the patented technology in question for both the patentee and the prospective licensee (or prospective buyer of the patent). Such uncertainty may increase transaction costs for the negotiation and potential costs for judicial procedures to clarify the scope of protection or to invalidate the patent.

67. By combining technical and legal information disclosed in patents, third parties can identify the public domain technology, which can be used freely by anyone.

68. It is important to ensure availability of access to third parties in biotechnological inventions as it requires physical access to the biological material in order for a person skilled in the art to understand the invention to the extent that he or she could carry out the invention. However, difference exist in the formal and substantive requirements regarding such a filing under national/regional patent laws.

### 1.10.2. Licensing Issues:

69. Article 40.1 of the TRIPS Agreement, it is generally recognized that some licensing practices or conditions pertaining to intellectual property rights which restrain competition may have adverse effects on trade and may impede the transfer and dissemination of technology. Consequently, Article 40.2 allows WTO Members to specify, in their national legislation, licensing practices or conditions that may in specific cases constitute an abuse of intellectual property rights having an adverse effect on competition in the relevant market. Examples of such anti-competitive practices include: exclusive grant back conditions, preventing challenges to validity and coercive package licensing.

70. Licensing is the mode by which a patent holder makes available his protected product of know-how to manufacturers or users. Licensing is an important tool as it balances the rights of an inventor with that of the society. Licensing obviates mis-use of patents, which is exemplified in a patent holder seeking monopoly rents. The exclusive patent right allows a patentee to prevent others from using the patented product or know how by outsiders. All the same, licensing precludes unauthorized use of patented product or know-how. A license may be an exclusive license, a sole license or a non-exclusive license (ibid). An exclusive, sole license over a public good like drugs and pharma products can promote monopolistic control over the product or know how. In general, licensing has a major role to play in transfer of technology provided they are free from imperfections and ambiguity,

71. One source of imperfection arises from clarity in a licensing agreement regarding 'the extent of rights licensed, terms and conditions, obligations of the licensor and the licensee, representations and warranties and clauses concerning disputes, expiration and termination of the agreement and applicable law (WIPO, 2009a). One critical point about licensing agreement is whether Government registration and monitoring of licensing agreements facilitates technology transfer process. There are some scholars who feel that monitoring of agreements by Governments will inhibit technology transfer. (Maskus,2004)

72. In case of joint licenses, the terms and conditions of exploiting the patent or IPRs need to be laid out in terms of relative contributions made by different partners either by way of research inputs or donation of IPRs to the Joint R&D or finances or organizational support to ensure that ToT's not hindered by litigations or disputes.

73. In case of patents held by Universities and academics institutions, the patented product is not related to the core business of the patent holder ToT can be facilitated through licensing fees or financial incentives.

### 1.10.3. Public- Private Partnerships, Bayh Dole and ToT

74. Collaborative innovation networks have become popular in the recent past between private sector and government-funded agencies. Many of these collaboration models rely on patent strategies and contain provisions on the management and use of patent rights. While in the private sector, companies are engaged in all stages of product development and commercialization, public sector enterprises limit themselves to financing other public institutions and commercialization is again delegated to the private sector. In addition to the legal and institutional framework of the knowledge production system, the capacity of the business sector to absorb the research results and other enabling environments are essential for effective public-private partnerships.

75. In many cases, the private sector seeks the support of the public sector entities like Universities for their research expertise, for instance in the drug and pharma or renewable energy sector. On the other hand, many universities and public research institutions are not able sufficiently to convert the results of their research into viable products, mainly because of the absence of sufficient cooperation with the private sector.



76. With an increasing number of governments allowing for public research organizations to claim ownership of their research, universities and public research institutions have, to a large extent, set up IP and licensing policies, and decide on the distribution of royalty incomes among the stakeholders. It is stated that the US Bayh-Dole Act of 1980 allowed and encouraged research institutions in the United States of America to patent technology developed with federal funding, and to license that technology in return for royalties. In principle this means that universities and small businesses may retain the title to inventions made under the funding agreement with a federal agency, subject to the fulfillment of a number of obligations in order to meet the principal objective of promoting the utilization of inventions arising from federally supported research (SCP 14/4). The Bayh-Dole Act triggered a substantial increase in patenting activities in US universities leading to increased licensing revenues in those universities and research institutions. (ibid). This has also led to a shift in the ownership of the patents from individuals and firms to the Universities itself. However, the 2009, WIPO study also suggests that increased revenue for universities through licensing agreements might not hold true. Moreover, it is also observed that patenting and licensing have been concentrated in the biomedical sciences. The Bayh-Dole Act has simplified complex administrative processes to obtain intellectual property for inventions resulting from public-funded research, and has facilitated the entry into patenting of a number of institutions with little experience in managing patenting and licensing activities.

77. Developing countries have are also actively engaging themselves in the simplification of administrative complexity to obtain intellectual property from research institutions, developing the intellectual property policy of those institutions, establishing technology transfer offices (TTOs) and reviewing funding and financial schemes for research activities carried out in those institutions ( WIPO,2009a) .

78. In order to facilitate collaboration between the public sector and the private sector, some countries provide standard model agreements, such as model research collaboration agreements and consortium agreements, for a variety of circumstances. For example in Europe, to facilitate the creation of a standard approach for effective mechanisms and policies to promote both the dissemination and the use of public-funded R&D results, the European Expert group has been created to overcome issues of different IP systems across Europe.

## 1.11. ROLE OF FLEXIBILITIES IN TRANSFER OF TECHNOLOGIES

### 1.11.1. Compulsory Licensing:

79. Compulsory license provisions are considered as an instrument to prevent abuses of the exclusivity inherent in the patent rights and as tools to ensure that the patent system contributes to the promotion of innovation in a competitive environment and to the dissemination and transfer of technology, meeting the objectives of the system and responding to the public interest at large. Consequently, various conditions and grounds found in national laws aim to balance the interests of various stakeholders including the right holder, their competitors and the public at large. International legal instruments, such as the Paris Convention, the TRIPS Agreement, the Doha Declaration on the TRIPS Agreement and Public Health and the Decision on Implementation of Paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health, allow countries to issue compulsory licenses under certain conditions aimed at safeguarding the legitimate interests of the patent holder and third parties. Some experts believe that compulsory licenses are effective in cases of known technology where only access is required.

### 1.11.2. Parallel imports:

80. Article 6 of the TRIPS Agreement and the Doha Declaration on TRIPS and Public Health stipulate that countries are free to provide their own rules regarding the exhaustion of

intellectual property rights. The exhaustion of patent rights occurs once a patentee, or any other person with the consent of the patentee, puts a product protected by a patent on the market which means that the rights to prohibit others from using a patented product without the patentee's consent are "exhausted" when the patentee puts the product on the market for circulation or when it is put on the market with his or her permission. Furthermore, if a patented product is put on that regional market or on any market in foreign countries, the domestic patent right with respect to that product is exhausted, and therefore, the patentee cannot prevent the import of such a product put on the regional or foreign market.

81. Since the market price of the same product may be different from one country to the other, a third party may acquire a product from the foreign market at a lower price, and resell that product domestically outside the normal distribution channel of the patentee and the authorized importer/seller (parallel imports). The wide availability of parallel imported products in the domestic market, which are generally cheaper than products distributed through the normal distribution channel of the patentee and his or her authorized dealers, may increase the possibility for third parties to reverse engineer the technology. However, wide availability of parallel imported products may discourage foreign right holders from investing in the domestic market, since the parallel importer could free ride on the investments made by authorized distributors.

#### 1.11.3. Competition law:

82. A balance between competition policy and patent rights is required to prevent abuses of patent rights, without annulling the reward provided by the patent system when patent rights are used appropriately. Even if a patent allows a patentee to obtain a monopoly position, in principle, acquiring a monopoly position by lawful means does not constitute a violation of a competition law. Through integration of licensed technology to the licensee's complementary assets, patent licensing agreements integrate competitive elements.

#### 1.11.4. Exceptions and limitations:

83. Research exemption in technology transfer enables researchers to examine the stated effects of patented inventions and improve such patented inventions without fear of infringing the patent. It may possibly provide for a greater use of existing knowledge without any fear of infringement of patents.

#### 1.11.5. Supportive Environment in the Patent System:

84. Higher predictability in terms of the validity of the granted patents, high quality services offered by IP professionals and financial accessibility to the patent system all support the transfer of technology. For instance patent attorneys can be an important interface between the transferor and transferee of the technology in the technology transfer process.

### 1.12. ONGOING INTERNATIONAL EFFORTS TO OPERATIONALIZE ARTICLE 7 OF THE WTO-TRIPS

85. There are two broad approaches to dealing with IPRs. The first one involves a regulatory approach, while the second one involves promoting market based approach to IPRs

86. The regulatory approach which, while preserving the essential characteristics of intellectual property rights, seeks to intervene in the market for technology so as to rectify perceived inequalities in that market as between the technology owner and the technology recipient. Regulatory intervention in technology transfer transactions may involve the outlawing provisions in technology transfer transactions that unduly favor the technology owner. Such

measures are backed by performance requirements on the part of the technology owner as a pre-condition for transfer related transactions. (WIPO, 2011).

87. A second track views transfer of technology as best undertaken through the market based operations. The emphasis is neither on regulation or intervention in the technology transfer process, but on creating conditions to enable free market transfer of technology. The principal features of this approach are a reliance on the protection of private rights to technology based on intellectual property rights; the absence of direct intervention in the content or conduct of technology transfer transactions, where these violate principles of competition law by reason of their market-distorting effects and/or by their use of unreasonable restrictive trade practices; and by the prohibition, or highly proscribed use, of technology-related performance requirements( *ibid* ) .

#### 1.12.1. SLANT OF EXISTING MULTILATERAL APPROACHES

88. International Investment Agreements (IIAs) provide a slew of measures to secure proper use of IPRs. These assume the shape of ‘admission and establishment, the most-favored-nation standard, national treatment and fair and equitable treatment, taxation, environment, host country operational measures, funds transfer and competition.’ ( *ibid* )

##### 1.12.1.1. World Trade Organization (WTO)

89. The WTO, and in particular the TRIPS, aims to strengthen Intellectual Property Rights without creating adverse impacts on social and economic welfare. The many flexibilities that act as limitations to the proprietary dominance of IPR reflect the philosophy that IPRs in general and patents in particular, ‘should promote innovation, technological development, facilitate diffusion and transfer of technology and catalyze private investment flows, in those countries (WIPO,2009a)’ which suffer from development deficit. As per Article 40.1 of the TRIPS Agreement, some licensing practices or conditions pertaining to intellectual property rights, which restrain competition, may have adverse effects on trade and may impede the transfer and dissemination of technology. Thus ‘Article 40.2 allows WTO Members to specify, licensing practices or conditions that may in specific cases constitute an abuse of intellectual property rights having an adverse effect on competition in the relevant market. Examples of such anti-competitive practices include: exclusive grant back conditions, preventing challenges to validity and coercive package licensing’ ( *ibid* ). It has been suggested by scholars that patent protection can have a salutary impact on technology transfer and local innovation in developing countries. ( *ibid* ) . Viewed this way the WTO TRIPS aims at enlightened regulations that do not unduly smother the play of technology markets.

90. During the ‘the 1970s to the 1980s, the issues relating to the transfer of technology were debated through negotiations concerning a Draft Code of Conduct at the United Nations Conference on Trade and Development (UNCTAD) and a revision of the Paris Convention at WIPO, both of which were unsuccessful (WIPO,2009a) .

91. Thus while transfer of technology is the cornerstone for the stimulation of innovation and development, this has been achieved in recent decades in interesting ways. Some scholars note that the transfer of technology landscape has greatly changed, and that understanding the process of technology transfer has undergone significant changes during the past three decades ( *ibid* ). This can be because there are very interesting business models that have emerged to facilitate technology transfer.

92. The flexibility provisions of the TRIPS cannot be effective unless enabling conditions are created nationally to improve IPR systems with a view to rendering them important vehicles in transfer of technology. It is argued that ‘higher, higher predictability in terms of the validity of the granted patents, high quality services offered by IP professionals and financial accessibility to the patent system all support the transfer of technology’ ( *ibid* )

93. Further the role of patent attorneys is, in general, to give advice and assist inventors and applicants in obtaining and maintaining patents, to give advice to third parties on the relevance of existing patents to their business activities and to assist third parties during opposition and invalidation proceedings is also deemed important (ibid). These experts should be able to provide a full range of possible protection or enforcement options available to the client and assist the client if a patent is erroneously granted or an abuse of right is found (ibid). Also, given the importance of increasing integration of IP into the business model of firms, the role of patent attorneys in assisting in the IP management of his or her client appears to be increasingly important (ibid). What is more 'qualified patent attorneys and patent agents are in a position to understand the technology concerned and to analyze the scope and value of the patented technology (ibid) .

94. Patent attorneys can, thus be an important interface between the transferor and transferee of the technology in the technology transfer process.' (ibid).

95. Indeed UNCTAD's Innovation Capability Index suggests that there are large gaps among countries, not only between developed and developing countries but also among developing countries, in terms of technological activity and human capital.( Lall, Sanjaya, 2003).

96. Interestingly in a phase of takeoff in economic growth 'the intensity of patenting first falls with rising incomes, as countries slacken patents to build local capabilities by copying, then rises as they engage in more innovative effort' (ibid). Indeed the experience of the Republic of Korea concluded that strong IPRs protection would hinder, rather than facilitate, technology transfer to indigenous learning activities in the early stage of industrialization when learning takes place through reverse engineering and duplicative imitation of mature foreign products(ibid).He argued that it is only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation that IPR protection becomes an important element in technology transfer of industrial activities' (ibid).

97. Initially in the transition to a knowledge-based low labor wages was one of the major reasons for FDI in developing countries. However, with the increasing importance of intangibles and knowledge, the low price of labor is not the only reason for many companies to set up R&D facilities in developing countries. This is evident in the manner in which IT and drug company majors are shifting their base to India and Brazil (Damodaran, 2013). This raises issues of relevance to WTO-GATS as well, since the focus of these transfers of R&D facilities to developing countries has also to do with flow of capital to tap personnel and their skilled services.

#### 1.12.1.2. The WIPO

98. The slant of WIPO's focus on IPRs has been to provide enabling environment in developing countries to improve access to technologies relevant to development , including technologies that are protected by IPRs. Thus WIPO, has paid considerable attention to programmes and activities to meet the technological and IP needs of the Millennium Development Goals (MDGs) particularly in relation to 1, 6 and 8 targets(WIPO,2012,c). The rationale for this is the argument that 'development-oriented IP requires a delicate balance of market forces and public action and that such a balance is likely to be different for different countries' (ibid).The other aspects of WIPO action include the following:

##### *1.12.1.2.1. Promote Information dissemination to overcome Information asymmetry:*

99. For promoting licensing, following a recommendation by the PCT Working Group in June 2010, WIPO launched a new PCT feature in PATENTSCOPE in January 2012. This feature allows applicants interested in licensing the inventions contained in their international applications to request the International Bureau to make this information available on its

PATENTSCOPE website. Such applicants can submit new Form PCT/IB/382 "Request for indication of availability for licensing purposes," or send a letter indicating that the claimed invention(s) is (are) available for licensing. WIPO has been developing global databases. To facilitate technology transfer, WIPO provides services of patent information through its global database of patents, PATENTSCOPE. As of February 2012, the PATENTSCOPE system allows users to search more than 10 million patent documents free of charge, including over 2 million published PCT applications, thereby facilitating and accelerating access by the public to technical information relating to new inventions. At present, PATENTSCOPE contains the patent collections of the following countries and regions: Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Israel, Jordan, Kenya, Mexico, Morocco, Nicaragua, Panama, Peru, Republic of Korea, Russian Federation (including data of the Union of Soviet Socialist Republics (USSR)), Singapore, South Africa, Spain, Uruguay, Viet Nam, and ARIPO, EPO and LATIPAT (WIPO-EPO regional project for Latin American countries on patent front page database).

100. The main features of PATENTSCOPE as described in WIPO (2012,c and 2012,b ) are as follows:

- (a) Full text search facilities for published international applications under the PCT, back to the first publication in 1978, in an enhanced quality of data, and more than 25 national and regional data collections;
- (b) Access to the file contents including international search reports and international preliminary reports on patentability, informal comments from applicants on written opinions, and priority documents;
- (c) Searchable national phase entry data for over 40 countries;
- (d) Downloadable weekly collections of published applications through subscription services;
- (e) Graphical view and presentation of search results;
- (f) Cross Lingual Information Retrieval (CLIR) function, allowing users to perform searches simultaneously in multiple languages (Chinese, Dutch, English, French, German, Italian, Korean, Japanese, Portuguese, Russian, Spanish and Swedish) using appropriate terminology according to the field of technology to improve accuracy;
- (g) Integration with external Machine Translation providers to obtain gist translations of descriptions and claims;
- (h) A machine translation tool which allows users to translate titles of inventions and abstracts from English to French and Chinese and vice versa;
- (i) RSS feeds to track technology developments in specific areas.

101. Access to patent information included in commercial patent databases has been improved in developing countries by WIPO's partnership with patent database service providers under the ASPI project (see Section III).

102. It is felt that modernization of IP technical infrastructure can effect timely dissemination of patent information by national IP offices. By providing technical assistance to a number of developing countries in modernizing their technical infrastructure for generating and disseminating digital patent information on the Internet, WIPO provides a major enabling mechanism in tapping protected technologies that are potentially accessible (WIPO, 2012,c).

#### 1.12.1.2.2. *Platforms for Diffusion of Technologies*

103. WIPO's focus has also been to develop platforms that 'build on partnerships and collaborations between technology holders and technology users in order to facilitate sharing of knowledge and the adaptation, transfer and diffusion of technologies.' The two collaborative platforms developed include 'WIPO Re:Search' in the field of health and 'WIPO Green' relating to environmental technologies. WIPO Re:Search ( which involves sharing Innovation in the Fight Against Neglected Tropical Diseases ) was formed in 2011, to facilitate partnerships 'among WIPO, pharmaceutical companies, research and academic institutions and a nongovernmental organization by name 'BIO Ventures for Global Health.' The platform 'provides access to intellectual property for pharmaceutical compounds, technologies, know-how and data available for research and development for neglected tropical diseases, tuberculosis and malaria.' (WIPO 2012, b).

104. WIPO Green 'provides access to a broad range of environmental technology solutions and technology needs. Its key objectives are the accelerated adaptation, adoption and deployment of environmental technologies particularly in developing countries and emerging economies' (ibid).

105. In addition under Project DA\_19\_25\_26\_28\_01, initiated in January 2011, is included a range of activities that aim to explore possible initiatives and IP-related policies for promoting technology transfer and the dissemination and facilitation of access to technology for development (WIPO 2012,b) .

106. The six components of the projects are

- (i) Organization of five regional consultation meetings;
- (ii) Elaboration of a number of peer-reviewed analytic studies, including economic studies and case studies on international technology transfer that will provide inputs for the High-Level Expert Forum;
- (iii) Organization of a High Level Expert Forum on "Technology Transfer and IP Common Challenges – Building Solutions";
- (iv) Creation of a Web Forum on "Technology Transfer and IP: Common Challenges Building Solutions"; and
- (v) Incorporation of any outcome resulting from the above activities into the WIPO programs, after consideration by the CDIP and any possible recommendation by the CDIP to the General Assembly.
- (vi) A series of economic studies on IP and International Technology Transfer. These studies would focus on areas that have received less attention in the available economic literature and on identifying possible obstacles and suggesting possible ways in which technology transfer could be enhanced.

#### 1.12.1.2.3 *WIPO Web Forum on "Technology Transfer and IP:*

107. The Web Forum is intended to provide an interactive platform for the exchange of experiences on technology transfer as well as for obtaining feedback on the project process and on studies taken up..

#### *1.12.1.2.4. WIPO's specialized databases' access and support*

108. ProjectDA\_08\_01, aims to facilitate access to technological knowledge for users in developing countries, especially LDCs, and their regional and sub-regional IP organizations so as to effectively exploit them and, thereby, stimulate innovation and economic growth.

109. As a part of the implementation of this Project, WIPO's "Access to Research for Development and Innovation" (ARDI) program was launched in July 2009, providing access to scientific and technical journals for LDCs for free and for certain developing countries in agreement with publishers at a very low cost. On July 14, 2011, ARDI became a full partner and fourth program of the Research4Life (R4L) partnership, which includes the World Health Organization's HINARI program (access to biomedical and health journals), the Food and Agriculture Organization's AGORA program (agriculture based journals), and the United Nations Environment Programme's OARE program (journals focusing on environmental issues). Since January 1, 2012, the number of countries eligible for free-of-charge access has been increased and all non-profit governmental institutions have been allowed to access the journals at a very low cost.

110. The "Access to Specialized Patent Information" (ASPI) program was launched in September 2010, providing access to commercial patent databases to LDCs for free and to certain developing countries at a sharply reduced cost. Within the framework of this program, six leading patent database providers (LexisNexis, Minesoft, Proquest, Thomson

111. Reuters, Questel, and WIPS) make available their respective flagship database products.

112. In addition, the project foresees the establishment of a network of Technology and Innovation Support Centers (TISCs) in order to provide personal assistance regarding patent information and innovation support services to local users in developing countries, and to provide a network to exchange experiences and best practices in this field. Initial assessment missions have been carried out in 46 countries, and Service Level Agreements (SLAs), providing the framework for activities to be carried out in establishing or developing TISCs, have been concluded with 30 countries up until the first trimester of 2012.

#### 1.12.1.3. Multilateral Environmental Agreements (MEAs)

113. An important feature of Multilateral Environmental Agreements (MEAs) is their focus on global environmental problems that aggravate the problem of conserving global public goods like climate, biodiversity and land. The major MEAs include UN Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). Both are noted for their emphasis on the principles of equity and common but differentiated responsibility (CDR). The latter enables developing countries to seek appropriate environmentally sound technologies on 'fair and favorable terms' from developed countries. This prevents the unrestricted use of IPRs over technologies to secure commercial gains, particularly in relation to developing countries that bear the brunt of climate change or have the onus of conserving biological diversity that occur within their borders.

##### 1.12.1.3.1. UN Framework Convention on Climate Change (UNFCCC)

114. The UNFCCC includes a specific commitment by developed countries regarding provisions of financial resources and technology transfer in Articles 4.3 and 4.5, respectively. In particular, Article 4.5 states that:

115. "The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of

endogenous capacities and technologies of developing country Parties. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.”

116. Article 4.7 links the effective implementation of the Convention by developing countries to the implementation of the above commitments by developed countries as follows: “The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.”

117. While the text of the UNFCCC does not explicitly refer to intellectual property rights or patents, intellectual property issues have been raised in conjunction with the review of the implementation of commitments made by the Contracting Parties, in particular by developed country Parties, under Article 4. How intellectual property could be best addressed in the framework of the UNFCCC is part of the ongoing debate.

118. One scholarly study suggests that technologies relating to climate change should be less dependent on strong patent protection, and/or that patents are less likely to cause significant bottlenecks in the development and transfer of such climate related technologies to developing countries as compared to public health related technologies. An UNCTAD report revealed that a broad range of environmentally sound technologies was available to meet the needs of developing countries. It states that while public-funded R&D in the development of such technologies was significant, only a small proportion of public-funded technologies are patented, commercialized or transferred, due to, among other reasons, the costly and lengthy process of obtaining patent rights, the lack of knowledge about the business aspects of technology development, the absence of an incentive structure conducive to the commercialization of research results, and the fact that many R&D activities are still too upstream in many countries. The recent study indicates that many challenges to the dissemination and transfer of innovation in general are found in the area of eco-innovation.

119. Absorption and adaptation of technologies to local needs, the existence of complementary factors other than patents that affect innovation and the effective transfer of technology, information asymmetries and uncertainty regarding the qualities of the innovation are some of the challenges identified by the authors.

120. A detailed patent-based analysis regarding alternative energy technologies demonstrates the possibilities of using patent based information in identifying and analyzing existing and future technologies, and the usefulness of such information for wider policy formulation.

121. In some markets, such as China, India, Brazil and other rapidly developing economies, the spread of advanced clean technologies is happening at least at the same rate as in developed economies. For some technologies and countries it is even faster, since they are able to bypass the challenges of “restructuring” entrenched installations and infrastructure. In the least developed countries the challenge of pursuing economic and social progress necessitates facilitation and support to access existing low-carbon technologies and to strengthen their endogenous technological capabilities.(WIPO, 2011)

I. To stimulate investment in appropriate technologies, to deliver at the right time, place and cost, countries will need to consider the full lifecycle of technology and enable a portfolio of technologies to be developed in parallel, not sequentially. It is important to consider the life cycle and turnover of existing capital infrastructure as new low-carbon technologies are phased in and new long-term infrastructure is built (ibid).



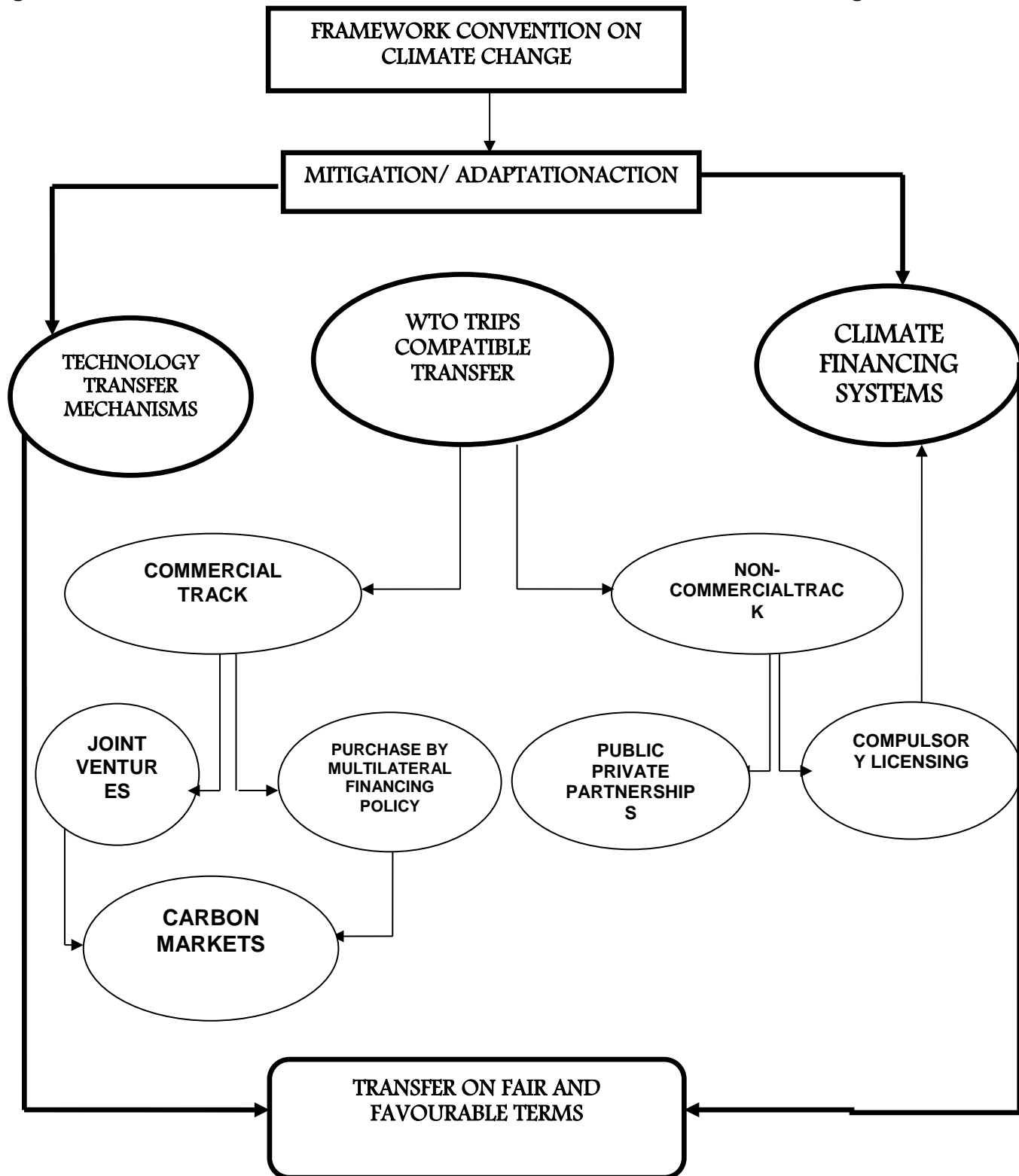
The WBCSD puts forward six key elements to enhance investments and sales of low-carbon technologies in developing countries. These range from government signals to foster low-carbon solutions to engaging business more actively into the international and national climate change process. As key providers of technology and innovation, companies can support these targets but the transition to a low-carbon growth will be facilitated if governments set up frameworks that are conducive to investment in the first place (ibid) .

II. Specifically, the six elements to enhancing investments and sales of low-carbon technologies recommended are:

- (a) Strong signals from governments toward low-carbon growth nationally and internationally, either through targets or regulatory measures;
- (b) Adequate institutional frameworks that provide stable policies, transparent investment regulation and favorable local conditions;
- (c) Appropriate absorptive capacity in institutions, business and society including a functioning education system, a receptive environment and targeted capacity building programs;
- (d) Economic and financial incentives to bridge the gap between low-carbon solutions and their commercial viability;
- (e) Energy efficiency drivers through removing barriers such as perverse subsidies, introducing economic incentives and consumer outreach; and
- (f) A more active engagement of business in the international and national climate change process to increase the likelihood of success in reaching common objective. In addition to these crosscutting elements, the report identifies specific enablers that can encourage diffusion of low-carbon technologies in individual industry sectors.

122. The structure of UNFCCC vis-a-viz the TRIPS is outlined in Fig 1 below:

Figure 1.1: Structure of Transfer Mechanisms of IP assets related to Climate Change



123. As the figure brings out while the UNFCCC has enabling provisions for technology transfer and climate financing, there are two tracks for acquiring or seeking transfer of technologies (1) a commercial track and (2) Non commercial track . While the regulation on the commercial track can happen through the 'market mechanism' , which is enabled by appropriate business models(Joint Ventures), Outright purchase at commercial rates by Multilateral

Financing Facility, which can make up for the cost by relying on carbon markets, the non-commercial track ( which rests on the notion of 'fair and favorable' technology transfer terms) will have to rely on the flexibility tracks of the WTO-TRIPS and/or Public – Private Partnerships.

124. As will be discussed in the last section, despite the wonderful possibilities of having technology transfer effected through enabling provisions of the UNFCCC and WTO-TRIPS, in practice, neither have the TRIPS flexibilities been utilized nor has the possibility of using financing ( via Multilateral Funds and Carbon Markets) been seriously explored.

#### 1.12.1.3.2. Convention on Biological Diversity (CBD)

125. The Convention on Biological Diversity (CBD) and the Convention to Combat Desertification (CCD) are two conventions that refer to intellectual property rights explicitly in conjunction with the transfer of technology.

126. The CBD, recognizes that access to, and the transfer of, technology are essential elements for the attainment of its objective, and the Convention requires Parties to provide and/or facilitate access for, and the transfer to, other Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources (Article 16.1).

127. The Convention also provides that access to, and the transfer of, technology to developing countries "shall be provided and/or facilitated under fair and most favorable terms, including on concessional and preferential terms where mutually agreed," and in a way "consistent with the adequate and effective protection of intellectual property rights" if the technology is subject to patents and other intellectual property rights (Article 16.2).

128. In relation to the transfer of technology, issues concerning capacity building, research and training, education and awareness raising, exchange of publicly available information and technical and scientific cooperation, are also covered by the Convention (Articles 12, 13, 17 and 18).

129. Articles 16 and 19 of the Convention call upon Contracting Parties to facilitate access for and transfer of relevant technology to other Parties, including modern biotechnology. The Convention's provisions on technology transfer reflect the global consensus among countries that the development, transfer, adaptation and diffusion of technologies, as well as the building of related capacities, is critical for achieving sustainable development. In a world that is besieged with a lack of suitable technologies to achieving the objectives of Multilateral Agreements (WIPO,2011: p 12 of Annex)

130. Under the program of work on technology transfer and technological and scientific cooperation adopted by the Conference of Parties (COP) in 2004, a technical study on the role of intellectual property rights in technology transfer in the context of the CBD was prepared jointly by the Secretariats of the CBD, UNCTAD and WIPO.

131. The year 2010 has been designated as the International Year of Biodiversity (IYB) by the UN General Assembly as a way to recognize the contribution of biodiversity to human development and well-being (WIPO,2011).

#### 1.12.1.4. Multilateral Measures to Operationalize WTO-TRIPS to Effect Improved Transfer of Technology

132. As mentioned at the outset, Article 7 of the TRIPS seeks to balance proprietary rights conferred by IPRs with social welfare. The spirit of Article 7 cannot be attained without realizing the basic goal of TRIPS viz, reaching critical technologies to needy countries and communities. This in turn requires measures to realize the provisos of Article 8 (dealing with national laws,

regulations and related measures) and Article 66.2 (transfer of technologies from developed countries to least developed countries. The measures advocated to implement the spirit of Article 7 of the WTO- TRIPS can be broadly categorized into the following:

Operational Measures at the national level (Article 8)

Enabling Measures at the multilateral level (Article 66.2)

While operational level measures include introduction of regulations and IP laws at the national level that give teeth to Article 8, enabling measures include multilateral measures to promote awareness and information required to render the three Articles effective.

133. The following measures are proposed to effect transfer of technologies.

*Patent Applications, Disclosure Agreements (Article 8)*

134. National measures include streamlining of patents applications, disclosure requirements (Article 29.9) , exemptions to patent rights ( Articles 30 and 31) , anti-competitive practices of patents ( Article 40) information on disclosure in patent applications and its utilization by countries where such applications have not been preferred, restrictions on publicly funded institutions in claiming advantages of patent rights without regard to social and economic benefits .

*Licensing Practices (Article 8)*

135. Improving clarity of licensing agreements, registration of licensing agreements, ownership issues where Joint R&D is involved, identifying motivations for transfer of technology by licensor, promoting Public –Private Partnerships and collaborative partnerships to facilitate development and transfer of technologies, getting private sector to be involved in commercializing technologies developed by Government Institutions, providing licensing guidelines to publicly funded institutions, grant of research exemptions, compulsory licensing, parallel imports, option of seeking exhaustion of patent rights on commercially released products, utilizing competition laws as countervailing power,

*Supporting Environment (Articles 8 and 66.2)*

136. Providing high quality patent attorney and related IP services to facilitate development and transfer of technologies from developed countries

1.12.2. CHARACTERIZING INTERNATIONAL EFFORTS TO OPERATIONALIZE ARTICLE 7

1.12.2.1. WIPO:

137. WIPO's activities in the realm of IPRs can be broadly categorized as falling in the realm of 'Supporting Environment'. Here WIPO's activities deal with multiple phases of R&D for innovation, dissemination through technology transfer and their successful operationalization in developing countries.

138. WIPO's PATENTSCOPE is designed to provide search facilities to further stimulate PCT applications from developing countries, improve quality of data, with detailed features such as applicant's comments, with data assemblage and synthesis features that serve to improve the demand and supply side factors as far as licensing is concerned. The first dividend of the system is the information it can yield on voluntary offers of license offers. The second dividend is that this facility can help to sharpen understanding of claims and the possibilities of working around patented innovations by developing country entrepreneurs, without inviting infringement

charges as per extant international norms. Coupled with WIPO's efforts to harmonize patenting procedures through better disclosure norms, PATENTSCOPE has the ability to improve local innovation activities in a manner that is consistent with high standards of IP protection. As far as technology transfer is concerned, much will depend upon the ability of national patent offices to improve patent examination and grant standards, archive, reflect and transmit information on applications, the claims contained in it. Technical assistance schemes as planned by WIPO will hopefully enable this process.

139. Similarly the twin platforms set up by WIPO to achieve diffusion of technologies viz, 'WIPO Re:Search' in the field of health and 'WIPO Green' relating to environmental technologies. Facilitate partnerships 'among WIPO, pharmaceutical companies, research and academic institutions and a nongovernmental organization by name to work on R&D and development and release of environmentally sound technologies and state of art drugs of concern to the public in developing countries.

140. WIPO's Web Forum on "Technology Transfer and IP has the important role of providing agents involved in technology transfer with intimate knowledge on the negotiations process, contract/license agreement processes, their strengths and limitations for enterprises that may like to avail technology transfer facilities involving overseas partners in particular.

141. WIPOs' specialized data bases including WIPO's "Access to Research for Development and Innovation" (ARDI) and Access to Specialized Patent Information" (ASPI) program by providing research materials (including commercial databases at low costs to needy developing countries can substantially raise R&D capabilities in developing countries. However much will depend upon how far WIPO's activities can promote B2B transactions between companies in the North and entrepreneurs in the South through partnership making.

#### 1.12.2.2. WTO:

142. Multilateral framework which is regulatory in nature: safeguard driven: code of conduct; It is argued that 'higher , higher predictability in terms of the validity of the granted patents, high quality services offered by IP professionals and financial accessibility to the patent system all support the transfer of technology' (ibid) .Further the role of patent attorneys is, in general, to give advice and assist inventors and applicants in obtaining and maintaining patents, to give advice

143. Interestingly in a phase of takeoff in economic growth 'the intensity of patenting first falls with rising incomes, as countries slacken patents to build local capabilities by copying, then rises as they engage in more innovative effort' (ibid). Indeed the experience of the Republic of Korea concluded that strong IPRs protection would hinder, rather than facilitate, technology transfer to indigenous learning activities in the early stage of industrialization when learning takes place through reverse engineering and duplicative imitation of mature foreign products(ibid).He argued that it is only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation

144. However, with the increasing importance of intangibles and knowledge, the low price of labor is not the only reason for many companies to set up R&D facilities in developing countries. This is evident in the manner in which IT and drug company majors are shifting their base to India and Brazil (Damodaran, 2011). This raises issues of relevance to WTO-GATS as well as the focus of these transfers of R&D facilities to developing countries has also to do with flow of capital to tap personnel and their skilled services.

#### 1.12.2.3. UNFCCC

145. By virtue of its provisions regarding commitment by developed countries for provisioning financial resources and technology transfer to developing countries in Articles 4.3 and 4.5, the

UNFCCC seeks to provide a regulatory framework on IPR regimes by relating the same to concrete financial and technological supportive measures. In this manner the UNFCCC seeks to implicitly provide teeth to Article 7 of the WTO-TRIPS regarding the need to regulate IP rights over climate smart technologies to secure the larger objectives of the convention, namely saving humankind from the perils of climate change. In more direct terms, the UNFCCC gives shape to Article 66.2 of the WTO-TRIPS regarding transfer of technologies to needy countries.\ through financial and other mechanisms.

146. These provisions of the UNFCCC have been the basis for capacity building and technical and financial support for the transfer of low carbon technologies developed under the Convention and its protocol namely, the Kyoto Protocol. By triggering national communications by Parties, the UNFCCC has also stimulated development of National and Sub-National Action Plans to address climate change, thus creating concrete conditions for transfer of climate friendly and low carbon technologies. However it needs to be noted that for all practical purposes, the UNFCCC has not succeeded in seeking exemption of patentability over climate smart technologies. Nor has the UNFCCC succeeded in enforcing compulsory licensing over these technologies. However by getting developing countries to commit resources to renewable energy in increasing measure , the UNFCCC has succeeded in creating conditions for transfer of climate relevant technologies through IP licensing and business models (like Joint Ventures) (Damodaran,2011).

147. In short, the UNFCCC has moderately succeeded in providing operational, national level conditions for transfer of climate relevant technologies from developed countries to developing countries, though in practice there have been many Business-to-Business concerns experienced by firms in developing countries like India and China in effecting a smooth transfer as pointed out in Box 2 in Chapter 4.7.

#### 1.12.2.4. CBD:

148. The CBD scheme of things rests heavily on Article 16.2 of the Convention that deals with transfer of technology on fair and favorable terms. However Article 16.2 remains a principle that is yet to witness traction. This is because products or technologies relevant to the CBD are the subject matters that fall under the purview of Patent laws or Plant Utility/ Breeder's rights that do not consider technology as non-proprietary goods. There is scope to link the access and benefit sharing regimes of the CBD with transfer of technology. As far as access and benefit sharing is concerned, the accent is on operational, national level measures to regulate access to genetic materials in developing countries through appropriate legislations and regulations. Since access to genetic resources and traditional knowledge is critically conditioned by conservation priorities and considerations of returns (finances, share in sales proceeds of end products) from sustainable utilization of the bio-materials and genetic resources accessed, there is an inbuilt quid pro quo element in this convention that has the potential to bind patent holders to part with their profits (Damodaran, 2008) . However ABS provisions are not linked or related to the Article 16.2. Also , in practice, the criteria of novelty, inventive step and industrial application which underlies the Patent Regimes ( both plant and industrial property based) in various countries and in the WTO-TRIPS stands in the way of access and benefit sharing realizing its intended benefits. The flexibilities of the TRIPS such as compulsory licensing and parallel imports are tenuously linked to the CBD, even if they relate to phyto-medicines or animal based medicines that have significant public impacts. The Nagoya Protocol of the CBD, though laudatory in terms of its objective of harmonizing Access and benefit sharing, has not met with the success it deserves on account of this fact. Thus technology transfer under the CBD depends upon voluntary public efforts at research and capacity building. This is what is being attempted through the resource mobilization drive initiated by the Convention in recent years. There is need to devise more operational programmes at the national and global levels to facilitate technology transfer relevant to the CBD.

## 1.13. DETAILED RECOMMENDATIONS

### 1.13.1. Compulsory Licenses

149. An important measure is the exercise by governments of their right to provide compulsory licenses (CL). Under the TRIPS agreement, there is considerable flexibility provided to WTO Member States on the grounds for issuing compulsory licenses. These grounds are not restricted, as confirmed by the WTO Ministerial Declaration on TRIPS and Public Health (WTO, 2001). For example, and contrary to a quite widespread notion, it is not necessary for a government to declare its country is in a state of health emergency in order for it to issue a compulsory license for a pharmaceutical drug. Similarly, the fact that a country requires a product or technology in order to meet its objectives or responsibilities to mitigate climate change or to adapt to climate change is a valid ground for compulsory licensing.

150. There are many cases where compulsory licensing has been disallowed in developing countries. For instance, Cipla requested the South African government in 2001 to issue compulsory licenses on several drugs, including nevirapine, lamivudine, zidovudine, stavudine, didanosine, efavirenz, indinavir, abacavir, and combinations of these drugs. The request was denied. In 2002, a compulsory license on imatinibmesylate, also known as 'Gleevec' was requested in South Korea but denied by the Korean Intellectual Property Office. For instance, the Colombian government rejected a request for compulsory licensing the HIV drug Lopinavir/Ritonavir in 2009. However, as a result of the request, the government set out maximum prices for the drug, driving the price down by 54-68%.

151. . Compulsory licensing is not a unique or exceptional policy. According to Reichman (2003), "the United States government has broad powers to seize and use any invention protected by privately owned patents, subject to the payment of reasonable and entire compensation, and it makes extensive use of this power". In fact in the US, compulsory license provisions are incorporated into specific legislation. For example the US Clean Air Act provides for CL of patented technologies needed to meet agreed standards. Compulsory licensing is thus an option that developing countries can consider using for those patented climate-friendly technologies for which they have need, which are expensive, and when negotiations with the patent holder are unable to result in a sufficiently affordable price either for the original product or for a license for an intended generic product.

### 1.13.2. Use of other TRIPS Flexibilities

#### *1.13.2.1 Exemption from Patentability:*

152. Two options in exclusion of patents, the first is a blanket exclusion of patentability for environmentally sound technologies and the second being an exclusion applied only to developing countries. In the second option, patent holders that funded their own research and development could recoup their innovation costs through a monopoly (for the specified period in the TRIPS agreement) of their products in the developed countries, while in the developing countries, competition to such technologies is allowed through an exemption from patentability. An appropriate amendment of the TRIPS Agreement would be required in either case, to the effect that WTO Members (or WTO developing country Members) can exempt such technologies from patentability.

153. . This can be considered a justifiable demand if climate change is considered a serious challenge. Developed countries cannot justify business as usual in the old system while also demanding a radical departure by developing countries from business as usual in their emissions pathways. Least Developed Countries (LDCs) already have some flexibility in this regard. LDCs that are members of WTO have a special transitional period for the implementation of the TRIPS Agreement.

*1.13.2.2. Technology pooling through a collective global approach:*

154. A “Global Technology Pool for Climate Change” could be developed in which owners of ESTs are required to place their IPRs in a pool, and make them available to developing country firms on payment of a low compensation (in some circumstance royalty free) and on standard terms (that are to be negotiated). The nature of the pool should be mandatory in that either through law or policy (e.g. a condition for receiving public funding for R&D) the protected subject matter is given to the pool for licensing to developing country firms. Patent holders would still be able to extract high commercial royalties from the far richer developed markets (Khor, 2012, p 18)

*1.13.2.3. Global System to Share Know-How and Trade Secrets:*

155. Another measure requiring international cooperation is the establishment of a global system for sharing know-how and trade secrets linked to climate-friendly technologies. The withholding of “trade secrets”, or the knowledge on how to make the technology, can be a major barrier to technology transfer, even for technologies that are not patented, as it can prevent the development of technology in developing countries. Thus, there is a case for an international cooperation mechanism to make trade secrets and know-how that are linked to climate-related technologies more accessible to developing countries.

*1.13.2.4. Understanding or Initiatives on Publicly funded technologies*

156. OECD countries, which hold ownership of most of the ESTs for mitigation and abatement, are in a Fully owned government technologies and related know-how can be transferred at no cost and on favorable terms. Where governments partially fund R&D, they should have partial ownership of any resulting patent. When a license is issued to a developing country firm, a corresponding proportion of the cost of the license should be waived, thus reducing the overall cost to the country. Incentives can also be given to entities (that are publicly funded) to make the patented technology, with its know-how, available to developing countries. It has also been proposed that to support no and low cost transfer, developed country governments should compile a “Publicly-Owned Technology Inventory”. As noted above, governments can also use their leverage as a funder of R&D to place conditions on recipients to ensure licensing to firms in developing countries on fair terms that take into account their development priorities and needs.

*Parallel Importation, Exemptions and Competitive Behavior*

157. Besides compulsory licensing, the TRIPS Agreement has several other flexibilities, which can be used to promote transfer of climate-related technologies. These include parallel importation, exemptions to patentability, exceptions to patent rights, and measures to address anti-competitive behaviour. The possible use of these flexibilities is detailed in South Centre (2009).

*WTO Declaration on Patents and Climate Technology:*

158. An important feature of the TRIPS and Public Health Declaration is that it created new rights for countries to waive a provision in the TRIPS Agreement that limits the supply of a generic product (under compulsory license) to “predominantly” in the domestic market. This restricts the volume of exports of a firm producing generics, and it also affects the adequacy of supply of generic products that a country with no or limited manufacturing capacity can import. A Declaration on TRIPS and Climate Change could establish a similar waiver to the restrictive TRIPS provision for climate-related technologies. This will enable an increase of supply of “generic” technologies and products to countries that lack productive capacity to produce their own products.



Legislation to Facilitate Easier Compulsory Licensing:

159. For example, the Clean Air Act of the United States provides for compulsory licenses to be given when the patented innovation is necessary to comply with the emission requirements, when no reasonable alternative is available, and where non-use of the patented invention would lead to a “lessening of competition or a tendency to create a monopoly.” Under the Act, a district court, with the Attorney General’s assistance, can determine whether a compulsory license should be granted and set reasonable terms.

*1.13.2.5. Overcoming Patent Laws and Procedures*

160. Correa (2011) put forth the following propositions with regard to patent laws and procedures:

- (a) Rigorous criteria to assess the novelty and inventive step of patent applications to pharmaceuticals should be applied. Patent offices should develop, in consultation with health authorities, guidelines to examine such applications so as to ensure the patents are only granted where genuine contributions to the state of the art are made.
- (b) Remove provisions in Patent Acts, which provides for ‘evergreening’ patents.
- (c) Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should be allowed in narrowly defined, exceptional cases. Polymorphs and isomers (when the racemic mixture was already disclosed) should not be patentable.
- (d) Restrictions on the so-called ‘Markush’ claims, so as to ensure that the granting of patents with such claims does not become a constraint for research on new compounds or an undue restriction to competition.
- (e) ‘Selection patents’ on a narrower group of the compounds covered by the original patent should not be allowed.
- (f) In order to improve the transparency of the patent system, the international non-proprietary name (INN) of drugs, when known at the time of filing of a patent application, should be mandatorily disclosed in its title and abstract.
- (g) Similarly, claims on second indications of pharmaceutical products, which are equivalent to methods of treatment, should be deemed non-patentable due to lack of novelty and industrial applicability.
- (h) Restricting possibilities of broad patents on climate smart technologies

1.14. CONCISE SUMMARY OF RECOMMENDATIONS

- Compulsory licenses: An important measure is the exercise by governments of their right to provide compulsory licenses (CL). Under the TRIPS agreement, there is considerable flexibility provided to WTO Member States on the grounds for issuing compulsory licenses.
  - Use of other TRIPS Flexibilities including Exemption from Patentability
  - Technology pooling through a collective approach
  - Global System to Share Know-How and Trade Secrets
  - Understanding or Initiatives on Publicly funded technologies

- Parallel Importation, Exemptions and Competitive Behavior
- Overcoming Patent Laws and Procedures
- Rigorous criteria to assess the novelty and inventive step of patent applications to pharmaceuticals should be applied and remove provisions in Patent Acts which provides for 'evergreening' patents.
- Government to Government commitments in developing countries to set up joint R&D with developed countries by twining public institutions to develop innovative products/ technologies
- Market Making Functions: Linking Appropriate Buyer to Appropriate Seller
- Encourage joint need assessment of public health needs which will become the basis for developing joint R&D programmes for creation of generics
- Encouraging Public Institutions in developed countries to buy out essential drugs for supply to core vulnerable least developed countries through Second Order Price Discrimination
- Setting up an Multilateral Fund for Operationalizing 1 and 2 for drugs and pharmaceuticals

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## **2. PAPER 2: INNOVATION, FINANCING MECHANISMS AND TRANSFER OF TECHNOLOGIES: NEED FOR AN INTEGRATED VIEW**

### 2.1. BACKGROUND

161. One of the limitations of the literature that deals with the issues of Innovations, IPRs and Transfer of Technology in their mutual inter-relationship, has been inadequate focus on the impact of financing mechanisms on the three elements. This omission is despite the fact that finance forms one of the major constraints in innovations, R&D and access to technologies by end consumers. As a matter of fact finance is critical even in the post-technology transfer phase where the end consumer is required to satisfactorily absorb the technology that is transferred. Thus designing good financing systems is a pre-requisite for innovation, technology transfer and technology diffusion to take place.

162. This paper examines the rationale of financing innovations and technology transfer and proceeds to probe the patterns of inter-relationship between financing systems, innovations and transfer of technologies at two levels – (1) the ‘international level’ in relation to the WTO-TRIPS and the WIPO Development Agenda and (2) at the ‘sector level’ with reference to how the inter-relationship between financing and innovation and technology transfer plays out in the case of drugs and pharmaceutical and the climate technology markets.

163. Based on the discussions mentioned above, the paper advances some key priorities for financing innovations and technology transfer for two public goods, namely, drugs and pharmaceuticals and low carbon technologies.

### 2.2. WHY FINANCE INNOVATION AND TECHNOLOGY TRANSFER?

164. Greenhalgh and Rogers (2010, p 4) define innovation as ‘the application of new ideas to the products, processes or other aspects of the activities of a firm that lead to increased value. Here “value” is defined in a broad way to include higher value added for the firm and also benefits to consumers or other firms’. There are two types of innovations viz those relating to products and those to process (ibid). According to the authors, there are broadly three steps in an innovation process, viz, Research and Development (R&D), commercialization and diffusion. R&D in turn covers three stages viz basic research, applied research and development and testing (ibid, p7). Commercialization involves investment in innovation product or process, while technology diffusion involves adaptation and improvement and market penetration. While basic research may be carried out by agencies external to the firm concerned, the subsequent phase of applied R&D and commercialization is carried out by the firm involved (ibid).

165. The crucial aspect of finance is that it encompasses all the steps and stages mentioned above. While large TNCs involve themselves in all the steps/stages of an innovation process, in frontier technology areas like Biotechnology, nanotechnology and energy, the task of going through different steps/ stages devolves on multiple agencies. Indeed in the area of sustainable development technologies, the role of start-up firms, set up by scientific institutions, is critical to carry out applied research, testing and commercialization. The scientific institutions carry out fundamental research in such cases. A case in point is ‘Strand Genomics’, a start-up company of the Indian Institute of Science, which carries out application and commercialization of ‘genomics’ products and applications generated by the Institute.

166. Barring the case of TNCs, a variety of financing sources are normally involved in the different steps/ stages of innovation undertaken by firms. In developing countries, fundamental research is carried out by public institutions that are funded by governments, through budgetary grants. On the other hand start-ups ventures of these institutions can be funded either by equity markets or other modes of private financing. The task of technology diffusion is done through private investments, though at times for critical demonstration and customization work for nascent technologies like fuel cells, clean coal combustion, public financing is sought for.

167. Multiple sources of financing, involving both public and private sources, do not create the urge for appropriability, as would be the case when a single agency undertakes to finance all the or stages of innovation. Most of the social costs of patents arise from the 'appropriability urge on the part of monopoly inventors who heavily invest their own financial resources to create innovative products and processes. Further, multiple sources of financing can lead to choice of innovative products that are locally relevant and are social welfare enhancing<sup>5</sup>.

168. Thus, financing of innovation from multiple sources, including public sources, have the advantage of producing quality products of high social utility at affordable costs. This serves to reduce the social costs associated with patents and related IPRs. These apart, financing structures also enable access to innovative public goods (such as life-saving drugs and highly efficient climate friendly technologies) by poorer communities in developing countries. Such financing structures may assume the form of capital subsidies on R&D expenses incurred by private companies that have innovated new products and processes. For the same reason, financing transfer of technology to needy consumers is of great importance to public goods. This involves paying for purchase or licensing of technologies, funding applied research that enables customization of purchased or / licensed technologies in country contexts. Financing is also important at the commercialization stage where the transferred technology is effectively absorbed and applied at the industry level. The role of enabling infrastructure (by way of labs ,qualified personnel and enhanced capacities) is important for effective absorption of technologies. Having financing systems that enhance supply of enabling infrastructure can only ensure this.

### 2.3. INNOVATION AND TRANSFER OF TECHNOLOGY IN THE WTO TRIPS AND THE WIPO FOR A

169. Financing of innovation is not explicitly mentioned in the World Trade Organization's Trade Related Intellectual Property Rights (WTO-TRIPS). Nor is it specified in WIPO initiatives on development and transfer of technology. However both the WTO-TRIPS and the WIPO development agenda do deal with issues that have relevance to financing issues.

170. The 'public nature' of climate smart technologies and life-saving medicines vis-a-viz private control over their possession and use, is highlighted by the WTO- TRIPS, which while being a treaty for protection of Intellectual Property Rights, also provides many provisions of exceptions to these 'private' rights, in the larger interests of addressing critical public interests ( Damodaran, 2010,a). One of these provisions relates to the linkage between IPRs, innovations and technology transfer/ dissemination as provided for in Article 7 of the TRIPS.

171. Article 7 of the TRIPS states as follows:

"The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations" ( WTO , 1995) .

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<sup>5</sup> As Lopez (2009) states,' It is not true that in the realm of innovation there is only one game in town, in the sense of innovating for global markets. There are such things as local needs and local markets, which are not necessarily well served and may require enhanced incentives from the government. Incremental and cumulative innovations, which are mostly informal (i.e. without R&D) and developed in the traditional sectors, are, thus, central to the innovative performance of developing countries. Although mostly dealing with low-level technologies, these innovations are generating local spillovers and, ultimately, will impact on the productivity of a wide range of sectors in the local economy.

172. Agreement by itself may not have much impact on technology acquisition by poor countries. WTO negotiators recognized this fact and accordingly introduced Article 66.2, which obligates the developed countries to provide positive incentives for technology transfer to the least developed countries. Indeed some studies have made suggestions for improving these incentives by effecting policy changes in recipient countries, source countries, and the global trading system.

173. Article 66.2 of the TRIPS Agreement, is explicit about the role of developed countries in transfer of technologies when it states:

“Developed country members shall provide incentives to enterprises and institutions for the purpose of promoting and encouraging technology transfer to least-developed country members in order to enable them to create a sound and vital technological base.” (ibid)

174. Article 66.2 rests on the idea that Governments in developed countries could possibly provide a favorable environment to provide incentives to enterprises and institutions to promote transfer of technology to least developed countries.

175. Coming to WIPO , it is seen that WIPO (2009a) lays down the following as also forming the mandate of WIPO:

“Exploring intellectual property-related policies and initiatives necessary to promote the transfer and dissemination of technology, to the benefit of developing countries and to take appropriate measures to enable developing countries to fully understand and benefit from different provisions, pertaining to flexibilities provided for in international agreements, as appropriate.

And

‘To encourage Member States, especially developed countries, to urge their research and scientific institutions to enhance cooperation and exchange with research and development institutions in developing countries, especially LDCs’.

176. Apart from these mandates the WIPO General Assembly in the year 2007 set up the ‘The Committee on Development and Intellectual Property (CDIP)’ to (i) develop a work program for implementation of the adopted recommendations; (ii) monitor, assess, discuss and report on the implementation of all recommendations adopted, and for that purpose it shall coordinate with relevant WIPO bodies; and (iii) discuss IP and development-related issues as agreed by the Committee, as well as those decided by the General Assembly. Consequently, implementation of the above recommendations has been monitored, assessed, discussed and reported at the CDIP (WIPO, 2009a).

177. Though there are direct references to financing issues in the WTO=TRIPS and the WIPO development agenda, there are concerns that reflect that are germane to financing. Thus the term ‘incentives’ in Article 66.2 includes financial and fiscal incentives both of which are key concerns insofar as financing of innovations are concerned. Similarly, WIPO’s CDIP programme as well as the emphasis in WIPO (2009a) about ‘supportive intellectual property-related policies and measures’ for transfer of technology, cannot escape the notion of financing innovative products and processes that are relevant to developing countries.

#### 2.4. SOURCES OF FINANCING INNOVATION AND TECHNOLOGY TRANSFER

178. As mentioned earlier, financing as an activity can be ‘voluntary’ or ‘open ended’ whereby an entity can contribute voluntarily to an R&D activity or project of central interest to it . However when we talk of ‘financing mechanism’ in relation to innovation and technology transfer, the connotation is different. A mechanism is an instrument that has the responsibility of

funding a set of activities in a given sector (say 'renewable energy' or 'neglected disease drugs'). Its focus is not just on funding specific projects that are sporadically chosen. Such a mechanism that finances innovation has to address two components: viz, economic instruments that generate or mobilize financial resources and an appropriately designed facility/ investment vehicle that can lodge and disburse resources so generated. Both elements are crucial to the success of innovation and transfer of technology.

Sources of financing technology transfer	Information resource: Damodaran. A (2009): climate financing approaches and systems: an emerging country perspective, working paper 8(e) – 2009, graduate school of management, st petersburg university, russia.
Public economic instruments	Reed, david, gutman, pablo, carstensen, kim and pols, donald (2009): new mechanisms for financing mitigation: transforming economies by sector, discussion paper, world wide fund (wwf), january. UNFCCC (2008): investment and financial flows to address climate change: an update, technical paper, fccc/tp/2008/7, 26 november. Anonymous (2010, a): report of the secretary-general's high-level advisory group on climate change financing, united nations, november 5.
Public sources	<a href="http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=22">http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=22</a> A.damodaran, 2011. Papers on climate financing and india: sources and instruments for the green climate fund, carbon markets, technology transfer and implementation strategies: prosperity fund india programme "international climate finance: green climate fund and national implementation strategy for india.
Multilateral development banks	<a href="Http://elibrary.worldbank.org/content/book/9780821334423">Http://elibrary.worldbank.org/content/book/9780821334423</a>
Global environment facility	<a href="Http://www.thegef.org/gef/technology_transfer">Http://www.thegef.org/gef/technology_transfer</a>

## 2.5. RESOURCE MOBILIZATION : INSTRUMENTS AND MARKETS

### 2.5.1. Public Economic Instruments.

179. Public Economic Instruments can be important sources of financing innovations in technologies that enhance the supply of public goods like life saving medicines or climate friendly technologies. Apart from generating revenues, Public Economic Instruments (PEI) can facilitate discovery of new and effective drugs and climate smart technologies. PEI can work to raise revenues for the drugs and pharmaceuticals and climate smart technologies by way of the following instruments

- (a) Transaction Tax for mobilizing resources required for R&D in promising drugs
- (b) Charges or general purpose levy for R&D for health purposes
- (c) Auctioning of Emission Allowances by public agencies of the State that facilitate CO<sub>2</sub> emission reductions to be achieved while at the same time generating public resources for supporting climate mitigation and adaptation

- (d) Domestic Carbon Tax on undertakings that emit CO<sub>2</sub>
- (e) Domestic General Purpose Tax to generate direct budget contributions for climate related issues
- (f) International General Purpose Levies including Financial Transaction Tax (FTT) imposed on transactions in foreign exchange and derivatives which can fund development of drugs and pharmaceuticals or climate smart technologies
- (g) Emission Trading Schemes and carbon market levies/ auctions that facilitate CO<sub>2</sub> emission reduction to be achieved at the least cost

### 2.5.2. Public Sources

180. This includes Government Budgetary grants for R&D in health and Official Development Assistance (ODA) from developed to least developed and eligible developing countries. During the year 2007, ODA flows through bilateral and multilateral channels was only of the order of US\$ 103.7 billion (UNFCCC, 2008). This represented on an average 0.23% of the GDP of developed countries as against the Monterrey ODA Target of 0.7% of Gross National Income (ibid, 2008). According to OECD, official long-term export credits amounted to \$ 24-27 billion/yr during 2003-05.

### 2.5.3. Multilateral Development Banks (MDBs)

181. Apart from dedicated finance operating facilities, other sources include MDBs. MDBs include international public institutions like the World Bank, Asian Development Bank, African Development Bank and Inter- American Development Bank (IADB). MDBs act as innovation financing sources through their lending activities. Trigger lending by MDBs in R&D projects or technology development and transfer can leverage private capital investments for these activities.

182. The United Nations High Level Advisory Group on Climate Financing (UNHLAG) (2010) mentions two methods by which Multilateral Development Banks (MDBs) leverage private finance:

- Co-financing, whereby the risk cushioning enabled by MDG investment in a project, induces a private investor (contributing 3/4th of the project cost) to sacrifice or reduce his expected rate of return from a low carbon project. The Net Present Value (NPV) of annuities pertaining to the sacrificed rate of return from a project can then be mopped up through a levy to cushion the incremental costs incurred on a mitigation project by a country with low financial capacity.
- Secondary Private Investment – This involves the secondary multiplier impact on private investment, induced by a dollar of lending by an MDB. The multiplier ratios for secondary investment range from 1:3 to 1:4 as per UNHLAG estimates.
- Technical Assistance by MDBs is also considered to leverage substantial private investment.

### 2.5.4. Private Earmarked Funds

183. These sources involve resources that are available from earmarked corporate funds or outflows from philanthropic funds kept that are kept aside by private companies for undertaking social obligations or for expending as grant for larger community causes in the realm of health, education and sustainable development.

### 2.5.5. Private Capital

184. Private financing of innovation, both national and international, is driven by drug prices and return on investment from markets. Private funds are inherently unpredictable as they are vulnerable to changes in the economic environment as signaled by changing tax regimes, alterations in the fiscal environment and developments that affect capital markets. Private financing is also presaged on availability of and access to risk sharing instruments. When combined with public financing systems they can generate sufficient resources for innovations of technologies and products that have a public welfare and livelihood implications. The trigger provided by public funds and MDB loans also leverages private finances. PEIs including research levies signal the social cost of not supporting innovation in the realm of public goods.

### 2.5.6. Operating Facilities

185. Instruments and markets can facilitate mobilization of resources. However unless an operating financial mechanism exists for pooling the resources raised and allocating and disbursing them scientifically, it may not be possible for humankind to realize its basic goal of providing health care to needy developing countries or for imparting resilience to ecosystems that are vulnerable to climate change in developing economies in order to enable them transition towards low carbon pathways. Such financial mechanisms can promote innovations in drugs and pharmaceuticals that are useful to address tropical diseases and/or 'neglected disease drugs'. Similarly dedicated climate finance operating facilities like the Green Climate Fund (GCF) that have been established under the aegis of the UNFCCC, should appropriately structure allocation of resources between adaptation and mitigation activities (Box 2.1). Adaptation financing needs to have special focus on most vulnerable developing countries and small island developing States. Indeed the 'combination of sources' approach, identified by the UNHLAG (2010) can be crucial in ensuring that development oriented projects that have both adaptation and mitigation features, are implemented in developing countries.

#### **BOX 2.1 : Philosophy of Resource Mobilization and Operating Facilities for Multilateral Climate Funds/ Facility**

The UNHLAG in the year 2010 proposed certain normative yardsticks for resource mobilization and deployment through Multilateral operating facilities like the Green Climate Fund (GCF) that have been set up under the aegis of the United Nations Framework Convention on Climate Change (UNFCCC). The base for the GCF resources should be new and additional sources of financial resources that need to be provided by a variety of PEIs. Public financing is the trigger that provides an atmosphere for financing climate related activities. Private financing, in turn, gets triggered by public investments. In other words, private financing is 'induced' and not 'autonomous' when it comes to climate related investments. Carbon prices provide signals for investment in low carbon technologies of relevance to mitigation action.

It is important to distinguish Gross versus Net investments, when it comes to climate financing flows. There should be an appropriate balance between mitigation and adaptation activities when it comes to GCF funding. Leverage-ability is a key criterion for assessing the effectiveness of a PEI. A combination of instruments, than just a single instrument, holds the key to mobilizing and catalyzing the required quantum of funds required by the year 2020 to implement the Climate Agenda

The UNHLAG analysis indicates that a carbon price of US\$20 to US\$25 could generate around US\$100 - \$200 billion of gross private capital flows for climate action in developing countries. It is conceded that there is no agreed basis, analytically or empirically speaking, to work out flows of private financing. However, based on reliable methodologies, the UNHLAG estimates that gross flows could lead to private net flows in the range of US\$10 billion to US\$20 billion.

The UNHLAG also states that a carbon price in the range of US\$20-US\$25 could generate increased carbon market flows to the tune of US\$30 billion to US\$50 billion annually.



The Advisory Group estimates that for every US\$10 billion in paid-in capital, multilateral development banks could deliver US\$30 billion to US\$40 billion in gross flows. The UNHLAG concedes that there is no analytical or empirically agreed basis on which to calculate net multilateral development bank flows; however, based on methodologies suggested by some members of the Committee, the net multilateral development bank flows have been worked out to be the order of US\$11 billion.

The UNHLAG adopted a multi method approach to determine the scale of resources potentially available for the GCF. Historical figures of leveraging ratios were utilized to arrive at leverage/ multiplier potential of public and MDG financing. From gross figures, net figures were derived by (a) deducting developing country flows/ investments and (b) converting all flows into grant equivalent figures.

Source: UNHLAG (2010)

### 2.5.7. Blending of Financial Sources

186. The greatest challenge of financing innovation in the public goods sector is to find financial resources on a sufficient scale and in a predictable manner for goods and technologies that are critical to livelihoods of poorer communities in developing countries. Since public financing sources such as ODA are inadequate and private capital is hard to come by, on account of low return on investments, there is a strong case for inter-source blending of funds to support innovation in socially critical sectors.

187. Public investments spurred by levies/taxes and budget contributions can provide trigger investments for innovation, which in turn, can leverage private investments in R&D projects.

188. In the context of climate change related remedial action, UNHLAG (2010) estimates an average leverage factor of 3 for private financing from an incremental unit of public financing.

189. MDBs can enhance their lending capacity for innovative projects by accumulating new sources of assets through the following means:

- (a) increase in paid up capital which takes up lending in the ratio of \$1:\$3/\$4 on gross flows replenishment of assets which enhances lending power in the ratio \$1:\$1.1
- (b) issue of bonds
- (c) balance sheet headroom to raise money in capital markets.

190. Of the four sources (a) and (b) are provided through public funds (budget contributions or otherwise), while (c) and (d) are leveraged from the capital markets. As lenders also, MDBs leverage private investments by advancing nonconcessional and concessional loans to the private sector to execute mitigation projects. While non- concessional lending attract a large multiplier (1:5), concessional lending has a smaller multiplier impact at (1:1.2)

191. UNHLAG (2010) propose a set of measures by which various instruments can be combined to optimize the flow of funds of the desired scale. These recommendations are as follows:

- (a) Private investment can be stimulated through the targeted application of concessional and non-concessional public financing. Careful and wise use of public funds in combination with private funds can generate truly transformational investments.
- (b) Flows of private investment will depend on a mix of Government policies and on the availability of risk-sharing instruments.

- (c) Loan price differentiation for 'low versus high' carbon investments could prove an alternative means of internalizing the cost of carbon within the terms of the loan (in the absence of standard practice across the MDBs for integrating a shadow price for carbon into project decisions).
- (d) Public sources, for example, should be combined in ways that avoid double counting of likely revenue sources
- (e) Sound design of public instruments, such as development banking instruments, can increase private flows as well as leverage paid-in capital. Equally, the United Nations system has considerable experience in helping developing countries to apply for and establish an enabling policy environment to receive new climate finance.
- (f) Revenue potential cannot necessarily be added together, for instance, because of spillover effects and potentially diminishing political appetite for mobilizing multiple sources. Combining different sources, both public and private, and examining their appropriate role and scale should be subject to further international and national analysis and discussions. National circumstances will be taken into account in evaluating the menu of options.

## 2.6. MODES OF MIXING FUNDING SOURCES

192. UNHLAG (2010) states that there are broadly two categories of mixing financial instruments: One by mixing different sources (public and private), the second by mixing different types of financial resources viz grants with loans.

193. In some cases mixing of funding sources is done within an instrument, that pools different sources or types of resources (grants, loans). This facility could be a standard publicly administered trust fund or a multilateral (trust or non trust) fund that is largely driven by donors or still, a 'Special Purpose Vehicle', which may neither, is neither a public trust fund nor a multilateral mechanism.

194. The mode of mixing funds also has their temporal characteristic. Funds that pool a variety of sources of financial resources from different sources may sequence release of one type of fund ahead of the other. Sometimes it may also be the situation that all sources/ types of funds are concurrently released to service different segments of a project or program.

195. Sequencing of segregation of financial resources can ensure that resources do not compete for the same avenue. This prevents one source does not crowd out the other.

## 2.7. PUBLIC PRIVATE INVESTMENT FUNDS

196. A case in point is the specialized Climate Investment Funds, which are designed as public-private partnerships. These funds can provide win-win benefits for both public and private investors, with successful examples displaying transparent governance, excellent alignment of interests between public policy goals and the private sector, and ensuring good returns on private investments.

197. In a PPP system, normally the public investor defines the broad investment criteria and the target region. The advantage accruing to the public investment agency is that its scarce grant funds are leveraged. The incentive for private investors is the layered risk/return structure, which enables them to invest in climate projects that normally would be considered too risky from a purely commercial perspective. Some of co-financed projects incorporate technical assistance components, thanks to the public component.

198. Technically some PPP funds utilize a tiered risk-sharing structure. Its liabilities consist of three types of securities bearing different risks: Senior A, Mezzanine B, and Junior C Shares. Private investors invest in the Senior Tranche with the highest return, international financial

institutions invest in the Mezzanine Tranche, donor agencies in the Junior Tranche. The Junior Tranche represents a first-loss tranche, fully subordinated to all other classes of securities issued. The returns for each tranche are fixed at appropriate risk return levels.

## 2.8. THE CONCEPT OF BLENDING PLATFORMS (LOAN GRANT PLATFORMS)

199. According to Anonymous (2011), the concept of blending platforms introduced by the European Commission, European donors and European Financing Institutions represent innovative financial mechanisms that seek to mobilize additional funding to cover the investment needs of specific countries and projects. As a financing platform, the blending approach generates a high grant to loan leverage ratio. Further, they make use of existing finance delivery mechanisms of eligible European Finance Institutions. For recipient countries the advantage is the high volume for capital made available by such platforms for intensive infrastructure projects at concessional rates.

200. Each EU blending platform has a strategic body providing policy directions, a decision making body that decides which projects should receive grants and a group of financiers who screen proposals and provide technical analysis before forwarding selected proposals to decision-making body for final approval.

201. An example for a blending platform is the Neighbourhood Investment Facility (NIF) in Europe Union countries. The NIF has been designed to finance capital-intensive infrastructure projects in partner countries covered by the European Neighbourhood Policy (ENP) as well as to support their private sector. The facility promotes key infrastructure in the transport, energy, social and environment sectors with particular focus on climate change mitigation and adaptation. The Facility brings together grants from the European Commission and the EU Member States with loans from European public Finance Institutions, as well as own contributions from the partner countries. To date, the NIF has contributed €277.4 million in grants to infrastructure and private sector projects, leveraging a total project volume of more than €10 billion.

202. The idea of a blending platform provides a significant trigger to private investments with public grants and loans providing the catalyst for private sector to crowd in towards high volume infrastructure projects. The approach can be tried out for large-scale low carbon projects that operate for large industrial clusters. However the relevance of a blending platform for small-scale adaptation projects in developing countries is limited. The scheme's relevance to research and development of low carbon technologies is also limited. The idea can be tried out on a limited scale in the mitigation portfolio.

203. However blending of financing sources holds equally well for the Drugs and Pharma sector as a well, especially for tropical medicines, where a combination of public, private and philanthropic funds take a molecule from R&D phase to , commercial phase.

## 2.9. EVIDENCE FROM THE DRUGS AND PHARMA INDUSTRIES

204. Financing of innovation in the Drugs and Pharma industry flows interesting patterns. In recent times there have been many suggestions on introducing new and novel systems of financing to promote R&D and innovation in the drugs and pharma sector. This section looks at the current 'not so favorable' scenario for R&D and innovation in the drugs and pharm industry, and proceeds to consider ongoing systems of financing in the sector before looking at new and novel techniques proposed for the sector.

205. The significance of financing innovations by way of new molecule entities in the drugs and pharma industry arises from the crises the industry is reported to be facing in terms of 'increasing costs, decreasing productivity, funding pressures and attrition of projects as they progress through the development process' ( Grant Thronton,2010). This assessment of constraints faced by the drugs and pharma sector is a 'supply side' viewpoint. In reality both 'supply side' and 'demand side' factors are important for analysis. By 'demand side factors' are

meant, constraints faced by end consumers of drugs in developing countries to access medicines that are relevant to their needs, both in terms of quantity, quality and affordable prices. In many ways, the supply side and demand side factors mentioned are inter-linked. Thus 'increasing costs of drug discovery' and 'decreasing productivity' can lead to lowered access for the medicine by consumers on account of higher than average prices. However it also needs to be noted that high prices for drugs and medicines in developing markets may also arise from higher than average mark-ups, enjoyed by companies that have patents over them.

#### 2.9.1. Supply Side Factors:

206. From the supply side point of view, 'increasing costs' can be attributed to the mounting costs of hiring qualified scientists, need to ramp up infrastructure facilities both by way of lab and post-lab facilities, costly clinical trials, cumbersome approval processes and possibilities of rejection faced by a candidate drug on 'safety grounds' in the pre-commercialization or commercialization phases. On the other hand 'decreasing productivity' is expressed in terms of rising R&D investments costs per drug discovered and commercialized. These two factors raise serious constraints in terms of investment flows into the sector. What is more, the recent trend in the industry 'whereby large pharma companies separate their discovery and research activities has added to difficulties in finding financing for R&D and innovation (Grant Thornton, op.cit). Venture capitalists and private investors are reluctant to fund new drug discovery activities on account of long lead-time and possibility of failure at the pre-commercial or post-commercial phases (ibid). This in turn constrains 'early stage drug discovery' operations on the part of private investors. The option is therefore to have early stage drug discovery funded by public or Government financing systems<sup>6</sup> However, financing by Governments have their limitations. This happens on account of cumbersome procedures involved and difficulties in actually availing financial assistance to the requisite degree. According to Grant Thornton (2010), 'Corporate venture capital' (CVC) has emerged as an important alternative financing mechanism for promising start-up companies globally. Amgen, Merck, Eli Lilly and Novartis have set up venture funds to invest in a portfolio of companies in drug discovery. Indian companies viz Dr. Reddy's, Ranbaxy, Reliance, TCG life sciences and the Tata group have incorporated life-science companies/ funds to specifically invest in drug discovery companies in the emerging areas (ibid). A key drawback of this form of investment is a conflict in objectives, dominating influence on operations of the private company funding the venture and often-even competition. Further, limited commitment on the part of the corporate entity and conflicting relationship between the supporting and supported entity, are some of the drawbacks seen in the past (ibid).

207. While CVC may allow the entrepreneur to bring on board highly experienced and focused partners guaranteeing a high degree of visibility, the drawbacks need careful consideration. Strategic alliances are largely seen between a large domestic pharma/ R&D company and a larger global pharma company (ibid) .

#### 2.9.2. New Age Creative Financing Models to address Supply Side financing constraints

208. Some of the key new age development models attempted in USA and Europe, include:

- (a) Research Collaboration Alliances
- (b) Contract Research

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<sup>6</sup> Indeed this is the practice in USA as well. Thus the drug Tofacitinib (Xeljanz), for the treatment of rheumatoid arthritis, which recently hit the market was developed on the research base provided by the National Institutes of Health (NIH). The expenses of drug discovery and preclinical and clinical development were however fully undertaken by Pfizer (Derek Lowe, 2013). In India, recognizing the importance of public funding of early stage R&D , Government of India brought in a Public Funded R&D bill and set up a venture capital fund to finance research and development work to promote early stage R&D in the drugs and pharmaceutical sector. Such policy initiatives led to the emergence of countries like India 'as the "partner of choice" for off-shoring several R&D initiatives with a 35-40% overall cost advantage' (Grant Thornton ,op.cit).

- (c) In licensing and Out licensing arrangements
- (d) Investments by High Net worth Individuals
- (e) ('HNI')
- (f) New stock markets (eg: the 'Alternative Investment Market')
  - (i) Project financing that entail
  - (ii) Combination investments
  - (iii) Combinations of Venture Capital and Angel Investment
  - (iv) Combinations of Bio incubators and Corporate Venture Capital (one of the most
  - (v) developing forms of investment in recent times in India)
- (g) Public Private Partnerships (PPP's)
- (h) New Age Stock Markets

#### *New Age Stock Markets*

209. The advent of new stock markets, such as the French Nouveau Marche, the Italian Nuovo Mercat, the UK Alternative Investment Market (AIM), and Nasdaq Europe, was among the most important reforms in international stock exchanges in recent times that can benefit new start-ups to raise financial resources. These new stock markets aim at attracting innovative early-stage and high-growth companies that would not have been viable candidates to public equity financing on the main markets of some of the larger stock exchanges. However, liquidity in such markets for this sector is largely linked to the performance of the overall stock markets (Grant Thronton, op.cit).

#### 2.9.3. Demand Side Factors:

##### *2.9.3.1. Narrowing Pipelines for NMEs and Lowering Access to Quality Drugs*

210. Juliano( 2013) states how narrowing pipelines of new drugs severely limit possibilities of making available quality drugs for the poor . He advocates measures for 'increasing the efficiency of corporate R&D, as well as several alternative strategies for pharmaceutical research, including academic drug discovery centers and the public-private partnerships that have been so successful in attacking neglected diseases' (ibid). Finally, Julianoop.cit , recommends 'the creation of non-profit drug development corporations (NPDDCs)' designed to bring key aspects of early-stage drug development into the pre-competitive public arena. The creation of effective NPDDCs promises to provide the health care system with less costly and more effective medicines.

##### *2.9.3.2. Taxation*

211. Governments play an important role in encouraging and fostering innovation through employing fiscal mechanisms such as taxation (Panos Kanavos et al, 2009). Taxation measures may partake of tax incentives via R&D credits with enhanced market exclusivity periods that can serve to encourage intellectual creativity. Taxation can also raise financial resources for scaling up R&D for oncology treatment. The authors argue that using prescriptive and coercive regulations may be cumbersome, expensive and inefficient, while output- or performance-based regulations may have more likelihood of success' (ibid).

212. There is also a proposal for introducing a Foreign Transaction Tax to raise resources for drugs discovery in critical areas. (Box 2).

#### 2.9.3.3. WHO Assistance Package

213. This includes provision of Direct Grants, working on equitable licensing systems, using enlarged pooled funds and patent pools. Assistance to facilitate negotiations for voluntary licenses by Patent Pools is another issue that is worth looking into (Box2). Another area of importance is that of financing 'promising Product Development Partnerships (PDPs)' that involve cooperation between the public sector and the private sector for development of drugs for critical diseases (Box2).

#### 2.9.4. Novel Financing Sources: Research Council Awards in Canada and UK

214. In recent years 'National and Regional Research Councils' have come up with well focused and targeted public funding moves to accelerate R&D for creating novel drugs to tackle cancer and other debilitating diseases. The effort seeks to involve lead Universities and industry in the process. A case in point is the assistance of £1.5M received by a pioneering drug development team (comprising of former industry professionals and leading academics) at the University of Aberdeen from the Scottish Enterprise and Biotechnology and Biological Sciences Research Council to create novel therapies based on the immune system of one of the most ancient species on the planet – sharks (Anonymous, 2013,a).

215. A second case in point is that of the 'Quebec Consortium for Drug Discovery (CQDM)', a biopharmaceutical research and drug discovery research network which received funding through the Business-Led Networks of Centres of Excellence (BL-NCE) program of Canada. The assistance amounted to \$11.7 million over five years (Anonymous, 2013,b).. The CQDM's industrial partners include AstraZeneca, Merck, Pfizer, Boehringer Ingelheim, Eli Lilly and GlaxoSmithKline (ibid).

216. The BL-NCE program is run by the Networks of Centres of Excellence Secretariat and involves three federal granting agencies—the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC)—in partnership with Industry Canada and Health Canada' (Anonymous, 2013,b,op.cit) . The programme was set up in 2007 to address major private-sector R&D and commercialization challenges by drawing on universities, research organizations and the private sector (ibid)

#### **BOX 2: WHO Models of Financing and related Enabling activities, Voluntary Pooling and Transaction Taxes**

The WHO's models include direct grants, equitable licensing, pooled funds, prizes and patent pools, collectively called 'best fitting' models. They also include 'less well fitting' models such as priority review vouchers and a [health](#) impact fund.

With direct grants, for example, small- and medium-sized companies in developing countries are given funds to develop a product to the stage where they can more easily find other funders to take it to later stages of development.

Equitable licensing aims to ensure that medicines arising from public funding are licensed to make them affordable to the poor. Pooled funds aim to provide, on a long-term basis, funding to research organisations from sources including taxes or bonds. And prizes are rewards for developing a product or for completing a step in the R&D process.

As part of these recommendations, the WHO strongly insists that patent pools are established, where a number of patents by different owners are brought together and made available on a nonexclusive basis to generic companies.

The Medicines Patent Pool (or the Pool), is a major commitment to implementing this idea. Founded and financed by UNITAID and backed by the WHO, UNAIDS, the Global Fund, and the Group of 8, the Pool is focusing on cutting-edge antiretroviral (ARVs) for [HIV](#).

The Pool seeks to negotiate with patent holders for voluntary licenses (VLs) on their ARV patents against the payment of royalties. Expected benefits include increased competition and affordable prices for generic ARVs licensed through the Pool.

Universal buy-in

The Patent Pool has signed two VLs with Gilead Sciences and the US National Institutes of Health, and is in talks with Boehringer-Ingelheim, Bristol-Myers Squibb, Roche, Sequoia Pharmaceuticals and ViiV Healthcare (a joint venture of GlaxoSmithKline and Pfizer). Meanwhile, generic companies have begun to take licenses from it.

Product development partnerships (PDPs)

A combination of two or more models will be needed to ensure that the outputs of R&D, innovation and access are available without restrictions. To achieve that goal, all models should complement current IP regimes and include partnerships, open source and needs-driven rather than market-driven rules.

Product development partnerships (PDPs) meet these requirements. They provide a framework for cooperation between the public sector (governments, academic and research institutions) and the private sector (companies, nongovernmental organisations and philanthropic organisations).

PDPs already established include partnerships between the Drugs for Neglected Diseases initiative (DNDi) and companies Sanofi Aventis and Farmanguinhos/Fiocruz — which have produced innovative anti-malarial products.

Similarly, there exists a partnership between DNDi and Merck aims to roll out medicines for leishmaniasis and Chagas disease. Similarly, the TB Alliance has teamed up with Johnson & Johnson to develop new [tuberculosis](#) drugs.

PDPs enable both industry and governments to do what they could not alone. And their sustainability would be enhanced if governments financed them more effectively.

The foundation of all viable models is sustainable financing mechanisms, and we must find innovative funding sources.

Towards a transaction tax

A financial transaction tax (FTT), which aims to support development and health needs, is now under international debate, and has been endorsed by the EU Commission. A 0.05-per cent tax on all financial market transactions could raise €209 billion (US\$273 billion) a year in the EU alone and would be sufficient to finance development priorities in the region and internationally.

**Source: Daniele Dionisio(2012)**

### 2.9.5. Neglected Diseases

217. The problem of neglected diseases has been a major roadblock in reaching effective drugs at affordable prices to developing countries. Bulk of the neglected drugs relate to tropical diseases, which pose a severe threat to public health conditions in developing countries. According to Patrice Trouiller et al (2002) while about US\$307 million per million DALYs is spent worldwide on non-infectious respiratory diseases, it is only \$3 million per million DALYs that is spent for tropical diseases. As Trouiller et al, op.cit, observe 'the total investment (public and private sector) in drug research and development for malaria, tuberculosis, leishmaniasis, and African trypanosomiasis was less than \$70 million'. While basic knowledge of many infectious diseases and the process of drug discovery and development exist, tropical infectious diseases such as malaria, leishmaniasis, lymphatic filariasis, Chagas' disease, and schistosomiasis continue to cause significant morbidity and mortality, mainly in the developing world (Murray et

al,2001). The burden of infectious diseases has been compounded by the re-emergence of diseases such as tuberculosis, dengue, and African trypanosomiasis. These diseases all predominantly affect poor populations in the less-developed world (ibid).

### 2.9.6. PPPs, IPRs and Technology Transfer

218. Sourcing and mobilizing financial resources for 'neglected diseases' is therefore a crucial priority. In recent times there have been a few initiatives by way of PPPs and collaborative research that holds promise. However these efforts need to be strengthened to promote innovation and create conditions for transfer of technologies to developing countries, so that the demand for drugs relevant to neglected diseases is achieved.

219. Moran et al (2005) have examined different models of PPP in the light of their approach to IPs and structure of functioning. Where PPPs have control over IPs they achieve their mission of providing medicines at affordable prices in developing countries. Where they develop new compounds in-house, or bring in external compounds to the PPP, the focus of the PPP may be on financing and providing technical support or get the PPP to organize clinical trials in the country concerned. Under such circumstances, where the protected IP is introduced, there is very little transfer of know-how or control over IP. In the event, the PPP is seen as a facilitator for introducing the medicine in the developing country market, and may use contractual agreements to secure reasonable or low mark-up prices for the medicines involved. The other manner in which a PPP functions is to eschew industry altogether and get R&D (early-stage mostly) done at the public institutions. Here the focus will be on having control over IP and marketing the product at prices that are affordable to consumers in developing countries. Financing by way of capital expense from public agencies plays a bigger role in situations where PPPs undertake to develop new compounds by themselves or where they need financial assistance for undertaking clinical trials. Private financing, plays a role as private voluntary contribution more than as private capital assistance. (Box 3)

#### **BOX 3: PPPs, IPRs and Patterns of R&D in the Drugs and Pharma Sector**

To provide drugs at affordable price to developing country patients PPPs may focus on developing existing compounds to new drugs. They access existing compounds from companies or academics (background IP) and develop new products resulting in foreground IP that they treat for providing affordable drugs. In other words they will do well with their mission when they have control over IPs.

One other classical model is where a PPP works in partnership with a small or large pharmaceutical company to develop an in-house company compound, for example, Wyeth's filariasis project with WHO/TDR (moxidectin) or MMV's antimalarial project with the small company Paratek (tetracycline). A variation is where the PPP brings external compounds to a company for further development: for example, the TB Alliance brought a series of PA-824 back-up compounds to Novartis to take advantage of their medicinal chemistry know-how.

Taken together, these approaches represent less than half of all PPP projects. As would be expected under this classical model, the primary role of the PPP in these partnerships is to provide the company with funds and any technical support they may need. The level of PPP input needed will generally depend on the size of the company and its developing country experience. For example, multinational companies usually (but not always) minimise the need for PPP funding by providing substantial in-kind services, whereas small companies may often seek full cost-recovery on their neglected disease work. Likewise, technical support may be modest for a neglected disease focused firm (e.g. assisting with trial partners), but can range up to conduct or co-conduct of clinical trials for less experienced small companies and multinationals, or even require the PPP to take responsibility for manufacture and distribution in some partnerships with small companies.

In the classical PPP category the IP situation will largely be out of the PPP's hands. PPPs generally deal with this issue by including binding contractual obligations on



price and delivery in their agreements with companies. As noted above, these agreements can be easier to conclude with multinational companies, for whom this IP is low-value, than with small companies, for whom it may represent their only source of profits.

Nevertheless, under current PPP agreements, the great majority of partners agree to provide the final product at a not-for-profit price or at a low mark-up (3-5 per cent) to neglected disease *patients in developing countries*. This includes all multinational company partners (around one-third of PPP projects), small companies focused on Western diseases, and the great majority of academic partners. The small number of companies who see the developing country market as commercially interesting tend to be less flexible, seeking larger margins (for example, up to 15 per cent in public developing country markets) or, as noted above, refusing to sign PPP deals that they feel would put their profits under pressure.

#### New models

PPPs may:

- choose to work with no partner, by simply subcontracting out R&D to multiple industry and academic/public groups;
- develop the compound itself, using academic or industry subcontractors for preclinical work, but bringing in an industry partner or subcontractor (in some cases a developing country firm) at a later stage to assist with regulatory work, manufacture and distribution;
- forgo industry input altogether, with R&D being conducted solely by public partners or public subcontractors. This happens particularly with early-stage projects (although industry input would be expected further down the development line), but sometimes also with late-stage registration projects.

Alternatively, active pairing of small Western companies (or academics) with developing country manufacturers can sustain a neglected disease pipeline that is far cheaper than the traditional commercial approach.

Multinational companies primarily seek funding to mitigate their costs, particularly at the clinical

trial stage, but also welcome technical help in conducting developing country trials, registration and implementation. PPPs are able to closely match these needs in a way that other public policies and incentives do not, and have therefore rapidly become a preferred multinational company approach— indeed, as noted above, PPPs are probably essential to industry's 'no profit-no loss' model of neglected disease drug development.

**Source: Mary Moran et al (2005)**

220. The main arguments against R&D for neglected diseases are lack of viable markets and the costly and risky nature of the Drug development process for tropical diseases. Hence unless there is flexibility to charge high prices on these drugs, there is little possibility for innovation to happen in this sector<sup>7</sup>. (There has been an improvement in R&D expenses in the neglected disease area since 2000. Indeed it is reckoned that there are 3 to 4 Multinational Companies that have dedicated R&D for neglected diseases (Mary Moran et al, 2005). There is potential for attracting SMEs in developed countries towards R&D in neglected diseases (ibid).

221. Product Development Partnerships that partake of PPPs form another option for neglected diseases. PDPs have been successful in attending to R&D in the neglected disease sector. Malaria related medicines have benefitted from this model. Besides PDPs have ensured a viable partnerships of international organizations, industry and national research /academic institutions . A case in point is that of the three-fold partnership involving The National Center for Drug Screening, Shanghai Institute of Materia Medica, Chinese Academy of Sciences of China, WHO and NN - Novo Nordisk A/S, for research on neglected diseases (Box 4).

**BOX 4: Chinese Institutes-WHO- Novo NordiskA/S Partnerships in drug discovery against neglected diseases**

**NCDS - The National Center for Drug Screening, Shanghai Institute of Materia Medica, Chinese Academy of Sciences.** Contribution: provides infrastructure and expertise to conduct high-throughput screening (HTS) and identification of leads for pharmaceutical development, as well as training of fellows from developing countries. **NN - Novo Nordisk A/S.** Contribution: supply of compound libraries, expertise with pharmaceutical research, development, and commercialization activities. **WHO - World Health Organization Special Programme for Research and Training in Tropical Diseases (WHO/TDR).** Contribution: oversees the management and technical review of the collaboration, supplies molecular targets through academic collaborators to support HTS, provides access to screening, medicinal chemistry, and DMPK networks, and sponsors fellows from Africa to be trained at NCDS as part of the collaboration.

**Source: Jakobsen et al ( 2011)**

222. Other successful cases involving neglected diseases include (a) the establishment of an institute by Novartis in Singapore focusing on research in malaria, dengue, and tuberculosis, (b) AstraZeneca working on tuberculosis in India and (c) GSK in Spain operating an open laboratory to support drug discovery for neglected diseases (Jakobsen et al,op,cit).

223. PPP based PDPs have the advantage of facilitating apportionment of sunk costs and sharing of risks, thus making it possible for effective drugs to be produced in the neglected diseases sector. In the past 10 years, the product research and development (R&D) pipeline, including vaccines, diagnostics, and drugs, for neglected diseases has been supported through product development partnerships (PDPs) (Jakobsen et al,op,cit). However PPPs that focus on PDPs require the support of Government by way of financing of innovations and tax concessions to yield results. There is also the feeling that PDPs by focusing on the low-hanging

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7 As Traullier et al (2002) state, 'Developed countries offer viable market incentives for research and development through individual purchasing power and purchasing through government-run health insurance programmes. In Europe, for instance, these mechanisms cover two-thirds of drug costs for 80-100% of the population as opposed to 35% in Latin America and less than 8% in Africa. With public spending on drugs at around \$239 per head per annum in countries belonging to the Organisation for Economic Cooperation and Development (OECD), the pharmaceutical industry has a strong incentive to develop drugs for this market. By contrast, most developing countries spend less than \$20 per year and per head on all health programmes (less than \$6 in sub-Saharan Africa, including drug expenditures). This situation results from a market too small to attract private-sector investment in research and development for the diseases that mainly affect developing countries.'

fruits may not have done justice to the hard-core areas of research (ibid). Besides it is doubtful as to how far PDPs have succeeded in involving participation of disease-endemic countries (DECs) (ibid).

224. Most of these limitations can be avoided by having inter-governmental networks that promote creative models of supporting innovation in respect of neglected diseases, through effective PPPs and North- South and South- South co-operation that tap regional innovation networks. A case worth mentioning here is that of the African Network for Drugs and Diagnostics Innovation (ANDI) ( Box 5).

**BOX 5: Tapping Regional Innovation Networks: The Case of African Network for Drugs and Diagnostics Innovation (ANDI)**

Some recent inter-governmental actions have stressed the need to invest in building sustainable capacity for health innovation in the developing world. Of note are the Global Strategy and Plan of Action (GSPOA) on public health, innovation, and intellectual property, which aim to promote new thinking on innovation and access to medicines for diseases that disproportionately affect developing countries. It also calls for stronger PPPs and North–South and South–South collaborations, as well as the establishment of regional and international networks in support of product innovation in disease-endemic regions. This initiative is best exemplified by the formation of the African Network for Drugs and Diagnostics Innovation (ANDI), which operates under a regional governance and management. ANDI hopes to provide a time-efficient, cost-effective, and inclusive model to meet critical health care challenges in the continent. It is anticipated that leads emerging from the NCDS, NN, and WHO/TDR collaboration could, for example, be further optimized and developed through regional innovation networks in developing regions like ANDI or other partners.

**Source: Jakobsen et al ( 2011)**

## 2.10. EVIDENCE FROM ENVIRONMENTALLY SOUND TECHNOLOGIES: THE CASE OF FINANCING CLIMATE SMART TECHNOLOGIES

### 2.10.1. Sources of Climate Financing

225. The UN Framework Convention on Climate Change (UNFCCC) was signed at the United Nations Conference on Environment and Development held at Rio de Janeiro in 1992 and came into force two years later. The objective of the Convention was to mitigate rising levels of CO<sub>2</sub> and Greenhouse Gas (GHG) 'build up' in the atmosphere, caused by burning of fossil fuels and deforestation, which posed severe threats to humankind by way of climate change and breakdown of livelihood systems. In the year 1997 the Kyoto Protocol on Climate Change was signed, though the protocol came into force only in 2004. The objective of the Protocol was to secure quantitative reductions in CO<sub>2</sub> and other GHGs and provide technological co-operation, financial assistance and market based instruments to help realize these reductions.

226. The UNFCCC divides countries into two main groups- a group of 41 developed countries are put under Annex –I including the OECD countries and Economies in Transition (EIT) countries while Non- Annex - I countries comprise of the developing countries. These member countries are subjected to certain fundamental obligations and responsibilities towards the overall climate change awareness and compile an inventory of their greenhouse emissions. In terms of the UNFCCC and the Kyoto Protocol, Annex-I countries comprise of the industrialized nations who are required to undertake mitigation of CO<sub>2</sub> and Green House Gas Emissions. More specifically they were required to keep their emission levels by 5.2% below that of in 1990 in their first commitment period. In case of failure to do so, they were bound to buy credits/allowances from the Non –Annex-I countries or invest in 'cleaner technologies'. Non Annexure 1 Countries who are most vulnerable to climate change, on the other hand were to be provided financial and technological assistance by developed countries to adapt themselves to

climate change. Indeed Article 11 of the UNFCCC provides for setting up a financial mechanism that function under the aegis of the Conference of Parties (COP) to the Convention. This proviso forms the basic principle underlying a financial mechanism that is set up to fund mitigation and adaptation activities as envisaged by the Convention.

227. Among the Non-Annex-I countries some are particularly disadvantaged owing to their geographic location while some due to their economic dependence on fossil fuel production. These include the Least Developed Countries (LDC) by the UN in regard to their low capacity to respond to climate change.

228. At the 17th Conference of Parties of the UNFCCC (COP 17) held in Durban in December 2011, recognizing the urgent need to raise their collective level of ambition to reduce greenhouse gas emissions to keep the rise in average global temperature below two degrees Celsius, a significantly advanced framework for the reporting of emission reductions for both developed and developing countries was also agreed, taking into consideration the common but differentiated responsibilities of different countries. It was decided to operationalize the \$100 billion per annum, Green Climate Fund (GCF) that was agreed to be set up at the COP-15 held in Copenhagen and provide conditions for developing countries to access the funds. The Technology Mechanism agreed upon at COP 15 at Copenhagen became fully operational in 2012. The operational arm of the Mechanism, viz, the Climate Technology Centre and Network was also firmed up at Durban.

229. Thus financing of innovation and Research and Development in low carbon technologies (referred to as 'Climate Finance') is enshrined as important components of the UNFCCC and its Protocol.

#### 2.10.2. Public Sources of Climate Finance: National and International

230. Public Finance is considered a key element in Climate Financing. Public finance in its national and international variants includes grants and soft loans made by national public bodies or multilateral financing institutions. National level donor driven funds are circumscribed by national plans and priorities, apart from FCCC objectives. Their deployment may be through multilateral or bilateral channels. The key funding instruments used for public financing are: Grants, loans, Debt Loans, Mezzanine Finance, Public Private Leveraged Funding, fiscal incentives and equity private. The most common funding schemes are grants and loans followed by Public –Private-Leveraged guarantees (Sharma and Mittal, 2009).

231. During the year 2007, ODA flows through bilateral and multilateral channels were only of the order of US\$ 103.7 billion (UNFCCC, 2008). This represented on an average 0.23% of the GDP of developed countries as against the Monterrey ODA Target of 0.7% of Gross National Income (ibid, 2008). According to OECD, official long-term export credits amounted to \$ 24-27 billion/yr during 2003-05. Estimates vary about the scale of funding required for adaptation activities. While the World Bank guesstimates current needs to be of the order of 9 to 41 billion US dollars, UNDP estimates are higher at \$86 billion. The UNFCCC places adaptation-funding requirements to be in the range of \$28–67 billion (Muller 2008, p 6). The World Bank's estimates are based on anticipated flows from ODA, FDI and domestic investment towards adaptation activities. It is reckoned by the Bank that 10 to 20% of the ODA and concessional flows amounting to \$4 billion to \$ 8 billion will flow for adaptation activities. The Bank likewise estimates that 10 to 20% of FDI flows amounting to \$2-\$4 billion will find its way for funding adaptation activities. Gross domestic investment is expected to contribute \$3billion to \$30 billion, which works out to be 2-10% share of aggregate domestic investment (Muller 2008, p 6). Even higher are the annual fund requirements estimates) for the coming decades 2020 and 2030, provided by a variety of sources including the World Bank, McKinsey and Stern. The details of mitigation and costs anticipated in 2010-20 and 2030 costs are illustrated in Table 1

232. Multilateral public financing dedicated to climate change, is largely driven by UNFCCC concerns and guidance. It is not driven by tangible profits. This includes assistance provided by the UNDP, African Development Bank, Asian Development Bank, IADB, the World Bank, and the Global Environmental Facility (GEF)

### 2.10.3. International Public Financing System: The Global Environmental Facility (GEF)

233. The Global Environmental Facility has been 'the' time-tested facility for financing climate change addressing activities. The Facility, which was set up in 1994, has a modest corpus, which is based on country pledges. As an operating entity – the GEF has a fiduciary arrangement with an internationally accepted Trust fund. The World Bank is the trustee of the fund and holds the fund in trust, assets and receipts. The trust mobilizes resources, does financial management, carries out investment in liquid assets, conducts disbursements of funds to Implementing Agencies in charge of projects (viz the UNDP, World Bank itself, Asian Development Bank etc.), maintains records and accounts, monitors application of budgetary and project funds in accordance with the GEF instrument. When it comes to project assistance norms, the GEF is subjected to the guidance of the FCCC.

234. GEF's primary strategy has been to provide grants to meet the incremental costs arising from implementing climate change and biodiversity. To put it differently, the GEF funds the "incremental" or additional costs associated with transforming a project with national benefits into one with global environmental benefits. Since its corpus/kitty is limited, the GEF relies heavily in acting as a trigger to catalyze a range of public and private financial resources. Since 1991, the Global Environment Facility has provided \$6.8 billion in grants and generated over \$24 billion in co-financing from other sources to support over 1,900 projects producing global environmental benefits in more than 160 developing countries and countries with economies in transition. In 2006, 32 donor countries pledged \$3.13 billion to fund its operations for four years.

235. In nominal terms GEF leverage ratios look impressive. But this is also due to the small corpus of GEF funds. Besides, the nominal leverage ratios conceal inter-sectoral differences. Cumbersome project sanctioning procedures and project cycles, coupled with problems with assessment of results, have curbed the leveragability of GEF in relation to private finance. A study of a spectrum of projects financed by the facility in various parts of the world indicates lower leverage for projects, which are in the medium or low category on the attributes of tangibility of outcomes and scale and 'high' in 'technological failure probabilities' (Sharma and Mittal, 2009).

236. Presently in the GEF scheme of things, allocation follows the principle of geographical and sectoral balances (UNFCCC, 2008, p96). The system seeks to follow transparency and cost effectiveness, based on a combination of global environmental benefits and country performance (GEF EO, 2008 as cited in UNFCCC,2008). However as also noted elsewhere, the resource allocation framework of the GEF is considered to be complex (ibid). There are issues relating to effectiveness, efficiency, predictability (in project selection) and the length of the GEF project cycle(ibid, p90).

237. The accepted model of finance disbursement, as has been noticed in the case of the GEF, is that of an operational entity set up by the COP of the Convention to carry out all business functions. As mentioned earlier, this includes pooling of received money resources for provision of grants, concessional loans, risk guarantees etc. through a fiduciary arrangement based on a Trust Fund approach. The operating system routes its resources through an intermediary or an implementing agency (World Bank, UNDP, ADB etc.), which in turn provides technical advice to catalyze project preparation, design, execution and implementation. Delays in project cycles and funds disbursements are noted as affecting the efficiency of financial mechanisms such as the GEF Trust Fund. This in turn is largely attributed to the intermediation processes. The Adaptation Fund Board seeks to address this inadequacy by providing direct

access to financial resources by the operating entity than its routing through an intermediary institution (like the World Bank, UNDP and the Asian Development Bank). China and G77 have proposed a like framework for future adaptation financing mechanisms (UNFCCC, 2008, p45).

#### 2.10.4. Other Public Climate Funds

238. A range of new climate finance facilities have been set up in the preceding 4 years to fund adaptation, mitigation and related enabling activities under bilateral and multilateral co-operation programs. Broadly speaking, these funds can be categorized as those created under the aegis of the UNFCCC, those that are based on bilateral pledges and those that are under the multilateral fold. In the first category come the adaptation funds constituted under the aegis of the GEF. These funds are based on country pledges by OECD donor countries to finance adaptation activities in vulnerable and least developed countries. It is to be presumed that these pledges are additional to their ODA disbursements. The funds are subjected to the approval processes and procedures of the GEF, which are dilatory in nature. Project implementation systems also follow the regular GEF structure of implementing agencies and the set GEF criteria of performance indicators.

239. The Adaptation Fund (discussed in the preceding section) is a dedicated trust fund set up based on donor country pledges and focuses on vulnerable developing countries. The governance structure of the fund is based on balanced representation of recipient countries, UN entities and donor countries.

240. There are bilateral funds that are based on resources pledged by donor Governments concerned to eligible bilateral partners. Assistance is by way of technology transfer from companies in donor countries, capacity building (The Cool Earth Partnership of Japan), leveraging private sector capital and other donor funds, providing strategic information, financial management capabilities, research into new technologies, development of zero carbon emitting Carbon Capture and Storage Technologies and undertaking forest related investments (ETW-IW of DFID and Climate and Forest Initiative ,Norway ). The governance structure of these funds is largely controlled by the donors, though there are efforts to represent recipient, developing countries in decision making. The common point to all the bilateral funds is that they represent efforts to tie assistance to strategies and technologies of donor country or donor country consortiums.

#### 2.10.5. Private Sources of Climate Finance

241. Private Finance emanates from institutions or organizations that are not under the direct control of government. These include those that function through market processes, and provide private capital for the development and deployment of environmental technologies. Some variants include undertakings based on public private partnerships, quasi-governmental agencies that raise bulk of their funding is raised from non - governmental sources.

242. Entities which fund environmental technologies include venture Capital investors, small and medium enterprises, private equity investors, business angels, high net worth individuals, banks and large corporations (Sharma and Mittal, 2009).

243. The key funding instruments for private financing include Equity Seed Capital, Equity Venture Capital, Private Equity, Pension or Managed Funds, Debt Loans, Debt Bonds, Debt Development Finance, Mezzanine Finance, Grants, Public Private Leveraged funding and Corporate Finance.

#### 2.10.6. Funding Stages

244. Private investors that a project based on futuristic technology carries high risks. Largely, private equity investors favor 'expansion stage' technologies, and venture capital investors look for proven mid- stage technologies. Debt financing investors do not generally issue loans or bonds until a technology reaches maturity stage.

#### 2.10.7. Goals

245. Goals for private financing differ from public financing in certain respects. Unlike public financing, where funding goals have specific political, environmental and social welfare elements, private investment tends to be focused on maximizing financial return. However, in terms of environmental technologies and eco-innovation, there are often indirect financial or even non-financial concerns that come into play. In particular, private investors identify risk reduction, regulatory considerations, best practice, good corporate citizenship, stakeholder pressure, and social responsibility as factors in their investment decisions. Some specific investor types, like angel investors and philanthropists, do invest with limited expectations regarding financial returns. This then explains why private financing is not forthcoming where public goods are involved.

#### 2.10.8. Performance Criteria

246. The performance criterion for most private investors is “rate of return”. Although there is some variation in terminology regarding which specific rates are being measured (for example internal rate of return, as distinct from return on invested capital), the use of this performance criterion is ubiquitous for all private investors.

247. While all investors measure rate of return, their goal is not always to maximize this. A common method is to measure actual rate of return from the expected rate of return. In many cases, private sector investors report that there was little material deviation from expected returns as opposed to actual returns.

248. A small but significant number may take a more strategic and long-term view, looking for investments in separate companies that they can eventually conglomerate into vertically integrated long-term businesses. Indicators used in such an approach vary widely.

249. A small segment of private investors, particularly sections of private equity and venture capital funds, use environmental returns as a measure of funds' performance. In the case of climate smart technologies, reported indicators include emissions credits (carbon dioxide, sulphur oxide, and volatile organic compounds measured per ton). Another reported measurement includes the level of re-investment in other environmental technologies or other projects and ventures in a similar environment technology. More significantly private financing is highly co-related to the state of national/global economy.

### 2.11. LIMITATIONS OF EXISTING CLIMATE FINANCING SYSTEMS

250. The United Nations Framework Convention in Climate Change (UNFCCC) lays down the maxims of climate finance in terms of the following desirable attributes: ‘new, additional, predictable and adequate’ (UNFCCC 2008). These attributes are yet to be realized even after a decade and half of FCCC existence. Indeed the Bali Action Plan adopted in 2007 by the Conference of Parties to UNFCCC, provides for a set of politically agreed upon criteria to improve access to adequate, predictable and sustainable financial resources and for provisioning of new and additional resources. The concepts of new, additionally and adequacy do not operate for private capital. This is because private funds are inherently considered to be unpredictable as they are vulnerable to changes in the economic environment signaled by economic activity levels.

251. The concept of ‘adequacy’ of environmental financing can be judged by the extent to which supply of funds meet with needs. Environmental or climate financing can be drawn from existing or new sources. It can be taken to mean flow of funds that are sufficient to cover relevant costs (Muller 2008, p24). Either way, ‘adequacy’ is a function of the scale of obligations that various countries are required to take up under the FCCC or the Kyoto Protocol. This, in turn, will depend upon how the future round of negotiations approaches burden sharing in terms of entitlement to atmospheric space for developing countries. Flow of funds for development and global environmental causes has not been encouraging even in years when

the global economy was booming. A variety of financing sources exist to fund climate related activities although none of them significantly contribute towards meeting the required quantum of funds. These include national budget based grants made by donor countries for climate change related activities, climate bonds, Climate related Special Drawing Rights (proposed by Joseph Stieglitz and George Soros), funds mobilized by diversion of a small portion of foreign exchange for developing clean energy projects, funds raised through national and international carbon taxes (including airline taxes), allowance auction revenues, debt swaps for climate related activities and lotteries designed to raise funds for climate purposes. In reality, existing discussions have skirted the issue of global carbon taxes to raise resources for addressing climate related concerns<sup>1</sup>. This is because a global carbon tax can violate the principles of common but differentiated responsibilities and differential burden sharing obligations enshrined in the FCCC.

252. The terms 'new' and 'additional', which form the other attributes of a sound environmental, financing system, have more complex implications. By 'new and additional' is meant 'over and above ODA' (Muller, op.cit, p 21). Doornbusch (2008) refers to new and additional financing as resulting from new revenue raising instruments. Additional funds can come directly from national budgets or through channelizing revenues from carbon market levies or allowance auction proceeds. Major trust funds like the World Bank Climate Investment Funds and the GEF trust funds rely on national budgets of donor countries.

253. There is no way of proving that national budget commitments made for climate change are additional to ODA, given the gaps on the part of donors in fulfilling even assigned ODA targets. Secondly the predictability of national budget funding for climate change related activities is questionable on account of Domestic Resource Constraint (DCR), donor fatigue and general reluctance of national parliaments to 'export grants' to third countries on a regular basis. All these factors render budget grants for climate purposes both non additional, unpredictable and inadequate, thus place a severe constraint on flow of funds from this source. However new sources of financing like climate bonds and carbon levies are also not predictable in terms of revenues raised. Further, climate bonds have to face competition from infrastructure bonds that face higher risk adjusted return. Unless climate bonds are credit rated they may not be in a position to raise adequate revenues. However in the still booming emerging economies, bonds enjoy better chances of success.

254. Carbon market levies are likewise unpredictable as they depend on the per unit revenue realization and seasonal demand patterns. Auction revenues by comparison may be predictable if they are properly designed.

255. Coming to emission permits, their auction could initially increase public finances, as they form new sources and are additional to ODAs and other public financing grants earmarked for development activities. However political will is required to recycle these revenues or to lower other taxes to neutralize the negative economic and purchasing power impacts of permit auctions. Alternatively or additionally, expenditure side investments will be incurred in order to enhance climate resilience of the economy.

256. Debt for nature swaps are not pervasive as revenue sources for addressing climate change and have been restricted to a few countries in East Europe and Africa in the past. Lack of predictability of flow of funds also contributes to their inadequacy as financing sources.

257. Finally multilateral and global Climate Funds, including the GEF have not been successful in providing support to innovation and technology transfer. This is for two reasons: (a) The focus of the funds being on programmatic action, the focus is on supporting programmes of adaptation and mitigation in developing countries through projects and programmes that are developmental and repetitive in nature than those that encourage R&D and innovation. Thus despite the fact that solar, wind and biomass gasification technologies not being technically



efficient and cost-effective, there have been very little resources put forth by the multilateral and bilateral financing systems to fund R&D and scale-up required to support innovations in these sectors.

258. There are severe constraints at the national level in developing countries, when it comes to financing innovative climate smart technologies and securing their transfer to consumers. This could happen despite strong policy commitments to develop climate smart technologies. These arise from dilatory financial procedures, constraints in mobilizing complementary assets for testing, demonstrating and commercial installation of the technologies, technical information gaps on the part of financial institutions and end consumers (Box 6).

**BOX 6: Constraints in Financing of Solar Projects by National Level Financial Institutions: Case of India**

Solar projects are capital intensive and lack of an effective financing infrastructure for these projects is another major factor impeding technology transfer and growth in this sector. Some of the constraints noted are:

Dilatory Procedures

Thus the time taken for project evaluation and financial closure increases and therefore increases the risk associated with completion of project in stipulated time period. There is need for better financing infrastructure, models and arrangements to spur the Solar Photovoltaic (PV) industry in India. Strong project management experience, a good track record, sound Engineering, Procurement and Construction(EPC) skills and good operations & maintenance contracts are also essential for a project developer to obtain financing for their PV project. Thus it becomes difficult for developers with less credentials or ability to obtain financing.

Land acquisition: Solar power is one of the most land intensive electricity generation options

requiring 5-10 acres/MW. The national Jawaharlal Nehru National Solar Mission (JNNSM), which provides project finance for Solar Projects, however leaves land acquisition operations to be decided at the State (Province) level, which adds another layer of process which can potentially delay the process. At present there are not any standards in place for land acquisition for solar manufacturing plants and power stations.

Technical challenges

a. Lack of authentic data on irradiation has been a big challenge and bankers are wary of the

legitimacy of the data provided by developers and its impact on the Capacity Utilization Factor of solar power plants. However the Ministry of New and Renewable Energy(MNRE), Government of India has initiated efforts to set up solar radiation measurement stations at various regions in the country in an effort to provide accurate and reliable data on solar radiation.

Raw Material Constraints

The industry has relied on international markets to source the basic raw material-silicon wafers. The world silicon market has been facing highly fluctuating prices, leading to uncertainties in availability of raw material.

Regulatory framework at Sub- National Levels

Although the Ministry of New and Renewable Energy (MNRE) has set up good regulatory framework and implemented policies at the central level, the absence of conducive policies and regulatory framework in some States /provinces is still a challenge. Only few states like Gujarat and Rajasthan have been successful in implementing policies at the state level, which has resulted in about 80% of total solar

PV capacity in these two states.

Grid Connectivity

Most of the renewable energy projects are located in remote areas which have sparse transmission / distribution system. This has been a major hindrance in harnessing the energy from renewable sources. Also the transmission and distribution losses make power generation through solar PV somewhat infeasible.

Lack of awareness

Solar Photovoltaic is a growing industry in India. However there is lack of awareness among end users regarding the technology, its economics and right usage. The current acceptability of this technology among end users is also very low because of technical and operational issues. Thus there is a need to build awareness among consumers about Solar PV and educate them about advantages of using renewable energy vis-à-vis conventional means.

Source: Bharati Vishal C.R. (2012)

2.11.1. Prospects in the Post Durban COP Phase

259. As mentioned, at the COP 17 held at Durban in 2011, it was decided to operationalize the \$100 billion per annum Green Climate Fund (GCF) and provide conditions for developing countries to access the fund. Similarly The Technology Mechanism agreed upon at COP 15 at Copenhagen became operational in 2012. The operational arm of the Mechanism, viz, the Climate Technology Centre and Network was also firmed up at Durban.

260. The decisions at the Durban COP open up possibilities of linking financing with innovations in Climate Smart Technologies. As Khor (2012) states, the Green Climate Fund could allocate a part of its resources to research and development for new technologies. The fund can establish priority areas for research, based on the decision of UNFCCC members, and research grants can be provided to successful applicants in line with the priority areas (ibid). As Khorop.cit states, patents that arise from inventions for which grants are provided by the GCF are to be owned by the fund, and this principle should form one of the conditions for the grants. It can be part of the understanding in this scheme that the fund would make the inventions available to firms in developing countries with licenses at no cost or nominal cost, also on the condition that the users cannot apply to patent the technologies (ibid).

261. The up-front funding of innovation, linked to making the ensuing technologies available at the most affordable prices to developing countries since the latter will obtain the technologies without paying for patent royalties.

262. The PPP models discussed earlier can be fruitfully employed for promoting Research and Development in low carbon technologies, with the fund providing catalytic support. More significantly, the GCF funds can be utilized to promote R&D for customization and demonstration of climate smart technologies in the context of developing countries. This process may involve scientists and technical personnel from developing countries as well.

263. Thus while the option for purchasing technologies along the lines of the Montreal Protocol Multilateral Financing Mechanism exists for certain critical technologies like fuel cells where research is confined to a few firms and R&D centers in developed countries, the larger task is to promote innovations of relevance to developing country contexts<sup>8</sup>.

#### 2.11.2. Strategy for Financing Innovations and Transfer of Technologies

264. The preceding discussions clearly highlight the significance of identifying effective and efficient financing mechanisms for enhancing innovation that augment the supply of public goods of relevance to the world community in general and developing countries in particular. The overall message that emerges is that public economic instruments and public financing form important means for raising and mobilizing financial resources and allocating them into strategic directions to effect innovation and transfer of critical technologies that are relevant to supply of public goods. However since both national and international public financial resources are getting to be scarce, there is a strong case for combining available public financial resources with other sources, including private capital and finances. Private financing by itself, is neither adequate nor predictable, but can be blended with public resources to promote R&D and innovation in the areas of drug discovery and environmentally sound technologies. However since we are contextualizing the debate within the context of multilateral obligations towards development and sustainable development, it is imperative that financing innovations is thought of at global, national and regional levels.

265. The ensuing section identifies key areas of interventions that are important to ensure that innovation and technology transfer is facilitated, Some of the recommendations advanced below relate to the mechanisms that are important to ensure that financing of innovations takes place, while others propose areas where financial resources can be deployed to secure innovation and transfer of technologies relevant to public goods.

### 2.12. CONCISE SUMMARY OF RECOMMENDATIONS

#### 2.12.1 Establish a Publicly Funded Global Financial Mechanism to Promote Innovation and Transfer of Technology

266. There is a rationale for having a dedicated facility that finances innovation and Transfer of Technology for the two critical public goods of concern to humankind, viz health and climate. The rationale for a dedicated financial mechanism for financing innovations arises from the following factors:

- (a) Technologies in areas that are critical to the WIPO Development Agenda are evolving and yet to reach the stage of economic maturity where they are available in requisite quantity and quality at affordable prices. Pilots or prototypes of these products that are at the lab scale need to be tested comprehensively or demonstrated conclusively before they are released for public use. This will help countries that have lower level of financial and technological capabilities to avoid learning and testing costs
- (b) The risks of technological and economic failure can be costly in terms of investment resources for developing countries- so are they for individual companies/ entities that are desirous of undertaking R&D in these products/technologies. The burden of high 'sunk' costs that are to be made and forgotten' will not be within the reach of these companies/

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<sup>8</sup> There can be counter-factuals as well. As Gans (2012) states, tighter emissions cap will reduce the scale of fossil fuel usage and that this will diminish incentives to improve fossil fuel efficiencies. As he proceeds to note, 'while such policies may stimulate the relative demand for innovations that improve the efficiency of alternative energy, the emergence of carbon scarcity may diminish innovation incentives overall. Thus according to Gans , only for technologies that directly abate carbon pollution will there be an unambiguously positive impact on innovation.

undertakings. This is true for the drugs and pharma sector, where discovery/ innovation process are time consuming. Such areas of research also raises the burden of costs on developed countries which plan to invest in these technologies/ products

(c) The need for customization and adaptation of innovated technologies and products is high as it is country or population specific or ecosystem or industrial plant relevant, all of which calls for a variety of multi-sectoral and multi-locational trials and/or demonstration in developing countries even if they pass muster in the developed world.

267. All the same, the challenge of a dedicated fund, for say, tropical medicines or low carbon technologies such as clean coal technologies and wind energy plants, can be daunting on account of their recursive impacts. In the case of health products, the challenge is to provide resources for carrying out acceptable and informed clinical trials in developing countries. In the case of climate smart technologies, the issue is of transforming the production system of large numbers of power, oil and chemical utilities, which form the infrastructure backbone of developing economies. Any change in production process that has increased cost implications can have macro multiplier impacts on the economy as a whole.

268. The following activities can be taken up by the Facility/Fund:

- (i) Joint R&D between developed and developing countries to develop drugs and low carbon technologies that are cost effective and customized to national contexts
- (ii) Financing pre-commercial and post-commercial trials and/or demonstration plants that test and re-design technologies in multiple cultural, ethnic and geographical locations and disseminating their results to developing countries
- (iii) Multi-tier capacity building involving various stakeholders viz regulators, impact assessors, regulatory authorities and national, regional and local implementing agencies who assess, monitor and implement safeguards,
- (iv) Technical assistance to facilitate technology choice, testing and assessment
- (v) Financing the agreed incremental costs on commercialization of technologies on a grant or concessional loan basis so as to enable leverage private capital flows into advanced projects that are risk-free. The project assistance component shall be based on a revolving fund approach
- (vi) Grants for technical assistance and capacity building
- (vii) Financial Assistance to WHO/UNFCCC or other bodies to disseminate information and data on technical properties of different drugs and low carbon technologies to enable responsible trials and demonstration plants from the technical, economic and safety angles
- (viii) Assist need based assessment of technologies in developing countries through country-level studies and action plans
- (ix) Facilitate PPPs in projects that involve national and international private and public partners through consortium approaches by brokering partnerships and consortiums and providing technical assistance for working out financing and risk sharing models that are appropriate.
- (x) The fund shall promote most efficient market based approaches to technology sourcing by firms or consortiums by encouraging auctions and bidding process that are transparent and free from information asymmetries and distortions. These

methods will be utilized for purchase or licensing of technologies. The objective of the exercise is to purchase or license technologies that are technically efficient and financially speaking, cost-effective and follow non-commercial pricing norms.

#### 2.12.2. Finance Implementation of WIPO Development Agenda

269. WIPO's development agenda is mainly focused on increasing the supply of developmental goods to developing countries. The following elements of the WIPO Development Agenda as contained in WIPO (2012a) are important as far as financing innovations are concerned.

270. Encourage pharmaceutical companies to make essential drugs more widely available and affordable by all who need them in developing countries. For this to happen, developing countries may be financed to undertake 'need assessment' for drugs and environmental technologies in collaboration with developed country industry.

271. Take special measures to address the challenges of poverty eradication and sustainable development in Africa, including increased transfers of technologies. This calls for financing low cost innovations that increase access of poor communities in Africa to quality medicines that reduce incidence of tropical diseases.

272. Finance new technologies, especially information and communication technologies (ICTs) promote strategic use of patents and related IPRs.

273. WIPO's PATENTSCOPE allows applicants interested in licensing the inventions contained in their international applications to request the International Bureau to make this information available on its PATENTSCOPE website. This facility can be further strengthened by financing capacity building initiatives that enable applicants from developing countries negotiate for technology transfer.

274. Finance Capacity Building initiatives to optimize results from improved access to information on patents under the ASPI project (see Section III).

275. Modernization of IP technical infrastructure has little direct relevance on technology transfer. However, the effective and timely dissemination of patent information by national IP offices depends on the availability of digital patent information of national and foreign applications filed with the IP Office. In this respect, WIPO continues to provide technical assistance to a number of developing countries in modernizing their technical infrastructure for generating and disseminating digital patent information on the Internet. However good results on the technology transfer front can result, if WIPO finances data bases on technology transfer licensing agreements including information/data on license fee / royalty rates.

276. Finance Technology Platforms like WIPO Re:Search in the field of health and WIPO Green to provide capacities for networks like ANDI to facilitate South-South Co-operation for research on neglected diseases and demonstration facilities for critical climate smart technologies like clean coal combustion, capture and storage, Solar PV and wind power.

#### 12.2.3. Other Avenues of Support

277. Finance National Efforts to Help SMEs and NEMs to innovate and obtain Critical Technologies. SMEs in developing countries, which are R&D oriented, may be provided grants for undertaking research in promising avenues of relevance to public health and sustainable development. This can be in addition to fiscal concessions by way of tax breaks, subsidies and government loan guarantees, or of alternatives to traditional bank credit, e.g. the formation of venture capital funds to assist start-ups (UNCTAD 2011). Also, governments can promote finance for licensing and franchising through official institutions that provide special windows for this type of activity, or encourage their formation within existing private institutions (ibid).

278. Finance Technology Transaction Exchanges that enable 'Market Making' for technologies that link Appropriate Buyer to Appropriate Seller of technologies

279. Finance development of Information/ database on Technology failure risks to alert research communities to focus their resources on R&D activities that minimize risks.

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### 3. PAPER 3: STRATEGIZING INNOVATIVE ENABLING CONDITIONS FOR TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES

#### 3.1. BACKGROUND

280. R&D and Innovation are stimulated by strategies and actions as well as macro-environment policies that affect the creative capabilities of enterprises, entities and organizations. The focus of this paper is largely on the latter aspect. While in the first paper the specifics of macro-level policies that can provide teeth to Articles 7, 8 and 66.2 of the WTO TRIPS, has been looked at, here the focus is also on generic strategies for stimulating innovation and providing responsible IPR protection that does not inhibit wider diffusion of sound technologies and products across society. It is the argument here that, apart from enlightened regulations, an 'SME driven innovation strategy' in knowledge intensive sectors, can go a long way to ensure social access to promising technologies and technology products. The role of Government Policies and inter-Governmental Collaboration initiatives for developing and diffusing technologies relevant to public goods are critical - so are pricing policies that respect the ability of different strata of society to pay for life-support systems such as potable drinking water, life saving medicines and nutrients. Finally the paper argues that there is a need to have in place, systems for information exchange to reduce costs of innovation and R&D. As has been argued in the second paper, it is also a felt necessity to have an effective and adequate multilateral financing mechanism to promote R&D, innovations and transfer of technologies in critical sectors of relevance to public goods.

281. The following elements are considered to provide enabling conditions for innovations to take place and provide increasing benefits to developing countries.

- (a) Stimulating optimum competition environment
- (b) Stimulating strategic use of patents and related IPRs
- (c) Putting in place sound and effective regulatory devices
- (d) Building Complementary Capabilities
- (e) Facilitating negotiations for technology transfer
- (f) Have in place a facilitating Policies in relation to Foreign Direct Investment (FDI) and Non Equity Modes (NEMs) of Business of Overseas Origin
- (g) Providing Government commitments in both developed and developing countries to set up joint R&D Systems through Public Private Partnerships
- (h) Setting up Market Making Functions that Link Appropriate Buyers to Appropriate Sellers
- (i) Encouraging joint need assessment for drugs and environmental technologies to facilitate joint R&D programmes
- (j) Setting up an Efficient Multilateral Funding Mechanism to facilitate Transfer of Technology
- (k) Providing Information base to prevent Technology failure risks
- (l) Encouraging Public Institutions in developed countries to procure essential drugs for supply to least developed countries by applying second order Price Discrimination principles

282. The ensuing section details the 12 strategic steps required to effect technology transfer to developing countries.

### 3.2. STIMULATING OPTIMUM COMPETITION ENVIRONMENT

283. While there is a strong body of academic opinion that considers innovation as driven by large companies, there is an equally contentious viewpoint that states that innovation driven large enterprises tend to be monopolistic in nature and therefore add to the burden of social costs and deadweight loss. These aspects are reflected by less than potential use of capacities and higher than average cost pricing for products or technologies produced. This problem is particularly true where new, vertically differentiated products are to be developed. In some cases, companies also strategically withhold technologies from the market to maximize profits. This may in part stem from a desire to limit their exposure to export competition in domestic markets that may result from technology diffusion. Also IPRs held by innovating companies might be of limited importance where reverse-engineering is easy, or where competitive advantage lies in keeping knowledge/know-how 'tacit' (e.g. as in the case of complex power plant technologies).

284. IPR may act as a barrier to access of technologies for critical drugs of high public health relevance or for climate technologies such as bio-fuel catalysts (Damodaran, 2010a). Finally, where a large cluster of patents (or "patent thickets") obtain, a company that holds the majority of the patents in the cluster, can create significant access issues (as in the case of vehicular pollution control technologies). Patent thickets can inhibit the feasibility of further research as they give rise to infringement suits (ibid).

285. In the case of drugs and pharmaceuticals such a situation leads to high prices of medicines that are required by people with lower ability to pay. Indeed even when process driven cost reducing innovations take place, monopolies that are responsible for these innovations do not pass on the benefits of lowered costs of production to consumers (Greenhalgh and Rogers, 2010, p 12). This lends credence to the Arrowian view that competition is better than monopolies when it comes to creating an environment of innovation, provided a good IPR regime exists (Greenhalgh et al, op.cit). However the problems with this viewpoint are many.

286. SMEs, the bulwark of competition markets face financial and organizational constraints in their quest for innovation driven R&D. Competition by SMEs and start-ups can be critical provided they are financed effectively to enable carry out R&D and post R&D operations and pre-commercialization work relating to a product or technology. This can be further strengthened, if these moves are stimulated by policies that support such initiatives through strategic collaboration with large units. The critical policy issue here is the need to provide balanced incentives for IP holders, while at the same time ensuring that the technology is accessed by needy sections of the society. Government policies can help to build the trust. Joint ventures between R&D institutes, start-up SMEs and big undertakings, can, if well designed and structured, obviate patent barriers that stand in the way of technology transfer involving public goods or goods and technologies that are of high public significance.

287. National level policies, whereby publicly funded educational institutions, including Universities and research Institutes of high promise in developing countries, are encouraged to license their lab and bench scale technologies to SMEs with promise (in terms of high quality personnel) or set up their own start-ups, to commercialize innovations generated by these institutions, can be really helpful<sup>9</sup>. In general, Universities are considered to be strategic and important, when it comes to Research intensive start-up ventures, They are also more open to

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<sup>9</sup> Notable University spin-offs include 'Oxford Instruments' of Oxford University and Stanford University's Sun Microsystems, Cisco and Silicon Graphics. In all these cases, technology transfer is managed by the University's Technology Licensing Units (Greenhalgh et al, 2010).



innovations and transfer of technologies (see Box 1). In developing countries including South Africa, Kenya, India, China, Brazil and Columbia there is considerable scope to exploit University/Institute processes due to the proficiency of these countries in the areas of plant and medicinal biotechnology (Damodaran, 2004). At the same time, there is considerable scope to pursue commercialization and post-commercialization operations including sun-set operations with the help of competitively driven firms in the private sector. Policies that promote pooling of human resources in Joint R&D ventures that involve SMEs and Universities, can by facilitating exchange of science and engineering personnel between commercial firms and academic departments, promote promising innovations by R&D driven SMEs (Greenhalgh et al, op.cit).

**BOX 3.1: Universities, Start-ups, Innovations and Transfer of Technology;  
Review of Studies**

Thursby and Kemp (2002) state that universities are more commercially productive than they were in the recent past and at the same time there is a wide heterogeneity of efficiency across the 111 universities they studied. They found that the increase in overall university resources is not a determinant of the increased licensing activity and higher levels of commercialization. Lach and Shankerman (2004) and (2008) developed a model and performed an econometric exercise on the role of economic incentives in university research and licensing outcomes. In particular, they examined how the share of license royalties received by academic inventors affects the number and licensing value of inventions in universities. They used data from the Association of University Technology Managers and collected information on the distribution of royalty shares from university websites for 102 US universities between 1991 and 1999. In the US, the inventors share with the university a portion of the fees and royalties from licensing IPRs and universities differ substantially in these royalty sharing arrangements. There are two types of agreements: linear and non-linear royalty schedules. In the case of the former, inventors receive a constant share of the license income generated by an invention. The average figure in this case is 41 per cent (maximum 65 per cent, minimum 25 per cent). In the latter case, inventors' royalty shares vary (in the majority of cases regressively) with the level of licensing income. In this case, variation across universities is even wider because the inventor's share ranges between 20 per cent and 97 per cent with an average value of 51 per cent. Lach and Shankerman showed that both academic research and inventive activity in universities respond to variations in inventors' royalty shares. In particular, they found that universities, particularly private universities with higher royalty shares for inventors, generate higher levels of licensing income. The papers of Lach and Shankerman are particularly important because they show that the specific design of intellectual property and the incentives in the form of royalty shares can have real effects on the direction of research. Royalty incentives work through two mechanisms: raising faculty effort and sorting scientists across universities. These incentives mainly increase the quality rather than the quantity of inventions.

Di Gregorio and Shane (2003) studied TTOs from the point of view of IP-related start up formation and inquired why some universities generate more new companies to exploit their intellectual property than others. They analyzed a panel of 102 universities over the 1994–98 period for which they collected data on start-ups, patents, intellectual eminence, venture capital and policy-related information with a survey of TTO directors. Therefore, they asked which factors affect the creation of new companies: the availability of venture capital in the university area; the commercial orientation of university research and development; intellectual eminence; university policies.

Their results showed that only the last two factors affected the creation of start-up firms. In particular the relevant policies are: (1) making equity investments in TTO start-ups; (2) maintaining a low inventor's share of royalties. This result can be compared with Lach and Schankerman (2004). Many universities leave a high proportion of royalties to inventors in order to encourage the reporting and exploitation of inventions. Di Gregorio and Shane (2003) suggested, however, that significant royalty sharing may create disincentives to the creation of start-up companies.

They also showed that more eminent universities have greater TTO start-up activity. Their results confirm previous evidence that star scientists found companies to earn rents on their intellectual capital and that the growth of biotech companies in the US regions is strictly linked to the high scientific standard of the researchers (Zucker *et al* (1998)).

Stuart and Ding (2006) underlined, for a sample of approximately 6,000 life scientists and 600 start-ups (or participation in the scientific advisory board of a new biotechnology firm), that the institutional context is crucial to explain the heterogeneity of behaviors of transition to commercial activities. In particular Stuart and Ding found that the orientation of colleagues and coauthors towards commercial science, as well as a number of other workplace attributes, significantly influenced scientists' hazards of transitioning to for-profit science. The quality of faculty members affects not only start-up formation, but also licensing activity. Eifenbein (2007) used approximately 1,700 inventions considered patentable from the Harvard University's Office of Technology and Trademark Licensing and the Office of Technology Licensing and Industry Sponsored Research at Harvard Medical School. He showed that inventors' prior academic output is positively correlated with the likelihood that their new technologies will be licensed.

Source: Montobbio, Fabio, 2009.

### 3.3. STIMULATE STRATEGIC USE OF PATENTS AND RELATED IPRS

288. As has been pointed out 'Technology is neither mere blueprints and formulas nor new and advanced equipment which is easy to move from place to place' (WIPO, 2009,a). While formal systems of transfer of technology involves transfer of ' blueprints and machines, transfer of both codified and non-codified knowledge, and adaptation and application of acquired knowledge for the purpose of innovation;, more complex are 'informal systems rely on strategic use of knowledge and information to design new verticals or horizontally differentiated products that make use of information contained in disclosures in patent applications (ibid) . Competition, if stimulated, and backed by strategic use of IP based information can help the development of new verticals especially for products that have public good impacts (ibid). This may include life saving drugs, climate smart technologies and renewable energy technologies.

289. One policy measure to promote strategic use of IP based knowledge is to improve dissemination of Patent based information. The other method is to fund or provide policy support for 'inspired research', based on strategic use of IP based information. Also relevant is strategic use of knowledge through licensing of know-how. The other instrument involves promotion of open innovation and cross- licensing of patents to legally gain from strategically disclosed trade secrets.

290. Disclosures in Patent Applications can be a good basis to devise new products that are 'related' to the protected product and yet 'different' from the former. Patent based information can be used to develop new product lines that are different from protected product lines. This is favored by TRIPS as well. Article 29.1 of the WTO TRIPS deals with disclosure requirement, Articles 30 and 31 of the said agreement concern exceptions and limitations to the right and Article 40 of the WTO TRIPS deals with control of anti-competitive practices in contractual licenses. (Chapter VII of WIPO,2009,a )

291. 'These provisions of the TRIPS aim at the timely and efficient recording of information relating to patent owners and related licenses, which would support disseminating accurate up-to-date information concerning the owner of the rights and their licensing status.' (ibid)

292. For strategic use of patents information to happen, it is important that patent laws provide clear indications of who is the owner of the right and on the scope of the right which is defined by the claims.

293. There is scope for gaining the know-how from a patent under certain other circumstances. By combining technical and legal information disclosed in patents, third parties can identify the public domain technology which can be used freely by anyone (ibid).

294. Unlike other inventions whereby a person skilled in the art may be able to analyze the claimed invention based on the text of the description and the drawings contained in a patent application, certain biotechnological inventions require physical access to the biological material in order for a person skilled in the art to understand the invention to the extent that he or she could carry out the invention (ibid)

295. Indeed, a legally fool –proof and economically efficient method is to work with patent holders concerned to develop new verticals based on information yielded by a patented product ( or associated process) in order to create commercial lines of production that create usable and affordable products. This will be helpful in the commercialization of new products that are developed, besides promoting testing and co-design or co- innovation possibilities. If these efforts are backed by clear rules that define IP ownership over new co-innovated vertically differentiated products, the task of developing the product for the market in a socially just manner, could be accomplished.

296. The other source of information that can stimulate ‘inspired research’ is from information related to inventions or innovations originating from publicly funded Universities and Research Institutions in Germany and other countries. Access to such information is enabled by the regulatory requirement that faculty of Universities and research Institutions need to notify their university about their inventions . Access also becomes easier on account of the provisions of law in these countries that enable universities to claim ownership over inventions created by their researchers/ faculty.

297. Policies that encourage open innovation form another source of information base that can promote strategic use of information. As Chesbrough et al (2006) state, ‘ Open innovation paradigm is built on the assumption that individual firms do not have the financial and personnel resources to carry complex innovation projects; hence they must share knowledge, ideas and inventions with other companies With Patent savvy companies such as Microsoft and IBM taking to the ‘open innovation’ mode of knowledge/product development, it is apparent that there is considerable scope for the open innovation model to take –off , thus providing a catalyst for strategic use of relevant information for developing innovative products.

### 3.3.1. Regulatory Mechanisms

298. The social costs/ burden of IP is typically reflected in six impacts: (a) higher price for products that creates adverse impacts on consumers (b) the benefits of cost reducing patented process not being passed over end consumers (c) less than capacity production by the ‘patent holder’ or the ‘licensee of the protected technology’ and (d) lessened access to protected technology by local communities , either due to ‘ refusal to license’ or due to prevalence of high license fee or royalty rates (e) use of patent portfolios to threaten infringements for alternative products that bear a close resemblance to the processes and product characteristics of the protected products (f) barriers that arise from transfer of technology connected to a patented product which inhibit further research on the product/technology concerned, that would have otherwise been socially beneficial, in terms of improved ‘cost-effective’ products. Such benefits lie at the roots of the open source software movement and open innovation models that have characterized the Information Technology Industry<sup>10</sup>.

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<sup>10</sup> In the context of Croatia, the UN/ECE Advisory Group for the Protection and Implementation of Intellectual Property Rights for Investment puts the following critical questions that can presumably serve as decision-making parameters for having regulations over IPRs (1) Have Croatia and neighbouring countries perceived higher product prices due to the IP system (2) Have Croatia and neighbouring countries perceived a higher product supply due to the IP system? (3) Did strengthening IPRs raise the incentives for foreign firms to transfer technologies to Croatia and

299. The end result of these possible scenarios is lower social returns from R &D investments for technologies or products that have public good characteristics. However where the per unit investment costs incurred by an innovating firm is high and the product in question is not a 'public good', regulations could be counter-productive. Even where the product in question is a 'public good', it is important that the innovating firm is compensated for possible loss arising from regulatory measures, through suitable fiscal or compensatory measures.

### 3.4. POSSIBLE REGULATION MEASURES

#### 3.4.1. TRIPS Flexibilities

##### *3.4.1.1. Compulsory licenses*

300. An important measure is the exercise by governments of their right to provide compulsory licenses (CL). Under the TRIPS agreement, there is considerable flexibility provided to WTO Member States regarding the grounds for issuing compulsory licenses. These grounds are not restricted, as confirmed by the WTO Ministerial Declaration on TRIPS and Public Health of 2001. For example, and contrary to a quite widespread notion, it is not necessary for a government to declare that its country is in a state of health emergency in order for it to issue a compulsory license for a pharmaceutical drug. Certainly the fact that a country requires a product or technology in order to meet its objectives or responsibilities to mitigate climate change or to adapt to climate change is a valid ground for compulsory licensing (Khor,2012).

301. In many developing countries, compulsory licenses have been issued for the import or local production of generic drugs. A particular type of compulsory license, "government use", has been made use of by an increasing number of developing countries in the area of pharmaceutical drugs. In such cases, prior negotiation with the patent holder is not necessary although remuneration or royalty to the patent holder is required.

302. However there are many cases where compulsory licensing has been disallowed in developing countries ( Correa, 2011) .For instance, Cipla requested the South African government in 2001 to issue compulsory licenses on several drugs, including nevirapine, lamivudine, zidovudine, stavudine, didanosine, efavirenz, indinavir, abacavir, and also for combinations of these drugs. The request was denied (Correa, op.cit). In 2002, a compulsory license on imatinibmesylate, also known as 'Gleevec' was requested in South Korea but denied by the Korean Intellectual Property Office. For instance, the Colombian government rejected a request for compulsory licensing the HIV drug Lopinavir/Ritonavir in 2009(Correa, op.cit). However, as a result of the request, the government set out maximum prices for the drug, driving the price down by 54-68% (ibid).

303. Compulsory licensing is not a unique or exceptional policy. According to Reichman (2003), "the United States government has broad powers to seize and use any invention protected by privately owned patents, subject to the payment of reasonable and entire compensation, and it makes extensive use of this power". In fact in the US, compulsory license provisions are incorporated into specific legislation. For example the US Clean Air Act provides for CL of patented technologies needed to meet agreed standards

304. Compulsory licensing is thus an option that developing countries can consider using for those patented climate-friendly technologies for which they have need, which are expensive, and when negotiations with the patent holder are unable to result in a sufficiently affordable price either for the original product or for a license for an intended generic product.

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[Footnote continued from previous page]

neighbouring countries? (4) Does the establishment of stronger IPR limit local imitation? (5)Are there positive examples for technology spill-overs in Croatia and neighbouring countries? (Nikolaus Thumm , 2004).

*3.4.1.2. Exemption from Patentability:*

305. Two options in exclusion of patents, the first is a blanket exclusion of patentability for environmentally sound technologies and the second being an exclusion applied only to developing countries. In the second option, patent holders who have funded their own research and development, could recoup their innovation costs through a monopoly (for the specified period in the TRIPS agreement) of their products in the developed countries, while in the developing countries, competition to such technologies is allowed through an exemption from patentability. An appropriate amendment of the TRIPS Agreement would be required in either case, to the effect that WTO Members (or WTO developing country Members) can exempt such technologies from patentability.

306. This can be considered a justifiable demand if climate change is considered a serious challenge. Developed countries cannot justify business as usual in the old system while also demanding a radical departure by developing countries from business as usual in their emissions pathways. Least Developed Countries (LDCs) already have some flexibility in this regard. LDCs that are members of WTO have a special transitional period for the implementation of the TRIPS Agreement (Khor, op.cit).

*3.4.1.3. Technology pooling through a collective global approach:*

307. A “Global Technology Pool for Climate Change” could be developed in which owners of ESTs are required to place their IPRs in a pool, and make them available to developing country firms on payment of a low compensation (in some circumstance royalty free) and on standard terms (that are to be negotiated)

308. The nature of the pool should be mandatory in that either through law or policy (e.g. a condition for receiving public funding for R&D) the protected subject matter is given to the pool for licensing to developing country firms. Patent holders would still be able to extract high commercial royalties from the far richer developed markets (Khor, 2012,p 18).

*3.4.1.4. Global System to Share Know-How and Trade Secrets:*

309. Another measure requiring international cooperation is the establishment of a global system for sharing know-how and trade secrets linked to climate-friendly technologies. The withholding of “trade secrets”, or the knowledge on how to make the technology, can be a major barrier to technology transfer, even for those technologies that are not patented, as it can prevent the development of the technology concerned in developing countries. Thus, there is a case for an international cooperation mechanism to make trade secrets and know-how that are linked to climate-related technologies more accessible to developing countries.

*3.4.1.5. Understanding or Initiatives on Publicly funded technologies:*

310. OECD countries which hold ownership of most of the ESTs for mitigation and abatement say in respect of fully-owned government technologies and related know-how, can transfer the same at no cost and on favorable terms. Where governments partially fund R&D, they should have partial ownership of any resulting patent. When a license is issued to a developing country firm, a corresponding proportion of the cost of the license should be waived, thus reducing the overall cost to the country. Incentives can also be given to entities (that are publicly funded) to make the patented technology, with its know-how, available to developing countries. It has also been proposed that to support no and low cost transfer, developed country governments should compile a “Publicly-Owned Technology Inventory”. As noted above, governments can also use their leverage as a funding agency for R&D activities, to place conditions on recipients to ensure that licensing to firms in developing countries are on fair terms that take into account their development priorities and needs.

*3.4.1.6. Parallel Importation, Exemptions and Competitive Behavior:*

311. Besides compulsory licensing, the TRIPS Agreement has several other flexibilities, which can be used to promote transfer of climate-related technologies. These include parallel importation, exemptions to patentability, exceptions to patent rights, and measures to address anti-competitive behaviour. The possible use of these flexibilities is detailed in Khor (2012).

*3.4.1.7. WTO Declaration on Patents and Climate Technology*

312. An important feature of the TRIPS and Public Health Declaration has been that it has created new rights for countries to waive a provision in the TRIPS Agreement that limits the supply of a generic product (under compulsory license) “predominantly” to the domestic market. This restricts the volume of exports of a firm producing generics, and it also affects the adequacy of supply of generic products that a country with no or limited manufacturing capacity can import. A Declaration on TRIPS and Climate Change could establish a similar waiver to the restrictive TRIPS provision for climate-related technologies. This will enable an increase of supply of “generic” technologies and products to countries that lack productive capacity to produce their own products.

*3.4.1.8. Legislation to Facilitate Easier Compulsory Licensing:*

313. The Clean Air Act of the United States provides for compulsory licenses to be given when the patented innovation is necessary to comply with the emission requirements, when no reasonable alternative is available, and where non-use of the patented invention would lead to a “lessening of competition or a tendency to create a monopoly.” Under the Act, a district court, with the Attorney General’s assistance, can determine whether a compulsory license should be granted and set reasonable terms ( Khor,2012).

*3.4.1.9. Facilitating Positive Treatment of R&D Subsidies and Overcoming Possible obstacles implicit in TRIPS and TRIMS plus Bilateral Investments*

314. Barton (2007) states that it is ‘it is important to analyze whether a number of areas of trade and WTO law are actually discriminatory or not’. According to Barton, the areas that deserve analysis include WTO and trade law principles on the treatment of R & D subsidies. Barton, also argues that it would also be useful to examine the provisions of Bilateral Investment Treaties, which are ‘TRIMS plus’ and TRIPS plus. For Barton , political restrictions on the transfer of technologies should not stand in the way of ‘global technological integration’. In other words, political considerations and trade provisions should facilitate R&D in critical sectors that have public goods implications .

*3.4.1.10. Overcoming Innovation Restricting Provisions in Patent Laws and Procedures :*

315. Correa (2011) put forth the following propositions with regard to patent laws and procedures:

- (a) Rigorous criteria to assess the novelty and inventive step of patent applications to pharmaceuticals should be applied. Patent offices should develop, in consultation with health authorities, guidelines to examine such applications so as to ensure the patents are only granted where genuine contributions to the state of the art are made.
- (b) Remove provisions in Patent Acts which provides for ‘evergreening’ patents (See Appendix 1 for details).
- (c) Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should be allowed in narrowly defined, exceptional cases. Polymorphs and isomers (when the racemic mixture was already disclosed) should not be patentable.
- (d) Restrictions on the so-called ‘Markush’ claims, so as to ensure that the granting of patents with such claims does not become a constraint for research on new compounds or an undue restriction to competition. (See Appendix 1 for details)

(e) 'Selection patents' on a narrower group of the compounds covered by the original patent should not be allowed.

(f) In order to improve the transparency of the patent system, the international non-proprietary name (INN) of drugs, when known at the time of filing of a patent application, should be mandatorily disclosed in its title and abstract.

(g) Similarly, claims on second indications of pharmaceutical products, which are equivalent to methods of treatment, should be deemed non-patentable due to lack of novelty and industrial applicability.

(h) Restricting possibilities of broad patents on climate smart technologies

316. Apart from these measures, Greenhalgh and Rogers (2010, p158) argue for more regulatory focus on

(a) The decision systems involved in licensing

(b) The novelty of a patent on an critical product technology which makes it hard to invent around

(c) Technologies and know-how involving greater ratio of codified scientific knowledge to tacit knowledge as accompanying tacit knowledge is more difficult to transfer under contract

(d) The higher the value of patents as denoted by the breadth of coverage across geographical territory and by the number of claims of the patent

307. There is scope for regulatory interventions in all the above cases to facilitate transfer of technology, through TRIPS and Non TRIPS WTO measures, particularly when products involved have public goods character.

#### *3.4.1.10. Regulating Returns on IPR by Facilitating Optimal Licensing Agreements*

317. The relationship between licensing, technology transfer and the strength of IPR protection can be highly complex due to the fact that technology licenses vary significantly from one agreement to the next (WIPO, 2009,a) . The diversity in technology licensing agreements is best reflected in variations in royalty and license fees from one contract to the other. This in turn is aggravated by information asymmetries in the technology markets in individual countries, which results in the same class of technologies ( say Solar PV panels ) of the same IP holder commanding differing royalty rates for different end users. Economou (2012) highlights the significance of adopting the right 'sources' to value IP. In the absence of a well laid down source of valuing IP , valuation of P may suffer from information asymmetry , huge variations in royalty and license fee rates with different impacts on recipients. Regulations that adopt royalty valuation rates that are consistent with social rate of returns from investments while at the same time promising economic returns to the inventor or holder of the IP over the technology, will ensure access to technologies and better uniform price discovery for the technology under consideration.

#### *3.4.1.11. Regulatory System to prevent adverse impact of Patent Trolls and Thickets*

318. The costs of innovating around an IP protected product is enhanced by the possibilities of infringement cases brought in by Patent Trolls and thickets. As mentioned earlier, adoption of a rigorous criteria to assess the novelty and inventive step of patent applications to pharmaceuticals coupled with restrictions on 'evergreening' of patents can go a long way in ensuring that threats from Patent Trolls and thickets are minimized. However these measures

by themselves may not be sufficient to solve the problem arising from infringements, unless information systems are provided which enable aspiring inventors to work on their innovations un-inhibited by fears of attracting infringement charges.

319. In the ultimate analysis, regulatory approaches to IP have to be consistent with the TRIPS and other cognate WTO agreements. However, there cannot be a universally acceptable set of regulations that can hold across all developing countries. Since the economic situation and development needs of developing countries differ, it is important that regulatory measures outlined above are carefully applied with due regard to national circumstances.

#### 3.4.2. Building Complementary Capabilities

320. For technology transfer to be facilitated, it is important that complementary capabilities and assets are created that enhance the capacity of absorbing the technologies in recipient countries. Complementary assets and capabilities include matching of domestic natural resource base with technologies developed elsewhere (such as suitability of domestic coal to clean coal combustion technologies developed elsewhere), facilities for customization and demonstration of technologies that are transferred to a recipient country and availability of human resources to run and maintain these technologies in the recipient countries. Also included in absorption capacity is the capacity to acknowledge, analyze and apply public domain technology in order to solve concrete problems encountered by the recipient party. Finally broad policies of the Government in the recipient country, such as 'land acquisition policy' for projects, which is critical for installation and operation of wind and solar energy projects can impact absorption of technologies by end users. Restrictive and long winded land acquisition policies inhibit transfer of technologies to recipient countries, despite the latter demonstrating keen interest in owning the technology.

321. Gans and Stern (2003) have explored the interaction between IP and complementary assets. In their view strategic choices of competition or co-operation between technology start-ups and incumbent firms depend on a strong IPR regime, and where the incumbent firm hold important and specialized position.

322. Thus absence of complementary assets may act as a barrier to transfer of technologies. Barton (2007) also considers national restrictions on technology licenses and investment in technology-based firms as a barrier to transfer of technologies. Impliedly, a policy that eases these restrictions can be considered to enhance complementary capabilities required for absorption of transferred technologies<sup>11</sup>.

#### 3.4.3. Facilitate negotiations for technology transfer

323. Transfer of technology, as has been noted, is neither transfer of blueprints nor equipments. It is also about transfer of know-how, both codified and tacit, demonstration and customization of the technology and finally its commercial application. Therefore the process of technology transfer is complex and involves transactions that are 'layered'. Suppliers of technology are concerned about chances of spill-over of knowhow and technology to unintended transferees through violation of terms of contracts or reverse engineering or both. Since royalty rates for technologies are normally fixed in terms of anticipated sales turnover, lenders of technology are concerned about the size of the market, its future growth rate, presence of complementary assets and capabilities on the part of the recipient that

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<sup>11</sup> Where most technology is embodied in capital goods there are few barriers to technology upgrading. On the other hand, in industries such as automotives and components, technology assimilation requires mastery of complex products, processes or systems. This makes technology and assimilation more difficult for new players on the scene, and explains the dominance of developed country TNCs in such industries. Under other circumstances, TNC entities that rely on non equity modes (NEMs) of business in developing countries through outsourcing, IP/know-how licensing and franchising look forward to the absorptive capacity of their partner units in developing countries for improving performance(Giuliani, Pietrobelli and Rabellotti, 2005) as cited in UNCTAD, 2011,p 159.



circumscribes her ability to absorb and commercialize the technology, location of the points of production and distribution of end products in recipient countries, competition levels, controls in business operations (pricing and production operations) that are induced by the macro and micro business environment, prices realizable on end products and so on and so forth.

324. From the recipient viewpoint, the decision to go for a technology primarily depends on its novelty and the recognition of the technology as a national priority in national level development policies and programmes (employment generation, health, commitment to CO2 Mitigation and adaptation or supply drugs of purport to public and community health at controlled prices). Indeed there are clear policy pronouncements on these aspects from countries concerned. Thus Ghana's model Bilateral Investment Treaty (BIT) specifies that foreign investors 'shall to the extent possible, encourage human capital formation, local capacity building through close cooperation with the local community, create employment opportunities and facilitate training opportunities for employees, and the transfer of technology' (UNCTAD, 2011, p122. Similar provisions are also enunciated in Botswana's model BIT of 2008 (ibid).

325. Other considerations that guide policies of countries to seek foreign direct investment and transfer of technology include the difficulty of imitating/ copying the technology due to stringent patent laws within the recipient country and the presence of non codified elements in 'know-how' transferred, which reduces the efficacy of reverse engineering of equipments and embodied products that are imported.

326. In general, the most formidable barriers to licensing of technology arise from information asymmetry, which in turn means, inadequate knowledge on the part of the transferee about the true relevance and applicability of the technology to her needs and insufficient knowledge on the part of the supplier about the suitability and capability of the recipient to utilize and deliver the necessary technological and financial value for the asset transferred. This complicates the process of technology transfer including the negotiations related to them. To facilitate negotiations for technology transfer, the following enabling conditions are proposed:

#### 3.4.4. Setting up a Technology Exchange

327. that links an appropriate buyer to an appropriate seller Such an Exchange should provide a platform for exchange of information on various technologies, details of IP owned on those technologies, details about owners of the technologies, the detailed functioning of the technologies enlisted and if possible, 'supply (offer)' and 'demand (bid)' price expectations.

#### 3.4.5. Orienting Incubation centres for SMEs to acquire complementary skills and capabilities

328. Incubation centers attached to eminent universities in India, Brazil and China are currently mandated to help start-up companies in niche technology areas. However these incubation Centers may have to be oriented to promoting ecosystems that promote technology transfer and joint R&D for established SMEs that seek to source new technologies and customize them to local conditions in order to stay ahead in the competitiveness scale<sup>12</sup>.

329. Such firms require complementary capabilities in negotiating technology transfers agreements, and to plan joint R&D with the technology transferring unit, besides working out business models for sharing royalties arising from commercialization of joint products and technologies. More significantly they can also have the benefit of involving University Professors and Researchers of high merit in the customization and commercialization of transferred technologies. Three outstanding cases are the joint venture between the University of the

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<sup>12</sup> Citing studies by Agrawal and Cockburn (2003) and Cockburn and Henderson (1998), Montobbio (2009) states some firms could assume the shape of an "anchor tenant" firm that by virtue of its geographic proximity and co-location vis-a-vis research institutions involved, can be particularly conducive to vertical knowledge flows between downstream industrial R&D and upstream university research. The SMEs referred to here, could also partake of the features of these "anchor tenant" firm.

Philippines Science Technology Park and the private sector to establish an incubation centre for hi-tech projects, the “Technology Park Malaysia” – centre for research and development for knowledge-based industries and the Shenzhen Economic Zone. (UNCTAD, 2011, p 121 ff).

#### 3.4.6. Provide infrastructure facilities for Demonstrating Nascent Technologies

330. Many developing countries have or are in the process of setting up National Research facilities for encouraging flow of advanced technologies in the areas of drugs and pharma, public health and alternative energy. Most noteworthy examples are the facilities spawned by the Qatar Foundation in UAE, the National Research Council of the Sultanate of Oman and similar S&T facilities in China, Brazil and India. These facilities need to be augmented by facilities that demonstrate and test ‘state-of-art’ ‘bio’ and ‘nano’ medicines and complex land requiring climate smart technologies like Carbon Capture and Storage and Solar and wind technologies. Availability of land and water resources and state-of-art hydraulics and energy evacuation systems are required for such demonstration facilities to function properly.

#### 3.4.7. Providing Due Diligence on IP Enforcement:

331. Horizontal technology leakages form a major concern for overseas IP holding companies who are lured to developing countries on account of growing markets. They would like to be assured that IP laws are not just existent, but are also well enforced. By facilitating providing of advanced ‘due diligence’ measures, through credible third party agencies and acting on such reports to rectify scope for possible IP leakages, technology recipient countries can allay fears of technology transferring entities from developed countries, about horizontal leakage of know-how.

#### 3.4.8. Capacity Building in Technology Licensing negotiations

332. WIPO in collaboration with the Korean Women Inventors Association has initiated capacity building programme for women inventors and entrepreneurs of Korea on IP and innovation Management. This programme accords critical importance to tools and techniques for technology licensing negotiations. Similar efforts in other parts of developing countries can be helpful in developing capabilities in technology transfer.

#### 3.4.9. Facilitating FDI Policy and Non Equity Modes of Business of Overseas Origin

333. In recent years FDI and Non Equity Modes (NEMs) of business have become the basis for technology flows from the developed countries to developing countries. Developing countries have emerged as strategically important to TNCs both from the points of view of FDI and NEMs.

334. There is no conclusive evidence about the role of IPRs in the FDI scheme of things Kumar (2001) found no relationship between the strength of IPR protection in the host country and the overseas R&D activities of transnational companies. Similarly Falvey, Foster and Greenway (2006) have suggested that unlike high and low income countries, middle income countries do not benefit from stronger IP regimes. Going by this logic, a stronger IP regime in BRICS nations that enjoy a threshold level of technological capabilities, is not desirable. Some researchers found that changes in the IPR regime abroad led to an increase in technology transfer by US multinationals to IPR-reforming countries. There could be other studies that suggest absence of statistical association between FDI flows and IPR or Patent Laws. Nevertheless it is accepted that ‘IPRs are considered as one among many variables that determine the attractiveness of an FDI location.’

335. In a firm-level study on multinational companies investing in Eastern Europe and the former Soviet Union, it was found that investors in sectors relying heavily on IP protection were deterred by a weak IP regime. It was concluded that the lack of IP protection deterred investors from undertaking local production and encouraged them to focus on distribution of imported products. Mansfeld and Lee (1996) examined the strength of IPR protection in a host country and the volume and composition of FDI from US firms and found that the total volume of the FDI as well as the percentage of the FDI that was devoted to final production and to R&D facilities

was lower in the host countries with weaker IPR protection. Similarly Maskus (2000) states that 'FDI is sensitive to the IPR regime and that amounts of possible additional investment as a result of patent reforms could be larger'. Maskus op.cit argues 'that the dynamic benefits arising from knowledge spillovers could overcome losses in terms of trade for those countries that suffer in the short and medium term in a transition to stricter IPR requirements'. ( cited by Greenhalgh et al,2010).

336. Broadly, theoretical predictions on the relationship between IPRs and Technology transfer fall into 2 extremes. On the one extreme, it is argued that increased standards of IPR protection raise the costs of unauthorized and uncompensated imitation and thus stronger rights will impede transfer of technology that had previously worked through this channel. On the other hand, it is contended that strong IPRs may encourage licensing and thereby reduce the cost of imitation. In other words, in terms of this argument, after paying license fee, the overall costs of the technology may be less than undertaking unauthorized imitation (Greenhalgh et al, 2010).

337. Braga and Willmore (1991)state that more open economies benefit from effectiveness of IPR protection because of greater capacity to innovate. Based on US TNC activities in 16 countries during 1982-99, Branstetter et al (2006) analyze how patenting , royalties and R&D expenditure vary after patent reform. They find that after Patent Law reforms, US TNCs increased royalty payments and patenting in countries concerned. More R&D investments also happened in these countries.

338. Considering the fact that developing countries are likely to emerge as NEM hubs which carry out R&D activities, clinical trials and contract manufacturing in the drugs and pharma sector( for cases on India and Brazil see Appendix 1), it may be important for developing countries to provide prospective investors with 'Rapid assessment Studies / Reports of investment climate'. These assessments need to be prepared by credible third party analysts. Such rapid assessment are important for other reasons as well. The pharmaceutical industry, for example, remains attractive to foreign investment, in emerging economies, thanks to the rapid growth in the number of scientists and pharmaceutical firms in emerging economies, most notably in China and India as well as the dynamism of its market (UNCTAD, 2011, p9). Rapid assessment reports that focus on state of art information on R&D capabilities, and on ability of the country and its enterprises to execute NEM business models ,can enhance interest of NEM seeking TNCs even in non emerging markets. The WIPO WebNair Patent Infrastructure Services can also relay such Rapid Assessment Reports for the benefit of FDI and NEM seeking entities.

339. All these pro-active measures can go along with or without prejudice to any action that might have been /or are likely to be taken by these countries under the flexibility provisions of TRIPS or otherwise to make available generic versions of selected drugs that have severe public health impacts at affordable prices.

### 3.5. GOVERNMENT COMMITMENTS IN DEVELOPED AND DEVELOPING COUNTRIES TO SET UP JOINT R&D SYSTEMS THROUGH PUBLIC PRIVATE PARTNERSHIPS

340. Public Private Partnerships (PPPs) for R&D and commercial development of technologies involve a cooperative venture between the public and private sectors to actively manage and accelerate the development of technologies under focus, while maximizing economic and technical efficiency and effectiveness through effective delineation of risk and investment commitments by the key partners. A PPP structure may involve private companies and Governments, professional institutions with domain expertise, Universities and academic institutions, R&D centres, financial institutions, civil society representatives, regulators and professional assessors of technology and environment impacts. These players should ideally speaking steer, guide and take up responsibilities for sharing costs, risks and benefits. PPPs typically function through Special Purpose Vehicles (SPV).

341. In general, PPPs are advocated, as they enable sharing of costs and investment risks. In the European Union PPPs are considered to be crucial factor in the commercialization of key environmental and low carbon technologies like Carbon Capture and Storage (CCS). In a public private partnership system, it is important that all stakeholders have a clear understanding of each other's needs and objectives related to the process. This will ensure the sustainability of testing/ validation, scale up and deployment of solutions. Also the role of PPPs in leveraging finance and sourcing it from multiple channels holds great attraction. Public funding serves to bridge the gap between R&D and the commercial deployment of the technology, while private funding can be leveraged for technology testing through pre-commercial demonstration projects. In the context of developing countries, PPPs can ensure that the cost-push impacts of the developed technologies are kept under control and price of the end product is kept within reasonable limits.

342. This can be achieved by:

- (a) • Ensuring participation by multiple levels of government and industry.
- (b) • The need for risk sharing in the early implementation of technologies and the development of markets.
- (c) • Ensuring the overall “public good” nature of the technologies developed
- (d) • Overcoming lack of public understanding about the technologies
- (e) • To provide a bridge to concerned countries and project to achieve a better understanding of technology and policy developments in the international sphere.
- (f) • Providing the potential for an investment vehicle to effectively manage the funding of R&D and post-R&D work

343. There are different models of PPPs depending on the depth and scope of the partnerships. These are;

- (a) Life Cycle PPPs that encompass the entire chain of a new product or technology development, commencing from R&D and proceeding to the phases of generation of new technology, its protection, testing and assessment , demonstration, customization, scale up and commercialization, awareness and capacity building and continual improvement.
- (b) Segmented PPPs where a segment of the life cycle is taken up for partnerships. Segmented PPPs include the following variants:
  - (i) PPPs in R&D through Joint R &D efforts to develop new technologies at the ‘lab’ or ‘bench scale’ or conduct R&D for adaptation or customization of technologies that have been developed. Joint R&D involves joint sharing of IPRs and share in commercial development or customization of the products.
  - (ii) Post Innovation Partnerships involving commercial scale up of technologies by the proprietor firm (which holds IP on the technology) with the support of the Government or special purpose vehicles set up by the Government
  - (iii) Post Innovation Partnerships whereby a consortium of firms join hands with the Government agency or its Special Purpose Vehicles to source the appropriate technology from the vendors, customize it, demonstrate its working and upgrade it for commercial scale up
  - (iv) PPPs that exist for carrying out enabling activities of capacity building, technology assessment, risk assessment, demonstration, awareness building and

- (v) The choice of a PPP model will determine the choice of the business model and the structure of financial mechanisms that are designed to provide financial support for the technology or the product.

**BOX 3.2: Lessons from PPPs in Carbon Capture and Storage (CCS)**

PPPs in CCS offer immense scope of partnership activities that can render the technology viable. One sees both pre and post innovation PPPs possible for CCS. These can encompass both pre and post combustion, transport and storage technologies. The CCS partnerships that have focused on cost-reduction R &D in Germany fall in the pre-innovation PPP category, while there have been private-private and public-private partnerships in Germany that have aimed at transfer of the technology, its demonstration and their commercialization. Validation is critical, considering apprehensions about the safety of CCS technologies. Vattenfall's CCS demonstration plant is a case in point. Validation of CCS pilots has been attempted at pre-commercial and commercial phases in US and Canada. In pre-commercial demonstration exercises, the role of Universities has been crucial as demonstrated in the case of the International Test Centre for CO<sub>2</sub> Capture (ITC) programme at the University of Regina. The same is true of small-scale technology development pilot plants as has been the case with the ITC. The project at the University of Regina has two main components: a pre-commercial scale chemical adsorption technology demonstration pilot plant at the Boundary Dam power plant near Estevan, and a technology development pilot plant at the Petroleum Technology Research Centre (PTRC), University of Regina. In the US the DoE's Clean Coal Power Initiative is designed to provide PPPs for small-scale field tests in different geographic regions and geologies with focus on sensitive large volume sequestration tests. As has been noted the US DOE's Clean Coal Power Initiative (CCPI) seeks PPPs with private industry to partner with government to demonstrate new clean coal technologies at the commercial scale. Australia's CRC Program has focused on the development and application of a spectrum of CCS technologies.

The other significant aspect has been Regional approaches to PPPs in CCS as has been demonstrated in the case of the US and Canada, which involves industry, NGOs, Universities and Governments. These regional approaches have been complemented by International facilitation involving the Carbon Sequestration Leadership Forum (CSLF) which has been set up to promote the technical, political, and regulatory environments for the development of CCS technologies in the world and the efforts of the International Energy Agency (IEA) which also looks at various dimensions associated with CO<sub>2</sub> emission mitigation involving use of coal, oil, lignite.

In the light of the lessons learnt from existing cases of CCS PPPs, the following challenges emerge:

- (a) The challenge of developing joint products remains to be addressed in a systematic manner. CCS being a costly option, revenue streams need to be broader and diverse to cover costs. Apart from the possibility of CCS-Certified Emission Reduction (CER) linkages, one has to see how CO<sub>2</sub> that is captured, has secondary re-use by way of its use in alternative occupation such as 'enhanced gas recovery' in oil fields that face reserve drawdown as was noted in the case of Altmark gas field.
- (2) The second challenge is to utilize Public CCS funding and programs to facilitate transfer of technology and enable risk assessments and capacity building
- (3) The third challenge is to integrate programme based approaches to project development in CCS or facilitate Program-Project Linkage for sounder PPPs in pre-innovation and post-innovation R&D
- (4) Further R&D work is required to develop cost-effective technologies in capture, transport and storage of CO<sub>2</sub> involving inter-agency approaches taking cue from the Australia's 'Pet cooperative research centre for greenhouse gas technologies (co2crc)'.

(5) PPP based R&D work to support non-incremental breakthrough in research needs to be taken up to improve the economic viability and safety of CCS technologies that involves international agencies like CSLF and national public R&D centers and private industry

(6) Setting up a 'Technology Exchange' for disseminating information on CCS technologies, their safety features and results of demonstration exercises on CCS in various parts of the world. Technology choice being a tricky issue for CCS seeking entities, there is need for information on these technologies. The idea of the exchange is to match the buyer with the best seller. For instance, Norway has developed a system of seeking bidding for CCS technologies to enable the pick-up of the best technologies. A global system of bidding for CCS technologies is essential for CCS technologies to find successful application.

(7) An IPR facilitation system that promotes joint patents for inventions that arise from PPPs and also informs stakeholders of the type and range of rights over CCS technologies over which patents have been obtained.

Source: Damodaran, 2010a

344. In general, PPPs while being a promising approach, can be fraught with difficulties for want of rules on developing joint products, sharing the resultant IP, issues of financing demonstration plants that can ensure further refinement and customization of the technology to local conditions. Box2 details the experience with PPPs in relation to the evolving Carbon Capture and Storage (CCS) technology that involves sequestration of carbon from power plants and storing it underground (or under sea beds), with a view to mitigating CO<sub>2</sub> emissions arising from combustion of fossil fuels. While capture of CO<sub>2</sub> from power plants is deemed uneconomic on account of high costs, their sequestration underground is fraught with risks of leakages. This, coupled with the fact that CCS seeks to justify continued use of CO<sub>2</sub> intense fossil fuels, makes it a contentious low carbon technology. Currently there exists no commercially functional CCS plant in any developing country.

### 3.6. MARKET MAKING FUNCTIONS: LINKING APPROPRIATE BUYER TO APPROPRIATE SELLER

345. Since many nascent technologies (or products of technologies) relevant to development (drugs or environmentally sound technologies) are not standardized products a standard 'market clearing price is not realizable. Each technology is supplied at a unique price and the price is arrived at based on negotiations. Just as buyers differ in their willingness to pay, so do suppliers of technology in their supply price. Much of the problems associated with technology transfer arises from the difficulty of matching the 'willingness to pay' with the 'willingness to accept'. Ockwell (2008) refers to a study by Lewis on how leading wind technology manufacturers in developing countries like Suzlon (India) and Goldwin (China) acquired access to wind technology by license purchases but from second-tier developed country firms which had less to lose in terms of competition and more to gain in license fees. There are many small suppliers who may be able to supply relevant technologies at lower prices (Khor, 2012). There are not many companies in developing countries that are aware of such possibilities. Hence there is a need to have a market making function to link them to each other. A technology transaction exchange or transaction platform can achieve this by globally linking buyers with different abilities to pay to sellers who are willing to go along with.

346. A international technology exchange that has connecting nodes to various national level exchanges and technology pooling platforms, can also obviate the problem of finding supply partners who are appropriate to your requirements. A proper technology exchange or market making mechanism, by rendering informed choice of a collaboration partner, can obviate adverse situations arising from such 'tying' arrangements.

347. The other manner in which a technology exchange can be helpful is to tie private players with substantial downstream capabilities to take up promising lab scale or bench scale technologies to its commercialization phase. By providing risk management instruments , private entrepreneurs can take up frontier lab or bench scale technologies without fearing risk of failure.

348. A Technology Exchange can be helpful in providing data on valuation of IP assets by stock markets for different lines of drugs or environmentally sound technologies. This will enable provision of quantitative support about the reasonableness of royalty rates and technology transfer agreements. This will encourage a priori sound decisions on the part of manufacturers in developing countries regarding choice of appropriate royalties rates and proximate clauses in technology transfer agreements.

349. A Technology transaction exchange goes beyond a clearing house mechanism envisaged under the Convention on Biological Diversity and other multilateral environmental agreements that merely catalogues different available technologies, provides detailed information about them, but do not contribute to price discovery for the technologies by matching the best buyer with the best seller.

### 3.7. ENCOURAGE JOINT NEED ASSESSMENT FOR DRUGS AND ENVIRONMENTAL TECHNOLOGIES TO FACILITATE JOINT R&D PROGRAMMES

350. It is stated that the research portfolio of MNCs may shift in favor of diseases relevant for developing countries especially those with large populations with reasonable ability to pay. Further the development of Singapore and China as NEM hubs for outsourced R&D activities involving MNCs is another trend that improves the status of developing countries to take advantage of the 'centrifugal tendencies in R&D' ( Sanjaya Lal,2001). The reason for such off shoring is that it is cheaper and promotes adaptation to the local market, ensures availability of high quality personnel and focuses on highly growing markets (Stine Jeson Haakonsson, 2012)

351. As Greenleagh et al (2010) state, pharmaceutical companies of India are exploring the following options:

- (a) Developing new pharma products
- (b) Undertaking outsourced R&D activities for early stages of drug development
- (c) Focusing R&D on drug delivery mechanisms , and bio-enhancers to improve the efficacy of existing patented drugs
- (d) Focusing on process R&D for patented drugs to acquire [process patents and explore cross- licensing / licensing options
- (e) Focusing on contract manufacturing of patented drugs
- (f) Focusing on drugs going of patents
- (g) Producing drugs that are off patent today
- (h) Co-marketing/ marketing arrangements

352. Further developing countries that would like a quick track approach to commercialization of drugs that form a key priority to public health needs of the country, may need to have a list of priority drugs that may fall in the category of fast track commercialization. Also such a priority list will enable developing countries to enable generic manufacturers to begin their R&D process in time to ensure that affordable equivalent generic medicines can be brought to the market immediately upon the expiry of the patent on the existing drug.

353. In the field of climate smart technologies, it is seen due to pre-occupation of firms in different value segments, integrated approaches are lacking. This results in absence of research and development on cost-effective solutions in areas like thin filament technology, which can cut down on a developing country's import bill on poly silicon wafers. (Box 3) . Also the fact that patents the increased trend of patenting climate smart technologies in the realm of wind energy Solar PV , water purification and IGCC ( See Appendix 2 for details of Patent Applications with USPTO and EPO during 2003-12 period) calls for solutions in the shape of PPPs that provide incentives to Patent holders while at the same time resulting in transfer of technologies

354. All these factors call for joint need assessment exercise involving developed and developing countries.

### **BOX 3.3: Segmented Competencies of Players in Solar Energy In India**

The three major players in PV solar energy in India are Tata BP Solar, Bosch India and Moser Baer. Their operational focus is as below:

#### Tata BP Solar

- Tata BP solar operates mainly in the Engineering space and PV cell & module production.
- Have strategic tie-up with Tata Power which is essentially a developer. Tata Power also has others EPC partners
- Source of revenue is through
  - Sale PV cells and modules
  - O&M maintenance contracts of Solar power plants
- Implement projects on turnkey basis

#### Bosch India

- Nascent player in Indian market. No power grid project involvement yet (as on 16-Aug)
- Plays on Ersol (Bosch's global solar wing based out of Germany) advantage
- Ersol is presently a completely backward integrated (up to polysilicon) player
- Current business model focuses on EPC space and PV modules to be imported from Ersol.
- Consider Chinese and Indian PV cell/module players as key competition due to low cost dynamics

#### Moser Baer Ltd

- Present in the developer, EPC , Solar PV cell manufacturing space
- Only player in India to have thin film manufacturing capability

#### Emerging Trends in Indian Solar PV space

**Technology:** Technologies that lower poly-silicon consumption like thin film technology lead to lower reliance on global markets for PV material. This enables cost reduction and is being viewed as the next wave that will drive solar power costs down.

**Business Models:** It is observed that different players start off at different segments in the value chain based on their advantage (both technical and commercial). Thus MoserBaer started with PV module manufacturing, Tata BP Solar with EPC space and Bosch India also in the EPC space. There is no integration trend observed across the value chain . Had this been there, cost reduction for solar technologies would have occurred in India sooner than expected .

In recent times MoserBaer has emerged as an integrated player.

Source: Shubashree Mohanty and Sridharan (2011)



### 3.8. SETTING UP AN EFFICIENT MULTILATERAL FUNDING MECHANISM TO FACILITATE TRANSFER OF TECHNOLOGY

355. In the drugs and pharma sector as well as in the field of environment, the key challenge is to finance technology transfer. However existing debates have not looked at this aspect in detail. Indeed the UNFCCC and the Convention on Biological Diversity (CBD) have also not looked at this aspect well enough. The Conventions have not considered the linkage of the financial mechanism of the Conventions to the issue technology transfer, though there have been efforts to promote demand side conditions for stimulating absorption of technologies by developing countries. The reason for the relative neglect of transfer of technology in the UNFCCC and CBD financing mechanism scheme of things, is that technology transfer as an objective, competes with more pressing needs of supporting field based conservation and adaptation action in developing countries. The problem can be obviated if a dedicated fund is created to promote Joint R&D in critical areas as discussed above which can be used to purchase technologies or improve technologies emanating from joint R&D projects involving scientists of developing and developed countries.

356. This is a felt need in the drugs and pharma sector, where no multilateral fund exists at present, to procure promising drugs or for developing new, effective drugs. In the case of environmentally sound technologies, a separate portfolio may be created within the Global Environmental Facility (GEF) (the financial mechanism for CBD and UNFCCC) and the proposed Green Climate Fund (GCF) of the UNFCCC, for supporting R&D or procuring critical technologies. For technologies to be developed for future use, the nature of the funding of research and development will exert influence on the proprietary nature of the products and technologies. Indeed the financing mechanism can be utilized for financing the 'market making mechanism outlined in the preceding point.

357. Thus financing holds the key to transfer of technology. In the absence of robust financing mechanisms, suppliers of technology will not be able to realize their supply prices, that need to cover not only costs/investment on R&D but also provide profits to the technology supplier. Sources of funding technology transfer can be divided broadly into two: Public and Private. Each of these categories in turn can be classified into national and international. As a rule, private sources of funds are based on risk adjusted return on capital invested, unless they happen to be philanthropic funds.

358. International public funding can be divided into two: namely 'bilateral' and 'multilateral'. Bilateral funds flow from one country to the other and are therefore limited in quantum, Multilateral funds, on the other hand are pooled funds from various donors belonging to a multilateral body/ agreement like the United Nations and are administered multilaterally by governance mechanisms that are inter-country based.

359. Multilateral funds (MLFs) (particularly those that come under the aegis of the United Nations,) have the potential of being larger. They are governed to advance multilateral interests and thus do not represent the interests of a donor or a narrow set of donors.

360. MLFs (if designed and replenished sufficiently) can enable smooth, appropriate and cost effective transfer of technology tuned to the needs of developing countries. Multilateral Financing mechanisms, with transparent governance and resources allocation systems, have the potential of providing means for purchase/ license of evolved and tested technologies. Alternatively they can provide means for lab scale technologies that are required to be tested, demonstrated, customized and commercialized. Further MLFs also tread into areas which are not taken to by banks and private financing<sup>13</sup>

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<sup>13</sup> For instance for India's solar sector, non steady flow of public investment can hamper commercialization of solar technologies. Banks cite inadequate data on solar plant utilization and absence of demonstrated technologies  
[Footnote continued on next page]

**BOX 3.4: Financing and technology dilemmas for Solar Power in India**

The Concentrated Solar Power (CSP) sector is fairly new to the financial institutions in the country, as only few of them have seen the full cycle of solar power projects and how they behave. For this reason, most financial institutions are looking at solar power from a very cautious perspective. Some institutions fear that the technology may not perform as expected and that developers may not get paid at time, which has resulted in issues related to extending finance. CSP requires high initial capital cost and hence it is very important to build investor confidence.

As far as the Solar Photovoltaic Industry in India is concerned, following are the challenges:

1) Policy protection to local manufacturers: A couple of years ago, Indian solar panel manufacturers were riding high on the sudden increase in the demand for panels which was mainly due to the introduction of Jawaharlal Nehru National Solar Mission (JNNSM) in January 2010.

However, since 2012, the manufacturers are facing a tough time for want of orders. All those setting up solar-based power plants prefer to buy equipments overseas, especially China since the equipments are cheaper. Manufacturers in countries like Germany have been hit hard due to the European economic woes, which have resulted in some governments reducing or doing away with subsidies. Thus manufacturers in such countries are selling their products at very low prices, often to clear up their inventories. Additionally the soft loans provided by the Export-Import bank of China to those buying Chinese products make a big difference. The Indian solar panel manufacturers cannot match Chinese prices. Indian manufacturers have to differentiate themselves from their competitors if they have to be successful in this market.

2) Financing of Projects: Solar projects are capital intensive and lack of an effective financing infrastructure for these projects is another major factor impeding growth in this sector. A Financial Institution's understanding of the Renewable energy sector is less and clarity on various factors is required. This increases the time taken for project evaluation and financial closure, thus increasing the risk associated with completing the project within the stipulated period. There is need for better financing infrastructure, models and arrangements to spur the PV industry in India. Strong project management experience, good track record, skilled Engineering, Procurement and Construction (EPC) players and good operations & maintenance contract is also essential for a developer to obtain financing for their PV project. Thus it becomes difficult for developers with less credentials or ability to obtain financing.

3) Land acquisition: Solar power is one of the most land intensive electricity generation options requiring 5-10 acres/MW. Under the JNNSM scheme of things, land acquisition, power and water supply and other basic amenities are sanctioned at the state level which adds another layer of process which can potentially delay the installation process.

4) Lack of authentic data on irradiation has been a big challenge and bankers are wary of the legitimacy of these data and its impact on the Capacity Utilization Factor of solar power plants.

5) Uncertainties of the global silicon wafer market. The industry has relied on international markets to source the basic raw material-silicon wafers. The silicon market has been highly fluctuating in the past as far as prices go.

6) Absence of Collaborative Environment: Currently research & development (R&D) in

[Footnote continued from previous page]

as reasons for being wary to fund technology acquisition and development. Similarly absence of 'demonstration funds' inhibit private investment'. Finally, nascent entrepreneurs are starved off funds for taking up R&D, as banks do not lend for this purpose (Vishal, 2012). Also see Box 4.

this sector is on a slow track due to lack of collaborative and goal driven efforts on this front. Technological innovations that improve the efficiency of current solar energy systems are necessary to exploit the solar energy potential in India. In order to facilitate this, government has to frame comprehensive R&D schemes.

7) Absence of Regulatory framework in the States: Although the Ministry of New and Renewable Energy (MNRE) has set up a solid regulatory framework and implemented policies at the central level, the absence of conducive policies and regulatory framework in some states is still a challenge. Only few states like Gujarat and Rajasthan have been successful in implementing policies at the state level, which has resulted in about 80% of total solar PV capacity in these two states.

6) Grid Connectivity: Most of the renewable energy projects are located in remote areas which have sparse transmission/ distribution system. This has been a major hindrance in harnessing the energy from such renewable sources. Also the transmission and distribution losses make generation through solar PV somewhat infeasible.

Source: Bharathi Vishal, C R (2012)

361. Further, for least developed countries, MLFs can provide grants and soft loans to facilitate transfer of technology. A case of a successful MLF is that of the Montreal Protocol Multilateral Fund that has successfully purchased CFC substitute technologies and provided acquired technologies at affordable costs to needy developing countries as required under the Protocol to phase out Ozone Depleting Substances. Box 3.5 provides the mechanics by which the Montreal Protocol MLF succeeded in its objectives.

#### **BOX 3.5: The Success Story of the Montreal Protocol Multilateral Financing Mechanism**

Sound governance and project approval processes and appropriate technology financing choices and attention paid to customization and demonstration underlay the success of the Montreal Protocol MLF in its endeavor to effect transfer of technology.

The financial contributions to the MLF that have been provided by industrialized Countries and are mainly earmarked for technology transfer. The implementing agencies were invited by the MLF, along with three other UN agencies, to channel these resources to developing countries (Kelly, 2004). In its long years of existence the MLF had served as a dual catalyst, one for raising finances from other sources and the second as an information disseminator and national policy facilitator on ODS phase out. Each implementing agency was required to draw up a Country programme which reflected the policy and operational capabilities of the country concerned. As Kelly notes lack of ownership of a country programme is sometimes a major constraint in the implementation of the strategy underlying the mission of the Convention.

Kelly mentions the following lessons from the World Bank's involvement with the MLF

(1) Assumption of low financial risks by the implementing agencies on ODS substitute projects. By approving only a small share of approved funds on individual projects, the financial risk is limited to the size of the advance institutional risk in environmental projects.

(2) All ODS projects are rated as category B, requiring that appropriate precautions must be taken, but not requiring a formal environmental impact assessment, as is the case for category A projects.

(3) Fostering government ownership of ODS phase-out efforts and building capacity at the national level (in particular in the Financial Intermediary chosen by the Bank and government) for identifying and developing projects. This line of action is preferred to centralized project identification, development and procurement operations, and avoiding national systems of project implementation.

(4) Strategic approaches aimed at minimizing project duration, maximizing impact, and

increasing project flexibility.

(5) Involvement as an IA 'to leverage money to the field.'

(6) Strengthening capacity of the National Ozone Units are key prerequisites in the future compliance goals and sustainability of the program

(7) The catalytic role in leveraging existing MLF resources through the promotion of new partnerships and new project financing mechanisms to supplement the existing sources

(8) Experiment with innovative financing approaches, such as the Chile Auction program and the China auction program under the halon production/consumption sector phase-out plan

(9) Setting up a revolving fund mechanism whereby a government leverages the impact of an MLF grant by providing financial support to enterprises in the form of contingent financing. Here repayment is made in full to the government if the project is successful, with repayments then used to finance other activities, including institutional strengthening or technical assistance. An example is the revolving fund was set up by the government of Turkey in 1994 to more equitably manage ODS phase-out funds approved by the MLF. A major finding of the

revolving fund approach was that enterprises are willing to participate in mixed financing — that is, both loans and grants — for ODS phase-out projects.

(10) Full contingent financing on a case- by-case basis. Specifically, it has co-financed chiller conversion projects — projects that generate energy efficiency gains and are therefore not eligible for incremental costing.

(11) Streamlined loan procedures

(12) Involvement in Fund projects that offer demonstrations of existing alternatives that test these alternatives (particularly through field trials) to determine their feasibility.

(13) The unique composition and decision-making structure of the MLF, which features balanced representation of developed and developing countries and consensus style decision making, has fostered an unprecedented model of international cooperation. The program is advised by periodic scientific assessments.

(14) The adoption of 'umbrella project and terminal umbrella project approach' by the World Bank which allowed a number of enterprises to be converted under one project. This approach had the advantage of allowing smaller enterprises to be targeted where the cost-effectiveness threshold was relatively high. This approach was used several times by the Bank and other agencies. However, the more recent trend has been to move to sector and national approaches.

(15) The dual role as an implementing agency and a development partner in the Fund requires balancing its obligation to implement a narrowly focused international environmental agreement with its institutional mandate by utilizing an approach that features capacity building and local execution of project identification, preparation, and implementation.

#### **Why the MLF is a Success Story?**

As El-Arini (2000) states, projects to transfer technology to developing countries are evaluated by the mechanism against a criteria adopted by the Committee of the MLF - within the framework of the provisions of the Montreal Protocol and decisions of the Parties. This process ensured technological soundness, safety, fairness and cost-effectiveness. Implementing projects involved installing or modifying equipment, trying out substitute technology and testing new products. The MLF promoted collaboration with local experts and provided training of user groups by suppliers of the technology and external consultants to ensure smooth and safe transition. This was further

guaranteed by supervision by consultants from implementing agencies, including periodic visits to ascertain progress and/or reinforce earlier training.

Though the MLF deals only with ODS technologies and know-how, their activities provide insights for a financial mechanism that should aim to transfer CCS technologies. The following details culled from Annexure 1 confirm this fact.

In the refrigeration sector, technologies transferred at the initiative of the MLF include two fully hydrocarbon (cyclopentane and isobutane) domestic refrigeration projects and two projects for the conversion of Chinese compressor manufactures. In the realm of Urethane foam processing, the LCD technology transferred had low Global warming potential as well. The technology transfer saw the patent owners getting agreeing to licensing of their technologies as part of investment projects. The solvent sector also witnessed technology transfer by way of imports to the user industries in the electronic industries. As far as process agents are concerned, the MLF encouraged use of substitute technologies based on imported technologies. The fumigant sector was characterized by the Demonstration Projects to convince farmers of the utility of alternative technologies available from European countries. The problem was that there was no single acceptable fumigant substitute. Customization was called for, crop-wise. The MLF had to support developing countries by way of producing guidelines for the sector to sell the technology to developing countries.

Many technology transfers of ozone substitute technologies took place between developed and developing countries in Europe. But there have been a few developing countries firms, like the case of a Lebanese firm (engineering drawings and refrigeration components) and a few Hungarian firms supplying compressor designs and technology to firms in China and Iran. In the fumigation sector similar South-South initiatives were noticed, such as the case of Colombia providing expertise on non-Methyl Bromide technologies to Uganda etc.

The MLF has also performed well by way of secondary technology transfer by acquiring new skills for production and installation of equipment, essential for a conversion project. Indeed some MLF funded projects have tapped local suppliers of equipment, materials and components by supporting projects that upgraded their skills, to the extent that they were able to supply new types of products (e.g. storage tanks for hazardous chemicals, some production equipment, new types of components, etc.) that met international standards. Similarly equipment installation was encouraged from local workers under the supervision of international equipment suppliers. The additional skills passed on to the local staff enabled them to undertake construction and assembly of sensitive and up-to-date equipment involving hazardous technologies, advanced electronics and control systems.

The key aspects of successful transfer of ODS phase out technologies are enhanced project design, production engineering, equipment maintenance and repair skills.

International Institutional collaboration has also played an important role in MLF activities. The case of redesign of the first batch of ozone-friendly freezers at the XingXing Group in China required assistance of a refrigeration institute from the United Kingdom, and the joint effort that trained the company engineers was highly effective. As a result Chinese engineers were able to carry out conversion of existing technologies on their own. The project also trained operators and maintenance staff in the best operating and up-to-date safety practices, which were then applied throughout the entire production process.

Capacities were built both at plant level and national levels. Plant level capacity building was done to achieve reductions and relocations in all the plants and production lines with the aim of eliminating the consumption of ODS. While the thrust of the Montreal Protocol programme is on plant-level phase out of ODS, the focus has also helped improve the capacities of public and private sector institutions to deliver services to industry.

At the national level, the most important step is the creation of and support for National Ozone/Secretariats or Units that are usually, but not always, with the national environmental protection ministry. It is the responsibility of these units to design, monitor and implement the ODS phase out Country Programme and to select

enterprises that need to be assisted by the MLF. Acquiring such capability is a precondition for countries' access to MLF project financing.

The Montreal Protocol MLF has also facilitated technology transfer that has provided composite benefits to the company/firm implementing ODS substitute technologies by way of not only effecting ODS substitution and thus honoring the commitments to the Protocol but also in improving factor productivity and economic performance. The other significant externality induced by MLF projects have been indirect employment effects and the large indirect catalytic impact of the MLF in spurring successful private enterprises in developing countries which implemented the Protocol with MLF assistance.

Luken and Grof(2006) provide examples in this regard. The case of the high-end refrigerator manufacturer, viz the Huari Group in China is a case in point. As part of its conversion process to cyclopentane insulation foam blowing and isobutane refrigerant, the Company also upgraded its premises and rationalized its manufacturing processes to effect improvement in productivity. The result, was that Huari not only eliminated the consumption of 338 ODP tons of CFCs, but also increase annual production by 5% and improved labour productivity from 352 to 455 units per worker per year (Luken and Grof(2006)).The case of Pars Appliance Manufacturing, Iran's largest manufacturer of refrigerators is another example of how composite advantages were obtained by user firms availing the MLF. The firm built a second production hall for the assembly of refrigerator bodies at its own expense, adding US\$ 2.6 million of its own funds to the US\$ 2.1 million provided by the MLF. It designed the new facilities and layout for the extremely sensitive HFC-134a and cyclopentane technologies. As a result, Pars eliminated the consumption of 193 ODP tons and increased annual production by 20%, achieving its design capacity of 195,000 units.(Luken and Grof, 2006).

Luken et al provide similar instances of composite benefits from the flexible foam sector that introduced liquid carbon dioxide (LCD) blowing technology for the production of foam slabs in 10 projects in five countries International experts helped the firms license the LCD technology, undertook production cost assessments and analysed new product markets in order to optimise the new production programmes. The installation of the equipment required training of operational and managerial personnel. Introducing the LCD technology eliminated 1740 ODP tons of ODS, increased production capacity on average by 15 to 20% and opened new domestic markets for soft- and low-density foams.

In the aerosol segment, the main conversion technology transferred entailed replacement of CFC propellants with hydrocarbon aerosol propellants (HAPs). The conversion process in a case brought about a significant increase in production by a factor of three while in another case allowed a company to correct its declining sales of CFC-based aerosols against cheaper hydrocarbon-base equivalent. In most cases, as illustrated by, the conversion of an aerosol plant to HAP based technology involved reformulation of the aerosol product composition, which allowed the project beneficiary to maintain or improve the quality of its products (Luken et al op.cit).

Quality was the other by-product of phase out of CFCs and this was achieved by re-design of processes and equipment. Factories on their own initiative improved the quality of their products as part of their CFC substitution process. Luken et al also mention how Chinese and Iranian engineers with the assistance of an Italian engineering firm and Hungarian compressor manufacturer redesigned their traditional CFC-12 compressors to handle ODS-free (isobutane and HFC-134a) refrigerants, reduce noise and vibrations and improve energy efficiency [18–19]. Through design modifications that met the latest international standards and consumer requirements, the compressor factories were certified to ISO 9000.

At the same time, their customers (the refrigerator manufacturers) were able to upgrade their products, using the up-to-date compressors to give them an additional marketing advantage.

The other positive spin-offs were growth of large enterprises specializing in CFC substitute technologies which acquired world wide profile through strategic joint ventures. Thus Luken et al mention the case of Aucma which increased its export of deep freezers from a few thousand in 1995 to 170,000 units in 2001. The firm went on to sign an agreement with General Electric to export 500,000 freezers under the General Electric label because its freezers were ODS free and met energy efficiency standards. The other case of acquired dominance cited by Luken et al is the case of the Al Hafez Company of Syria, improved the quality and energy efficiency of its newly designed ODS-free models of refrigerators at its own expense. As a result, it has been able to maintain its leading market position domestically (40% share) and for the first time now exports 20% of its ODS-free refrigerators to other countries in the Middle East.

The limitations encountered in the Montreal Protocol MLF process related to difficulties encountered by agricultural enterprises in adopting new technologies in packaging and exporting agricultural products. In China, Luken et al mention how agricultural enterprises took time to absorb and make operational the new hydrocarbon technology associated with packaging and marketing products. In this case, the few large firms that emerged from the consolidation of several smaller firms needed considerable time to absorb and make operational the new hydrocarbon technology. Lastly, convincing the growers of strawberries in Morocco to phase out methyl bromide was not easy. Project implementation required showing the practical results of a special demonstration project using viable and appropriate technologies.

However the positive performance of MLF outweighed the limitations. Production change and augmentation, productivity improvements, quality improvement, stand as positive achievements of the MLF. In the long run, ODS free products along with better design and improved quality of products have helped many firms improve their market access, i.e. export potential.

Source: Damodaran (2010a)

### 3.9. INFORMATION BASE TO PREVENT TECHNOLOGY FAILURE RISKS

362. Technology failure risks are a major problem that affects successful development and commercial application of new drugs and environmentally sound technologies. The reasons for technology failure can be attributed to both supply side and demand side factors, From the point of view of the supply side poor quality of transferred technology insufficient pre-commercial testing and inadequate transfer of know-how are some of the factors that have contributed to technology failure. From the demand side point of view, causes for technology failure can be attributed to poor absorption conditions on account of infrastructural bottlenecks for testing and demonstration poor quality human resources, IP violation risks and policy and regulatory controls. Since financial resources available for this segment are limited in comparison to other potential investment avenues, the challenge of allocating financial resources needs to be presaged upon technical, economic and environmental assessment exercises to minimize risks. Drawing on the literature on foreign direct investment, Janssen (2002) distinguishes three main categories of risks that can affect the performance of project-based emissions crediting: (i) technological risks that are tied to the process of production and refer to uncertain output quantities; (ii) economic risks that refer to uncertain input and output prices; and (iii) political risks

363. A risk assessment exercise also needs to be added to the repertoire for technologies that are perceived as likely to carry societal and environmental risks. At present these exercises take place in independent layers in developing countries.

364. Assessments provide the basis for technology ranking particularly for a new genre of technologies like biomass combustion and CCS where proven-ness is questioned, research is progressing and where intricate patent thickets characterize the IPR spectrum. Patent thickets

are normally the result when the degree of distinction between successive inventions is less, though otherwise the newer products fulfill the requirements of novelty, non-obviousness and 'industrial application'. As mentioned, patent thickets raise the probability levels of IP infringements due to the 'closely clustered' nature of existing patents and the high propensity of newer inventions trading on any of the existing patents. The second problem created by 'patent clusters' is that of 'embarrassment of riches' which create problems of making informed technology choice for potential customer. The transaction costs of making judgments is high for developing countries and their fossil fuel fired power sector firms that may desire to take up projects based on new and advanced technologies. Further 'information asymmetry' in the IP markets, adds to the problems of making judgments on technologies which developing countries are generally reluctant to accept due to their 'mandatory' and non proven nature. The fact that 'safety issues' associated with technologies like CCS are also a major concern to developing countries, adds to the problem of technology choice.

365. Box 6 sums up some of the major failures associated with CCS technologies.

366. There are two challenges that arise as far as overcoming technology failure is concerned. One, of facilitating informed technology choice and second of creating capacities at the national, regional and local levels to undertake ex-ante and ex-post integrated technical, economic, environmental and risk assessment exercises in recipient countries.

367. To obviate large scale possibilities of technology failure, it is important that a multilateral system of information dissemination on the potential risks of technologies is put in place. Indeed as Box 3.4 brings out the Framework Convention on Climate Change has established a Technology Executive Committee and a Climate Technology Centre and Network to address preparation of technology outlooks, conduct regular review of technology development and assess and monitor transfer of technology. However there is no mention of technology failure in the Terms of reference for these Committees/ Centres. These mechanisms should be mandated to address technology failure associated with climate smart technologies.

**BOX 3.6: Issues relating to Technology Failure Risks: The Case of Carbon Capture and Storage (CCS)**

Zorlu and Tomlinson (2008) explore the current debate about technology transfer in the context of climate change. Drawing from a recent publication by E3G and the Royal Institute of International Affairs (Chatham House), they propose a framework to overcome the potential deadlocks around risk, innovation and intellectual property rights (IPR) issues in developing countries.

The authors argue that current innovation programmes are inadequate to manage the risk of policy and technology failures and enhanced climate sensitivity. A number of mitigation models have attempted to assess future energy mixes and roadmaps across a range of different emissions reduction targets. In general, these models focus on a combination of specific technologies like large-scale carbon capture and storage (CCS) deployment, substantial diversification in the energy mix through renewables and energy efficiency, across four key sectors (industry, buildings, transport and power).

Overall, there are major risks associated with the presumed technology mixes that current models describe. As mentioned earlier, policy and technology failure and enhanced climate sensitivity also form major risks. Experience of delivering energy-efficiency savings shows that achieving real reductions are often hard to achieve. Therefore there is a significant risk that policies will fail to deliver the large improvements shown in many of the models, requiring increased action through innovation. Some technologies, which play a major part in many scenarios, such as second generation biofuels or advanced nuclear power, may fail to emerge due to technological barriers or public opposition.



Based on Phase I of a UK–India collaborative study, the authors analyze two case studies of low carbon technologies—hybrid vehicles and coal-fired power generation via integrated gasification combined cycle (IGCC). The analysis highlights the following six key considerations for the development of policy aimed at facilitating low carbon technology transfer to developing countries: (1) technology transfer needs to be seen as part of a broader process of sustained, low carbon technological capacity development in recipient countries; (2) the fact that low carbon technologies are at different stages of development means that low carbon technology transfer involves both vertical transfer (the transfer of technologies from the R&D stage through to commercialisation) and horizontal transfer (the transfer from one geographical location to another). Barriers to transfer and appropriate policy responses often vary according to the stage of technology (3) less integrated technology transfer arrangements, involving, for example, acquisition of different items of plant from a range of host country equipment manufacturers, are more likely to involve knowledge exchange and diffusion through recipient country economies; (4) recipient firms that, as part of the transfer process, strategically aim to obtain technological know-how and knowledge necessary for innovation during the transfer process are more likely to be able to develop their capacity as a result; (5) whilst access to Intellectual Property Rights (IPRs) may sometimes be a necessary part of facilitating technology transfer, it is not likely to be sufficient in itself. Other factors such as absorptive capacity and risks associated with new technologies must also be addressed; (6) there is a central role for both national and international policy interventions in achieving low carbon technology transfer. The lack of available empirical analysis on low carbon technology transfer, coupled with the prominence of the issue within international climate negotiations, suggests urgent need for further research effort in this area. In the event of technology transfer being imperfect, it is likely that technologies may fail leading to capital losses for the recipient country. A multilateral technology risk assessment system can provide information on possible risks of technology failure arising from some or all of the above factors. Decision 1/CP.16 of the Conference of Parties of the Framework Convention on Climate Change which established the Technology Mechanism, comprising a Technology Executive Committee and a Climate Technology Centre and Network, aims to enhancing action on technology development and transfer to support action on mitigation and adaptation in order to achieve the full implementation of the Convention, Interestingly while the mandate of the Committee includes preparation of periodic technology outlooks, production of technical papers, regular review of technology development and transfer of technology, there is no mention of risks of technology failure. This omission needs to be rectified, given the technical and demand side uncertainties associated with key low carbon technologies.

Source: Damodaran (2010a)

### 3.10. ENCOURAGING NEMS TO APPLY SECOND ORDER PRICE DISCRIMINATION PRINCIPLES AND PUBLIC INSTITUTIONS IN DEVELOPED COUNTRIES TO PROCURE ESSENTIAL DRUGS FOR SUPPLY TO CORE VULNERABLE LEAST DEVELOPED COUNTRIES

368. Maskus and Penubarti (1997) analyzed exports from 22 OECD countries to a sample of 25 developing countries, and concluded that stronger patent laws in developing countries have a positive impact on bilateral imports into both small and large developing countries. While on the one hand, strong IPR protection in the importing country may encourage foreign firms to export patented goods, it may also reduce the possibility of domestic firms imitating the patented technology thus strengthening the market power of foreign firms. The latter is a

possibility and perhaps explains why China and Singapore are emerging as the NEM hubs for contract manufacturing and R&D off shoring<sup>14</sup>.

369. Given the promise of contract manufacturing for many developing countries, policies that encourage second order Price Discrimination by NEM companies, would be helpful in optimizing supply of critical public goods, including life saving drugs. Second order Price Discrimination can be done by charging different prices for different blocks of goods that are produced by NEMs and selling different blocks at different prices to different countries with lower prices reserved for developing countries. Under this dispensation, lower prices could be charged for exports to developing countries, while full cost pricing could be resorted for consumers in developed countries with higher ability to pay for such drugs. A second order price discrimination principle applied by contract manufacturing firm in a developing country can go a long way in overcoming the drastic characteristic of TRIPS flexibility measures such as compulsory licensing. (Second order differential pricing is a cost of production sensitive concept and is marginally different and more persuasive from the idea of differential pricing discussed in Appendix 1. However both concepts aim to secure lower prices for consumers in developing and least developed countries, who have very low ability to pay for drugs).

370. Second order price discrimination, if used in conjunction with regulations that tighten possibilities of incremental innovation will lead to lessened pressure of competition from generics, less resort to anti-competitive behavior by suppliers of technologies concerned and better observance of IP laws in recipient countries.

371. However, even with such a model it may still be that average consumers in developing countries may still not be able to pay prices that cover the average cost of producing the drugs. Under such circumstances, for life saving drugs, a system of public agencies procuring relevant quantum of drugs from manufacturers and selling them at affordable prices may be thought of.

372. There is considerable scope to utilize WIPO's Webnair Patent Infrastructure system, to disseminate information on contract manufacturing systems, their IP sharing agreements and 'good' price discrimination methods followed by NEM companies.

### 3.11. CONCISE SUMMARY OF RECOMMENDATIONS

- (a) Stimulate optimum competition environment through enabling policies
- (b) Stimulate strategic use of patents and related IPRs
- (c) Put in place sound and effective regulatory devices
- (d) Building Complementary Capabilities in terms of capacities and R&D support systems
- (e) Facilitate negotiations for technology transfer to ensure efficient, effective and result based technology transfer
- (f) Have in place facilitating Policies in relation to Foreign Direct Investment (FDI) and Non Equity Modes (NEMs) of Business of Overseas Origin

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<sup>14</sup> UNCTAD(2011, p 134) estimates that that the market for contract manufacturing and services outsourcing combined was in the range of \$1.1–1.3 trillion in 2010. As the report states, the toys and sporting goods, electronics and automotive industry are major users of contract manufacturing, outsourcing more than 50 per cent of production by cost of goods sold. Contract manufacturing, in industries such as pharmaceuticals, on the other hand, is relatively new and is still small measured as a percentage of cost of goods sold. Nevertheless, it is a fact that companies like Pfizer 'decreased its own plants by almost 50 per cent (to 46 plants) from 2003 to 2008 and outsourced it to other countries/entities since it was felt that these countries/entities provided 'capacity flexibility, cost competitiveness, and technology, while ensuring supply chain integrity/reliability, product quality and regulatory compliance'.(UNCTAD op.cit, p 174 ff 14).

- (g) Provide Government commitments in both developed and developing countries to set up joint R&D Systems through Public Private Partnerships
- (h) Set up Market Making Functions that Link Appropriate Buyers to Appropriate Sellers and thus promote an efficient technology market
- (i) Encourage joint need assessment for drugs and environmental technologies to facilitate joint R&D programmes involving partners from North and South
- (j) Set up an Efficient Multilateral Funding Mechanism to facilitate financial transactions connected to Transfer of Technology
- (k) Provide Information base to prevent Technology failure risks
- (l) Encourage Public Institutions in developed countries to procure essential drugs for supply to least developed countries by applying second order Price Discrimination principles

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## APPENDIX I

### CASE STUDY ON INTELLECTUAL PROPERTY RIGHTS , TECHNOLOGY TRANSFER IN THE DRUGS AND PHARMA INDUSTRY

#### EXECUTIVE SUMMARY

1. This Report forms Appendix 1 of the Main Paper titled 'Economics of IP and Technology Transfer'. This report is meant to be a review of existing work in the field of Intellectual Property Rights (IPRs) in relation to the drugs and pharmaceutical sector. The Report aims to understand the barriers in technology transfer that prevent developing countries from accessing the medicines they need at affordable prices. Thus the Report analyses Intellectual Property Rights (IPRs) and technology transfer from the perspective of developing countries in the world as well as from the angle of the global drug and pharmaceutical industry drawing upon case studies from South America, Africa and Asia, and specifically from developing countries (DCs) and least developed countries (LDCs) by various academics and scholars. The gist of observations discussed chapter wise in this Appendix Volume to the Main Report are summarized below:

#### *World Drug and Pharmaceutical Industry*

2. An overview of the drug and pharmaceutical industry is provided. The main focus is on the growing annual sales by leading drug and pharma companies in 2011.

#### *Increasing Drug Availability*

3. In this Chapter the mechanisms resulting in increased drug availability are discussed. The two significant concepts discussed are (a) parallel imports or imports of a patented or trademarked product from a country where it is already marketed due to different pricing of the same product - either brand-name or generic drugs - in different markets. (b) Differential pricing refers to differential pricing of drugs between industrialised and developing countries, allowing for R&D investments to be recouped in wealthier countries so that lower prices can be charged in developing countries. The role of generic drugs as pharmaceutical products, that is interchangeable with an innovator product that is manufactured without a licence from the innovator company and marketed after the expiry date of the patent or other exclusive rights, is also highlighted. It is argued that Generic competition lowers drug prices and enhances access to medicines, particularly by the poor. Local production in DCs and LDCs is analysed with emphasis on IDCs. Aided and govt. owned enterprises are compared with the private sector. Public-private partnerships are explained briefly. For example, comparing of prices for HIV/AIDS medicines illustrates we see that the US price of 3TC (Lamivudine) marketed by Glaxo is US\$3,271 (per patient per year) whilst Indian generic manufacturers, Cipla Ltd. and Hetero Drugs Limited, offer their generic versions for \$190 and \$98 respectively. (Third World Network, 2013)

#### *Transfer of Technology: Processes*

4. Processes enabling transfer of technology are elaborated in relation to the Drugs and pharmaceutical sector. A voluntary licence is a contract whereby the holder of a patent cedes to a third party, in whole or in part, the enjoyment of the right to its working, free of charge, or in return for payment of fees or royalties. Global information sharing recognises benefits to least developed countries and also promotes innovation. South-south cooperation amongst developing and least developed countries towards research and development of neglected diseases and technology transfer will lessen the burden on individual nations and lead to mutually beneficial welfare outcomes. Sublicensing organisations are involved in negotiating licensing agreements with research-based pharmaceutical companies, with the aim of sublicensing these products to generic companies to increase access to treatment in developing countries.

### *Transfer of Technology: Barriers*

5. Various barriers to the transfer of technology are analysed. Lax patent standards which disregard standards of 'novelty', 'inventive step' and 'usefulness' have undermined the quality of patents being issued. Excessive patenting is motivated by strategic reasons to restrict generic competition, rather than to protect genuine innovations. The surveyed literature indicates that ineffective implementation of patent claims relating to salts and polymorphs as well as the lack of easily accessible patent information continues to be a particularly serious problem. Markush claims (often used in chemistry, whereby multiple "functionally equivalent" chemical entities are allowed in one or more parts of a given compound) are detrimental as it may engender a situation where a single patent may potentially block research and development on and the commercialization of an extremely large number of products. Patents over minor incremental developments are termed as evergreening patents and may be used to exclude generic competition and thereby block access to affordable drugs. Bilateral and regional free trade agreements tend to include so-called TRIPS plus provisions that exceed the minimum standards required by the TRIPS Agreement. It has been seen that the grant of a compulsory license triggers significant pressure from developing countries.

### *WTO-TRIPS - Policy Measures Initiated to Overcome Barriers*

6. Policy measures introduced in the TRIPS Agreement and the Doha Declaration to enable technology transfer are analyzed here. The TRIPS agreement as well as the Doha Declaration further reiterate the right of nations to prioritize public health. Article 31 of the TRIPS Agreement enlists the provisions for compulsory licences use by the government or third parties authorized by the government. Under TRIPs, the most expeditious avenue for a country to issue a compulsory license is to claim a national emergency. The Doha Declaration provides Members the freedom of interpretation to determine what constitutes a national emergency. Least developed countries were provided lenient time extensions to enforce the TRIPS provisions, initially till 2005 which was further extended to 2016 in the Doha Declaration. Doha Declaration Paragraph 6 recognizes that WTO members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement and instructed the Council for TRIPS to find an expeditious solution.

### *WTO-TRIPS – Ineffectiveness of Policy Measures*

7. The ineffectiveness of WTO-TRIPS policy measures is analysed. It is stated that legal barriers limit the use of TRIPS flexibilities since many countries have yet to amend their national laws to incorporate them fully. There is significant ambiguity and uncertainty in the TRIPS Agreement as well as the Doha Declaration. The focus of the Doha Declaration on addressing epidemics is narrower than the broad public health focus originally sought by developing countries to be part of the Declaration. Terms such as —public health have not been explicitly defined in TRIPS.

8. Countries hesitate to make use of the TRIPS flexibilities due to non ambiguous terminologies and uncertainty with respect to the outcome of a judicial review, when flexibility actions are challenged. Territorial limitations exclude non-domestic manufacturers from inclusion within the term third parties.

### *Recommendations to Overcome Barriers to the Transfer of Technology*

9. The report concludes with recommendations to overcome barriers to technology transfer that stand in the way of providing medicines that are of public health significance to developing countries at affordable prices. The slant of the recommendations is three-fold – improvements in WTO- TRIPS policy measures, improvements to Article 6 of the Doha Declaration on Public Health and tightened Patent granting mechanisms in National Laws and finally exploring possibilities of spill-overs from patent holding companies through differential pricing systems that also work well for these companies.

## I.1. INTRODUCTION

1. The restriction to the free movement of ideas that the granting of a patent entails has been justified under different theories, namely natural rights, moral reward, incentive to invention, encouragement to innovation. The idea that patents are necessary to allow the investor to recoup its investment in Research and Development (R&D) dominates in current debates and jurisprudence of many countries (Correa, 2011).

2. Patent life has increased in the past 20 years, but the rate of innovation has not. Moreover, only one in three new drugs developed in the past 25 years represent a clear therapeutic advance (Trouiller, 2002). This decline seems paradoxical for three main reasons: first, the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS Agreement) allowed companies to increase income generation worldwide; second, mass screening of potential drug candidates has been substituted by more efficient methods enabling the rational design of drugs; third, the pharmaceutical industry has been one of the most profitable sectors of the economy, fourth only after mining, crude oil production and commercial banking (Correa, 2011). However profits made by an industry may have very little co-relation to the innovation performance. Where sunk costs on Research and Development (R&D) are voluminous and the risks of not being able to realize 'promising new and effective' products is high, the pace of innovation may come down irrespective of whether patent protection exists or not. Consequently, in such situations, the effort should be to have Joint R&D programmes where the burden of investment in R&D is pooled amongst public and private agencies and the risks as well as Patents, associated with non realization of new products is shared by Parties making R&D investments in new molecules.

3. In the USA, 39% of new chemical entities in clinical development are abandoned because profit prospects are poor. The existing global patent system will clearly not answer global population health needs, and certainly will not provide the answer for neglected diseases: a market monopoly incentive is irrelevant when market prospects are absent (Patrice Trouiller, 2002)

4. 2002). Only 10 per cent of the world's funds for health research are applied to the study of diseases in developing countries, which is where 90 per cent of the world's preventable deaths occur (also known as the —10/90 gap) (MDG Gap Task Force, 2012). In any case, whether the pharmaceutical industry—one of the most profitable industrial sectors today thanks to extended market monopolies—should be given further market incentives is to be questioned (Patrice Trouiller, 2002).

5. Patents produce a dead weight burden insofar as the benefits of innovations to society would have been greater in their absence, while they reduce the ability of other firms to exploit innovations on a competitive basis. The latter is a critical problem in the case of cumulative systems of technology, where patents may deter rather than promote follow-on innovations (Correa, op.cit). The World Trade Organization (WTO) Trade-Related Aspects of Intellectual Property Rights Agreement, which sets out the minimum standards for the protection of intellectual property, including patents for pharmaceuticals, has come under fierce criticism because of the effects that increased levels of patent protection will have on drug prices. While TRIPS does offer safeguards to remedy negative effects of patent protection or patent abuse, in practice it is unclear whether and how countries can make use of these safeguards when patents increasingly present barriers to medicine access (Hoen, 2003)

## I.2. WORLD DRUG AND PHARMACEUTICAL INDUSTRY

6. The IMS Institute for Healthcare Informatics predicts that the pharmaceutical market will reach nearly USD 1,200 billion by 2016, an increase of nearly USD 250 billion from the USD 956 billion recorded in 2011. This growth is coming mainly from market expansion in the leading emerging countries and from generics. Global brand spending is forecast to increase from USD 596 billion in 2011 to USD 615–645 billion in 2016. Global generic spending is expected to increase from USD 242 billion to USD 400–430 billion by 2016, of which USD 224–244 billion of

the increase is from low-cost generics in emerging markets (IFPMA 2012). The World Health Organisation Report suggests that the 10 largest drugs companies control over one-third of this market, several with sales of more than US\$10 billion a year and profit margins of about 30%. Six are based in the United States and four in Europe. It is predicted that North and South America, Europe and Japan will continue to account for a full 85% of the global pharmaceuticals market well into the 21st century (World Health Organisation, 2013). Companies currently spend one-third of all sales revenue on marketing their products - roughly twice what they spend on research and development (BMJ, 2012).

7. As a result of this pressure to maintain sales, there is now as per the WHO, —an inherent conflict of interest between the legitimate business goals of manufacturers and the social, medical and economic needs of providers and the public to select and use drugs in the most rational way. This is particularly true where drugs companies are the main source of information as to which products are most effective. Even in the United Kingdom, where the medical profession receives more independent, publicly-funded information than in many other countries, promotional spending by pharmaceuticals companies is 50 times greater than spending on public information on health (World Health Organisation(2013)

8. A similar conflict of interests exists in the area of drug R&D particularly in the area of neglected diseases. The private sector dominates R&D, spending millions of dollars each year developing new drugs for the mass market. The profit imperative ensures that the drugs chosen for development are those most likely to provide a high return on the company's investment. As a result, drugs for use in the industrialized world are prioritized over ones for use in the South, where many patients would be unable to pay for them (World Health Organisation (nd) .

9. Developing countries play an increasingly important role in manufacturing health products to meet global health needs. China is the world's leading producer of penicillin. The Serum Institute of India is the world's leading manufacturer of diphtheria-pertussis-tetanus vaccine. Over 60% of the United Nations Children's Funds vaccine requirements for the Expanded Programme on Immunization are met by Brazil, Cuba, India, and Indonesia. For example in Cuba, From vaccines (meningitis B, hepatitis B&C, dengue, preventive/therapeutic AIDS, cholera, therapeutic cancer), to natural products based on island's flora (such as PPG, the natural anti-cholesterol drug derived from sugarcane wax), to diagnostic tests and therapeutics, Cuba is a model in intellectual property in the area of biotechnology. Cuba's outstanding achievements in health biotechnology are a source of inspiration for the developing world, with the most successful product being the world's first meningitis B vaccine developed in 1985 by the Finlay Institute. More recently, the University of Havana developed the world's first human vaccine with a synthetic antigen. This H. influenzae type b (Hib) vaccine, against pneumonia in children under the age of 5, is a chemically produced antigen instead of a fermented bacterial culture, hence cheaper to produce and safer than vaccines coming from living organisms. In dollar terms, 67% of India's drug exports and 74% of Brazil's drug exports go to other developing countries, whereas 63% of Uganda's drug imports and 54% of Tanzania's drug imports come from other developing countries. By volume, India is now the fourth largest producer of pharmaceuticals in the world. Some observers have emphasized the need for developing countries to build their own capacity to develop drugs, particularly in the case of neglected diseases for which multinational pharmaceutical companies may have little interest in investing because the market is unlikely to provide adequate returns (Carlos M Morel et al (2005).

10. Box I.1 provides IMS Health Data Statistics of the size of the global pharmaceutical market during 2003-11, region wise break up of sales and spending and the relative market share of 20 large drug companies in the world. The relative low spending by developing countries (ROW) as compared to developed countries is perceptible, This is sufficient indication that access to affordable medicines on account of low purchasing power of patients in developing countries is a major issue. The top 20 companies with approximately 20 to 22% of the world sales have a crucial role to play in reaching medicines to the needy in developing countries.

## Box I.1: Economic Profile of the Global Pharmaceutical Market 2003-11



Total Unaudited and Audited Global Pharmaceutical Market, 2003 – 2011

	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total World market (*US\$ in billions)	\$503	\$565	\$611	\$658	\$729	\$800	\$833	\$881	\$956
Total World market (**Constant US\$ in billions)	\$567	\$611	\$656	\$702	\$752	\$800	\$858	\$896	\$942
Growth Over Previous year (**Constant US\$ Growth)	9.0%	7.8%	7.4%	7.0%	7.1%	6.4%	7.3%	4.5%	5.1%

Source: IMS Health Market Prognosis, May 2012  
Includes IMS Audited and Unaudited markets  
All information current as of May 2012

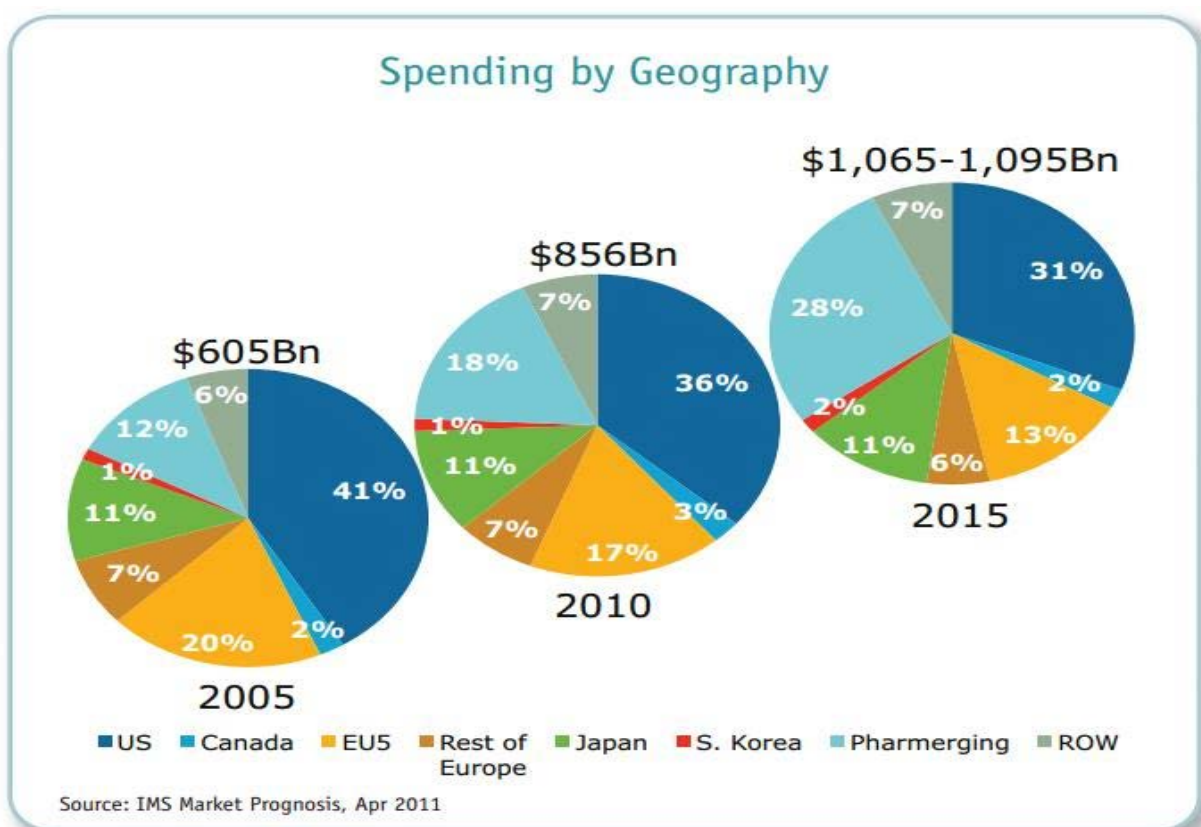


Total Unaudited and Audited Global Pharmaceutical Market By Region

	2011			2010	2007-2011	2012	2012-2016
	Mkt Size *US\$Bn	Mkt Size **Const. US\$	% Growth **Const. US\$	% Growth **Const US\$	CAGR % **Const US\$	Forecast % Growth **Const US\$	CAGR % **Const US\$
<b>Total unaudited and audited global market</b>	<b>\$955.5</b>	<b>\$942.2</b>	<b>5.1%</b>	<b>4.5%</b>	<b>6.1%</b>	<b>3 - 4%</b>	<b>3 - 6%</b>
<b>Total unaudited and audited global market by region</b>							
North America	\$347.1	\$346.2	3.0%	2.2%	3.5%	1 - 2%	1 - 4%
Europe	\$265.4	\$255.1	2.4%	2.9%	4.9%	0 - 1%	0 - 3%
Asia/Africa/Australia	\$165.2	\$163.1	13.1%	14.0%	15.5%	10 - 11%	10 - 13%
Japan	\$111.2	\$114.7	5.6%	0.1%	3.9%	0 - 1%	1 - 4%
Latin America	\$66.7	\$62.9	8.9%	12.7%	12.3%	13 - 14%	10 - 13%

Source: IMS Health Market Prognosis, May 2012





**Top 20 Global Corporations 2012**

	2012 Rank	2012 Sales (US\$m)	2011 Sales (US\$m)	2010 Sales (US\$m)	2009 Sales (US\$m)	2008 Sales (US\$m)	2007 Sales (US\$m)
Global Market		856,086	841,162	802,452	760,068	711,861	676,535
NOVARTIS	1	50,761	50,868	47,479	41,939	38,057	36,893
PFIZER	2	46,930	56,045	57,840	59,258	59,565	62,690
MERCK & CO	3	40,115	39,649	37,968	38,017	37,532	38,435
SANOFI	4	37,780	38,038	38,189	37,479	36,450	35,245
ROCHE	5	35,069	34,101	33,271	32,891	29,582	27,505
GLAXOSMITHKLINE	6	32,714	33,341	34,067	35,214	35,497	36,806
ASTRAZENECA	7	31,983	36,688	36,452	34,851	31,915	30,010
JOHNSON & JOHNSON	8	27,933	27,047	27,594	27,352	29,325	29,066
ABBOTT	9	26,715	25,475	24,256	22,984	21,819	19,985
TEVA	10	24,846	24,107	24,912	21,702	20,074	17,919
LILLY	11	21,981	23,695	22,448	20,402	18,648	17,106
AMGEN	12	17,211	16,642	16,022	15,284	15,285	15,993
BOEHRINGER INGEL	13	17,145	15,923	14,740	15,293	13,732	12,581
BAYER	14	16,214	15,809	15,575	15,519	14,869	13,771
TAKEDA	15	15,961	18,031	17,284	18,818	18,900	18,599
BRISTOL-MYERS SQB.	16	13,501	17,196	15,995	14,867	13,971	12,633
NOVO NORDISK	17	12,607	11,141	9,884	8,643	7,686	6,759
DAIICHI SANKYO	18	11,564	10,266	10,033	9,283	8,912	8,514
OTSUKA	19	10,651	9,976	9,090	8,403	7,219	6,400
MYLAN	20	10,514	8,919	8,167	6,923	6,013	6,018

Source: IMS Health, IMS MIDAS, December 2012  
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### I.3. INCREASING DRUG AVAILABILITY

#### I.3.1. Parallel Imports

11. Parallel imports are imports of a patented or trademarked product from a country where it is already marketed. For example, in Mozambique 100 units of Bayer's ciprofloxacin (500mg) costs US\$740, but in India Bayer sells the same drug for US\$15 (owing to local generic competition). Mozambique can import the product from India without Bayer's consent (World Health Organisation (nd)).

12. Sometimes referred to as —grey market imports, parallel imports often takes place when there is differential pricing of the same product - either brand-name or generic drugs - in different markets (usually owing to local manufacturing costs or market conditions). The TRIPS agreement explicitly states that this practice cannot be challenged under the WTO dispute settlement system and so is effectively a matter of national discretion (World Health Organisation, op.cit).

13. Parallel imports can reduce the price of health products and pharmaceuticals by introducing competition. However, they can also affect the negotiation of tiered pricing regimes with pharmaceutical companies. If a private pharmaceutical company agrees to sell a product at a lower price in poor countries, it will need some assurance that the cheaper product will not be imported back into its rich country markets, undercutting its profits (product diversion) (World Health Organisation, op.cit). ( See Box 2 on the relative costs and benefits of Parallel Imports)

### I.3.2. Differential Pricing

14. Differential pricing is a mechanism that has been mainly applied to vaccines and refers to differential pricing between industrialised and developing countries, allowing research and development investments to be recouped in wealthier countries so that lower prices can be charged in developing countries (e.g., pricing at production costs plus a small margin). Whether differential pricing can be applied to drugs is currently being explored, but it would be unlikely to offer much for the most neglected diseases that exist exclusively in poor countries (Patrice Trouiller, 2002).

15. Some governments have acted abusively by demanding that companies lower prices to marginal cost, thus eliminating the opportunity to recoup the costs of any R&D investment (Bate, 2008). The critical role of Differential Pricing as an economic instrument and distributive tool is highlighted in Box I.1.2.

#### **Box I.2: Differential Pricing: An Invaluable Yet Underutilized Tool**

Danzon & Towse, 2003 consider differential pricing as would going a long way towards making drugs available and affordable in DCs, while preserving incentives for R&D. Unfortunately, as the authors note, actual price differentials are not optimal, partly because manufacturers are reluctant to grant low prices in low-income countries because these low prices are likely to spill over to higher-income countries through parallel trade and external referencing.

Thus the authors argue that to achieve appropriate and sustainable price differences will require that either higher income countries forego these practices of trying to —import low prices from low-income countries or that such practices become less feasible. The most promising approach that would prevent both parallel trade and external referencing is for payers and companies to negotiate contracts that include confidential rebates. With confidential rebates, final transactions prices to purchasers can differ across markets without significant differences in manufacturer prices to distributors, such that opportunities for parallel trade and external referencing are eliminated. Danzon et al state as long as higher income countries can and do attempt to bargain for lower prices that are given to low income countries, companies will rationally be unwilling to grant these low prices to the low-income countries. This severely undermines the ability of these countries to achieve access to existing drugs, which in turn creates hostility to patents. However, patents need not – and probably would not -- entail high price- marginal cost mark-ups in low income countries if companies could be confident that low prices granted to low income countries would not leak to high and middle income countries. Thus, with reference to antiretroviral therapy Eran Bendavid et al (2010) explain how at the turn of the century price of antiretroviral drugs decreased dramatically as compared to the developed world through a combination of price negotiations, generic pharmaceutical growth, bulk purchasing, and trade agreements. By 2009 the price for a regimen of first line antiretroviral therapy in some places in Africa was less than \$100 a year. Obviously

the low prices held on well without leakages, though in terms of realizing the outcome of universal coverage of antiretroviral therapy, the low price regime by itself proved to be insufficient.. Merck and Abbott are examples of major drug firms that have successfully practiced tiered prices for HIV/AIDS Drugs (Bate and Boeteng (2007)

The authors argue that differential pricing alone cannot solve the problem of creating incentives for R&D to develop drugs for diseases that are confined to DCs, for which there is no high income market to pay prices sufficient to pay for the R&D. They are also of the view that differential pricing will also not fully resolve the problems of affordability for existing drugs if these have high marginal costs – due, for example, to high production or distribution costs—or if intermediaries add high margins, such that retail prices are significantly higher than manufacturer prices. Chronic medications, especially those that are costly to produce such as antiretrovirals, may be unaffordable for the neediest populations even at prices close to marginal cost.

In such contexts, differential pricing can reduce but not eliminate problem of making drugs affordable to DC populations. The authors therefore state that it is important that the option of compulsory licensing is available for use if generics have lower production costs than originators or if governments or other agencies are not procuring on behalf of low income populations. However, given the risks inherent in the compulsory licensing —solution, the authors argue that it will be promising to first try the approach of strengthening market separation, to enable originator firms maintain differential pricing. In these circumstances originators can be expected to offer prices comparable to the prices that a local generic firm would charge, eliminating the need for compulsory licensing.

Source: (Danzon & Towse, 2003)

### I.3.3. Generic Competition

16. A generic drug is a pharmaceutical product, usually intended to be interchangeable with an innovator product that is manufactured without a licence from the innovator company and marketed after the expiry date of the patent or other exclusive rights (World Health Organisation,(nd). Generic competition lowers prices and enhances access to medicines, particularly by the poor (Correa, 2011)

17. In some instances, generic manufacturers have shown insufficient regard for industry-standard Good Manufacturing Practices (GMP). With little or no regulatory control, substandard drugs are manufactured and distributed widely. Such low-quality drugs pose an immediate threat to public health and a potentially more serious challenge to the long-term viability of many first-line drugs by encouraging drug-resistant strains of pathogens Bate,2008. also see Box I.3) .One way out of this impasse is to go for import of generics from established companies in other developing countries (O' Carroll,2005, See also Box I.4) (Bate,2008. also see Box I.3) .One way out of this impasse is to go for import of generics from established companies in other developing countries (O' Carroll,2005, See also Box I.4)

**Box I. 3: Sub Standard Drug Production: A Serious Concern**

Bate (2008) mentions about the 2002 study in Senegal that found that twenty-one out of twenty-two samples of ampicillin (a common antibiotic) contained only flour. The Lancet Journal has projected that close to 40 percent of products in Thailand and Nigeria labelled as containing artesunate (an effective antimalarial) contain no active ingredients. In 2002, WHO estimated the total percentage of fake or adulterated drugs in Nigeria much higher, at 70 percent.

Similarly Bate (op.cit) mentions how in Ghana, adverse drug reactions from a locally-produced version of artesunate- amodiaquine (a common anti-malarial combination drug) that contained too much of one active ingredient made doctors and patients less willing to use the authentic ACT that was distributed by the Global Fund shortly thereafter.

Source: (Bate, 2008)

**Box 4 :Importing Generics From India: Zambia And Kenya**

O' Carroll (2005) discusses the case of import of generics from India by Zambia and Kenya. As Carroll argues both countries have a number of potential alternatives available for importing generic drugs from India. For Zambia, the most practical method will be to suspend the future application of its Patent Act until 2016. At this time, Zambia may import those pharmaceuticals for which it has already granted patents under a compulsory licence, and import those pharmaceuticals for which it has not granted patents under notification to the TRIPS Council. For Kenya, not a Least Developed Economy (LDC) the most practical method will be to grant a compulsory licence under its own Industrial Property Act.

As Carroll states any effort by either Kenya or Zambia to import generic drugs from India under these provisions will depend on the willingness of the Indian government to grant compulsory licences, and of pharmaceutical companies to produce under them. Indian pharmaceutical companies are able to produce at a lower cost than their counterparts in more developed parts of the world due to factors such as the lower price of labour. Furthermore, these companies have already engaged in exporting pharmaceuticals to African countries, and their infrastructure to do so is already in place. Indian pharmaceutical companies are highly adept at re-engineering pharmaceutical products, which helps to minimise their costs. Not only are these companies able to export to Africa, but a large portion of their income had traditionally come from developing country export markets.

Carroll argues that while Indian consumers may not be interested in issuing compulsory licences for exports of pharmaceutical products to Africa, Indian pharmaceutical companies are quite likely to be interested in the issuing of such licences.

Under the circumstances, according to the author, the political pressure is likely to come from the pharmaceutical industry, rather than from the public at large. Obviously, at this point, as the author argues, the future strategies of the Indian pharmaceutical companies are simply conjectures, but there is significant reason to expect that they will engage in exporting to Africa under compulsory licences in the future.

In future, as Carroll states, while the administrative costs of importing generic pharmaceutical costs will increase, and the costs of the drugs themselves are likely to increase due to remuneration of patent holders, the supply of generic medicines from India should remain viable. The need to import pharmaceutical products under compulsory licences will increase in the future as countries seek access to more products that are under patent protection.

Source: (O'Carroll, 2005)

#### I.3.4. Local Production

18. Proponents of local production, including activist organisations such as Médecins Sans Frontières (Doctors without Borders) and organisations within the United Nations (UN), argue that local production of pharmaceuticals would decrease transport costs, provide local jobs, increase expertise, and cut dependence on foreign suppliers (Bate, 2008).

#### *Developing Countries vs. Least Developed Countries*

19. Local producers, particularly in low-income countries, have to address a number of major challenges, including weak physical infrastructure, scarcity of appropriately trained technical staff, heavy dependence on import of raw materials including essential active pharmaceutical ingredients (APIs), weak and uncertain markets, high import duties and taxes, lack of a conducive policy environment and policy coherence across sectors, and weak quality control and regulation measures (MDG Gap Task Force, 2012).

20. Nevertheless, it is clear that developing countries aspire to build and strengthen their domestic medical product industry. Trends show that local production is growing and diversifying in these countries through national efforts and with support from numerous regional and international initiatives (for a review of initiatives supporting investment in local production and technology transfer in pharmaceuticals see WHO, 2011h).

21. For example, local production of medicines in Algeria covers 65% of national needs, with 70 production units comprised in both the public and private sectors. The Sidal Group (<http://www.sidalgroup.dz>), with the monopoly in the pharmaceutical industry, intends to increase its market share to 57% in volume and 34% in value by 2015, aiming for US\$2.4 billion in sales. Besides the national market, the Sidal Group is already exporting to other Arab countries (Morocco, Yemen, Egypt, Libya and Sudan) as well as penetrating Sub-Saharan Africa with local treatments for neglected tropical diseases (malaria and yellow fever). Recently, through the US-Algeria Business Council (USABC), the United States of America and Algeria signed a Framework Agreement in Biotechnology and Medicines Production, in which 11 of the giant US pharmaceutical companies will engage in partnerships for boosting local production. The collaboration partners include their Algerian counterparts as well as their local joint ventures such as Winthrop Pharma Sidal, (a Sanofi-Aventis subsidiary), and Pfizer-Sidal. The Agreement proposes a win-win situation where the large firms are given all the guarantees to invest, which in turn, will establish Algeria, as a regional pole for the pharmaceutical industry.

22. All developing countries can undertake health innovation to varying degrees. Some developing countries, however, are more scientifically advanced than others and are starting to reap benefits from decades of investments in education, health research infrastructure, and manufacturing capacity. We refer to these as innovative developing countries (IDCs) (Carlos M Morel et al (2005)). IDCs invest in R&D relatively more than other developing countries, there is a greater involvement of the private sector and the interactions between public institutions or private companies with innovation agents in developed countries are more frequent (Correa, 2011).

23. The investment, which has already led to important innovations, is projected to continue to grow. Furthermore, lower labour and other costs have the potential to magnify the impact of this investment population. Adjusting for both relative economic status and population the top 25 most productive countries in the world include India, China, Brazil, South Africa, Thailand, Argentina, Malaysia, Mexico, and Indonesia (Carlos M Morel et al (2005):

24. Comprehensive quality assurance conducted by regulatory authorities involves enforcing concepts such as Good Manufacturing Practice, Good Laboratory Practice and Good Distribution Practice as well as conducting —pharmacovigilance activities to monitor products in the market (MDG Gap Task Force, 2012).

25. To ensure the quality of the products procured by international funding agencies for the treatment of the major acute diseases, WHO established the pre-qualification programme. It replicates some of the functions that stringent regulatory authorities conduct for a limited range of products for HIV, tuberculosis and malaria. In recent years, additional products have been added to the prequalification list, such as those to treat opportunistic infections associated with AIDS (for example, fluconazole and azythromycin), contraceptives, pandemic flu treatments and zinc products for the treatment of diarrhoea. Since its inception, the programme has been able to approve roughly 240 products (MDG Gap Task Force, op.cit).

#### I.3.5. Aided and Govt. Owned vs. Private Sector

26. Drawing instances from Bate op.cit ,there could be the argument that local production that is backed by foreign assistance but owned by local governments, has the possibility of distorting the play of the market mechanism by protecting a local producer against a more efficient and competent importer. Indeed long-established economic theories have proven that such interventions are detrimental to the groups they are supposed to help, and frequently put more money in the pockets of the rich and powerful ( Bate, op .cit) ( also see Box 5 for arguments in this regard) . Indeed it is also contended that this is true for countries with weak civil societies, where political accountability is nonexistent and elections are unlikely (ibid) .However, if locally manufactured drugs can be verified as bioequivalent to originator medicines, they will become eligible for purchase by donor agencies. This will create the foundation for a potentially sustainable industry that represents no threat to health (Bate, 2008)

27. There could be more promising approaches and models for supply of drugs at affordable prices in developing and least developed countries. Partnerships between foreign pharmaceutical firms and African companies may also provide incentives for foreign companies to invest in the poor-country markets, which is not the case when tariffs are slapped on their products to protect locally produced drugs in which they have no vested interests. At the community level, such partnerships can help train a pool of skilled workers, improving a country's long-term development prospects (Bate, 2008).

28. Thus in Uganda, a partnership between Uganda's Quality Chemicals and India's Cipla led to the construction of a new \$38 million plant in Kampala. The plant opened in October2007 and is set to begin producing ARVs and anti malarials in January2008, the first such drugs to be manufactured domestically. The joint venture builds on the Indian company's earlier and ongoing partnership with Ugandan company Afro Alpine Pharma, which opened a\$4 million factory to produce artemisinin for malaria drugs in Kabale in April. In a similar fashion, the Indian firm Cadila Pharmaceuticals partnered with Ethiopia's Almetalmpexto build a facility to produce antibiotics, malarial and tuberculosis treatments, multivitamins, and ARVs domestically. The Indian company invested \$11 million and aims to begin exporting drugs to neighbouring markets in Uganda, Djibouti, Kenya, and Sudan after it establishes itself in the domestic market (ibid).

#### **Box I.5: Economic Protectionism vs. Market Forces**

The relative merits of economic protectionism vis-a-vis play of market forces has been examined by Bate (2008) in relation to the drugs and pharmaceutical sector. Bate's argument runs as follows: 'Local / national production systems may create efficiency losses on three separate counts: the start-up costs of establishing the industry, the costs of subsidising production, and the higher price of the finished product. In order to support inefficient and substandard home industries, a government bureaucracy may also protect it from foreign competition by imposing high tariffs on imported pharmaceuticals. At the same time, the government offers tax incentives and subsidies to local companies. This tends to make local companies complacent and unlikely ever to become internationally competitive. Aside from their direct economic disadvantages, the taxes and tariffs needed to protect infant drug industries also create portals for corruption, smuggling, and the proliferation of counterfeit drugs in

the market. 'This then could be the social cost of economic protectionism in the drug and pharma sector.

Bate concedes that some local production enterprises will succeed. However others will inevitably fail. Ultimately, however, Bate sees that it is the most effective system of drug production and distribution that will be realised. As he continues 'relying on the market to drive investment (or a lack thereof) in local production is more efficient than using public funds. In the interest of providing the most drugs at the most sustainable prices to the people who most need them, it may be more equitable as well'.

According to Bate 'market-driven investment, whether in multinational pharmaceutical companies or partnerships with local production enterprises, helps countries realise Ricardian gains from trade.

As an extension to his critical observations about subsidised local drugs production units, Bate proceeds to argue that market-driven investment also helps avoid the pitfalls of public choice economics. He admits that private funds can be subject to corruption – a fact exacerbated by the inevitably close relationship between private pharmaceutical companies and government regulators and buyers, and driven by the public interest in medicine – but as he summarizes in such cases, the investors and businessmen involved are first and foremost risking their own capital, not the capital of taxpayers.

Bate is not against local production. His central thrust is that local production can promote development – but only when the market prescribes it. While admitting that the international community is right in desiring local development, he gently cautions them to be far more vigilant to prevent local production from becoming a cover for development-impeding protectionism. "Protectionism can be disastrous: in the short run, drugs will be undoubtedly more costly, whether financed by subsidies or higher prices; over the long run, such protectionism will breed domestic complacency and discourage international investment, leading to a supply of scarce, low-quality drugs. The key to development is to allow ineffective projects to fail' (ibid).

Source: (Bate, 2008)

### I.3.6. Public Private Partnerships (PPPs)

29. Indeed there are good cases for Public-private partnerships (PPPs) that have worked out well in making available affordably reaching medicines for the poor. PPPs attempt to fill gaps in the health needs of developing countries through the establishment of public-private collaboration, networks, and partnerships. The private sector includes for-profit (pharmaceutical companies) and not-for-profit (charities, foundations, and philanthropic institutions) groups, whereas the public sector includes international organisations, development and aid agencies, governments, and academia (Patrice Trouiller, 2002). The key gap is to create PPPs for joint development and production of essential drugs that have huge public health impacts in developing countries.

30. Engagement with an industry whose strategy has so far largely been to maximise profit in the West, rather than establish an equitable pricing policy worldwide, requires careful management of intellectual property (Patrice Trouiller op.cit).

31. PPPs clearly do not provide the solution for all tropical diseases. They have been promising models for developing drugs related to tuberculosis and malaria because these diseases rank higher in the public-health priorities of developed countries than others. However it is the more neglected diseases that represent a potential niche for PPPs to be tried out. For neglected diseases that do not pose a health threat to the developed world, working out PPPs for developing relevant medicines would remain a major challenge (ibid).

**Box I.6: International Corporations Rising To The Challenge**

Some large pharmaceutical companies support health development through public-private partnerships. In a number of cases, international corporations and foundations have contributed drugs or products free of charge to help in disease eradication. SmithKline Beecham has made a US\$500 million commitment to WHO of its drug albendazole, used to treat lymphatic filariasis (elephantiasis). American Home Products has provided a non-toxic larvicide and the DuPont Company has contributed free cloth water filters for the eradication of guinea-worm disease (dracunculiasis). The Japanese Nippon Foundation has enabled WHO to supply blister packs containing the drugs needed for multi-drug therapy (MDT) of TB in sufficient quantities to treat about 800 000 patients a year in some 35 countries. The patients receive the treatments free of charge.

Source: World Health Organisation (nd)

I.3.6. Prizes as a pull-in instrument

32. Prizes are rewards for successful completion of a specified set of R&D objectives. There are basically two kind of prizes – for reaching specified milestones in the R&D process, or for reaching a specified endpoint such as a new diagnostic, vaccine or medicine with a specified profile in terms of performance, cost, efficacy and/or other important characteristics. Prizes may be offered in two main circumstances, both of which may apply in the neglected disease area. One, where it is considered that incentives for R&D are too small because the potential market is insufficient to stimulate needed innovations and two, where the R&D process has encountered a technological obstacle that needs a new approach.

33. The role of the State and grant-making bodies in inducing innovation and generate novel solutions to “grand challenges” has become popular. To help attract global attention to neglected tropical diseases, such as the Chagas disease or American Trypanosomiasis, countries including Bangladesh, Barbados, Bolivia, and Suriname introduced the concept of a prize fund to encourage technology solutions as differing from new product ideas (Prize Proposals submitted by the Governments of Bangladesh, Barbados, Bolivia and Suriname to the WHO Expert Working Group on R&D Financing

**I.4. TRANSFER OF TECHNOLOGY**

34. Following form the means by which transfer of technology is effected to the recipient

I.4.1. Voluntary Licences

35. Following World Health Organisation (WHO), we define a licence as a ‘contract whereby the holder of an industrial property right (patent, trademark, design or model) cedes to a third party, in whole or in part, the enjoyment of the right to its working, free of charge, or in return for payment of fees or royalties’ (World Health Organisation (nd)).

36. Under TRIPS rules, a voluntary licence is required if an entity other than the patent holder wants to market the patented product. However, in the case of a national emergency, extreme urgency, or public non-commercial use, the need for a voluntary licence can be waived and a compulsory licence issued by a judicial or administrative authority (World Health Organisation, op.cit).

I.4.2. Global Information Sharing

37. The Doha Declaration on the TRIPS Agreement and Public Health (2001) reaffirms the commitment of developed country members to provide incentives to their enterprises and institutions to promote and encourage technology transfer to least-developed country members. Moreover there is compelling evidence indicating that ‘collective invention’ based on sharing innovations is more efficient than patenting them; some studies suggest that innovation not only



thrives in a competitive environment, but that more profit can be generated by inventors in a system based on the broad diffusion and common use and improvement on innovations (Correa, 2011). As such global information sharing not only benefits least developed countries but also can promote innovation (see Box I.7 for instances).

**Box I.7 : Increased Global Information Sharing**

Developed countries have supported local production bilaterally through technical assistance and policy advice. For example, the Artepal project, funded by the European Commission provided technical assistance to producers of artemisinin raw material and formulations in Asia and Africa. Germany is one of the most active supporters of the development of local production facilities in least developed African countries, through the Gesellschaft für Internationale Zusammenarbeit (GIZ).

In October 2011, the World Intellectual Property Organization (WIPO) announced the launch of —Re:SearchII, a new consortium of pharmaceutical manufacturers, Government entities and non-governmental organizations (NGOs) which will share patents in order to drive R&D for new drugs, vaccines and diagnostics for tuberculosis, malaria and neglected tropical diseases. <http://www.wipo.int/research/en/>

India has set an example in the area of neglected diseases with the creation of the Indian Open Source Drug Discovery Initiative (OSDD). OSDD is an open innovation platform where ongoing projects and research results are reported on a web resource. This is India's new open source initiative for developing drugs to treat diseases such as tuberculosis, malaria, and HIV. Approximately 5,300 partners are registered from more than 130 countries, whereas 1,500 registered participants from 31 different countries are currently working on more than 100 projects posted online. In 2011, OSDD announced that they were involved in discussions with two pharmaceutical manufacturers for the start of clinical trials for two molecules that could lead to the production of effective and inexpensive medicines for treatment of tuberculosis. In terms of IP issues, it is expected that OSDD will follow a hybrid IP model by using a "clickwrap" license that requires the users to agree that they will not file product patent applications in cases where they rely on open source data. Source (MDG Gap Task Force, 2012)

I.4.3. South-South Cooperation

38. The lack of research and development towards 'neglected' diseases common in developing and least developed countries ([http://www.wipo.int/wipo\\_magazine/en/2007/06/article\\_0007.html](http://www.wipo.int/wipo_magazine/en/2007/06/article_0007.html)) and the high prices of new chemical entities are often justified by pharmaceutical industries who argue that research and development is an expensive and risky affair. Developed countries offer viable market incentives for research and development through individual purchasing power and purchase through government-run health insurance programmes (Patrice Trouiller, 2002). In such a scenario, cooperation amongst developing and least developed countries for research and development of neglected diseases and technology transfer would lessen the burden on individual nations and lead to mutually beneficial welfare outcomes. Examples of both public and private sectors involved in such networks of health innovation as adduced by the MDG Gap Task Force, 2012, may be seen in Box I.8.

#### **Box I. 8 : Enhanced South-South Cooperation**

Quality Chemicals, a pharmaceutical manufacturer based in Luzira, Uganda, that was pre-qualified by WHO and created with the help of the Indian generic manufacturer Cipla and the Ugandan Government, began production of tenofovir, an ARV, in February 2012. Quality Chemicals also produces generic Duovir-N tablets, a triple ARV combination of lamivudine, nevirapine and zidovudine, and generic efavirenz, as well as antimalarial medicines.

Public Sector:

Brazil has announced its intention to invest \$23 million in an ARV production plant in Matola, Mozambique, to provide medicines in South-eastern Africa. Farmanguinhos, a laboratory of the Brazilian Osvaldo Cruz Foundation (Fiocruz), is expected to supply technology and training to the Mozambican regulatory agency for marketing surveillance, inspection, certification, and control of medication in the ARV production plant. The South African Government, through Pelchem (Pty) Ltd., entered into a joint venture with the Swiss company Lonza Ltd. in 2012 to establish a pharmaceutical plant to manufacture APIs for ARV medicines in South Africa.

Source: (MDG Gap Task Force, 2012)

39. Indeed there are many institutions that have come up with interesting South-South co-operation efforts (Box I.9).

#### **Box I. 9 : Organisations Promoting South-South Cooperation**

In April 1994, FIOCRUZ and the Special Programme for Research and Training in Tropical Diseases (TDR) organized in Rio de Janeiro the first Parasite Genome Network Planning Meeting.

The Developing Country Vaccine Manufacturers Network, established in November 2000, includes both state-owned and private producers in Brazil, Cuba, China, India, Indonesia, and Mexico that are prequalified by the World Health Organization (WHO) for sale to United Nations (UN) agencies.

The South-South Initiative (SSI) in tropical diseases research, a TDR initiative begun in 1991, is designed to facilitate sharing of resources among research groups in Latin America, Asia, and Africa in order to increase competitiveness and optimize scientific opportunities. The SSI currently in its full operation is managed by a coordinating committee representing African, Asian, and Latin American investigators.

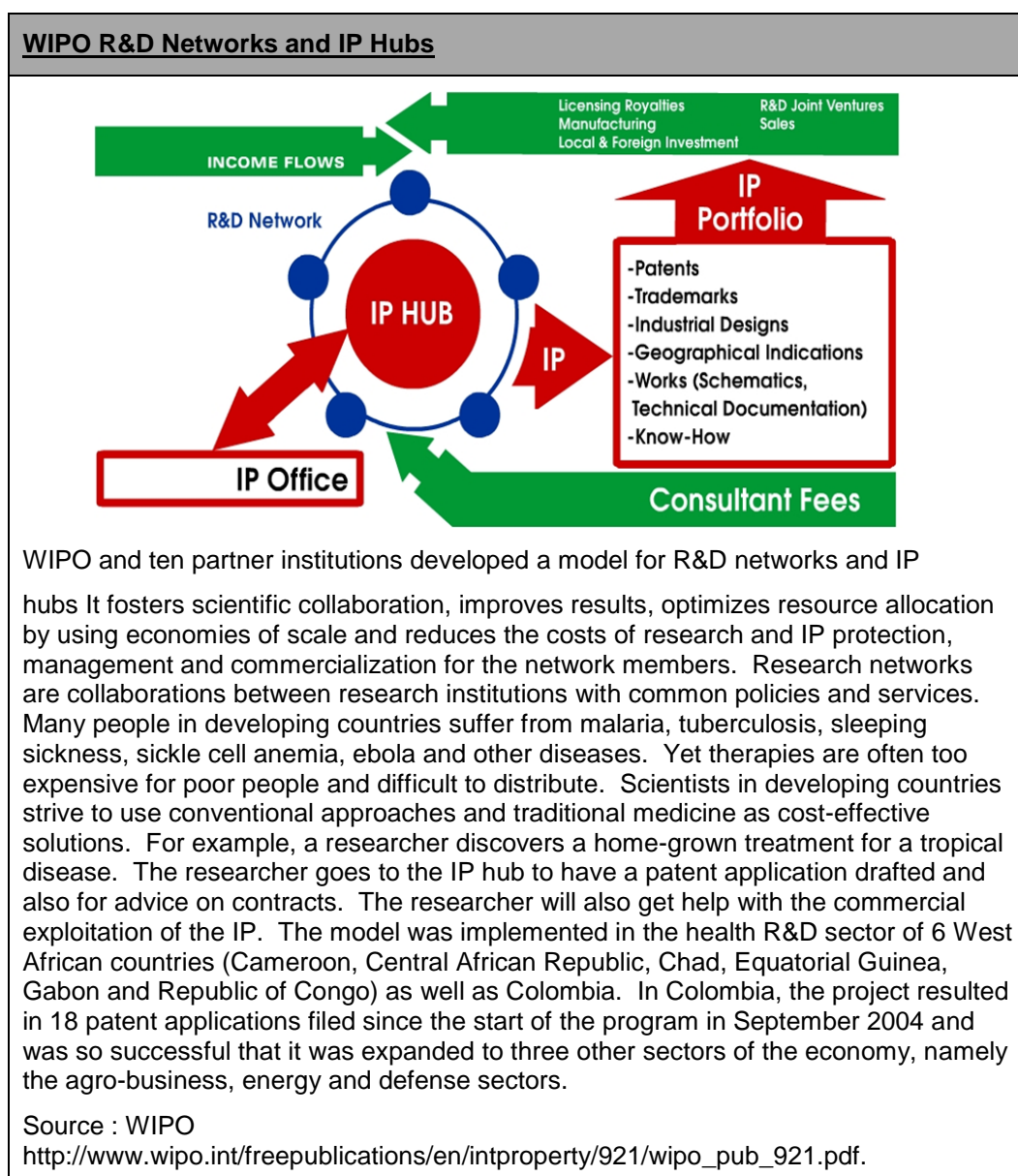
The India–Brazil–South Africa Dialogue Forum, established in June 2003, includes a focus on intellectual property and access to medicine, traditional medicine, and R&D on vaccines and pharmaceutical products to address national health priorities.

The Technological Network on HIV/AIDS, which was announced in Bangkok during the July 2004 International AIDS Conference, includes Brazil, China, Cuba, Nigeria, Russia, Thailand, and Ukraine (with perhaps India and South Africa joining in the near future). The Network supports research and South-South technology transfer to develop and manufacture antiretroviral drugs and new drug formulations, male and female condoms, microbicides, and HIV vaccines.

Finally, the WHO Developing Countries' Vaccine Regulators Network, created in September 2004, involves Brazil, China, Cuba, India, Indonesia, Russia, South Africa, South Korea, and Thailand.

Source: Carlos M Morel (2005)

#### I.4.4. WIPO R&D Networks and IP Hubs



#### I.4.5. Sublicensing Organizations

40. Various organisations are involved in negotiating licensing agreements with research-based pharmaceutical companies, with the aim of sublicensing these products to generic companies to increase access to treatment in developing countries.

41. One initiative in this regard is the Medicines Patent Pool Foundation, created by UNITAID in 2010. The Pool also endeavours to assemble the necessary intellectual property rights regarding key HIV products in order to develop new fixed-dose combination products that integrate multiple drugs into one pill, as well as missing paediatric formulations of existing treatments. In 2011, the Pool reached an agreement on non-exclusive licences with Gilead on tenofovir (TDF) and the co-formulation of TDF with emtricitabine, as well as licences on elvitegravir, cobicistat and their combination with tenofovir and emtricitabine. The negotiations also led to the inclusion of the indication for TDF for the treatment of hepatitis B. Subsequently, the Pool signed three licensing agreements with generic companies for the manufacturing of these products (MDG Gap Task Force, 2012).

## I.5. TRANSFER OF TECHNOLOGY: BARRIERS

### I.5.1. Lax Patent Standards

42. Article 27.1 of the TRIPS Agreement prescribes, that patents "shall be available for any inventions ... provided that they are new, involve an inventive step and are capable of industrial application", but does not contain any specification about the concept of 'invention' nor about the precise way in which the patentability criteria are to be applied. It has, hence, left WTO Members room to interpret in good faith the concept of 'invention' within their legal systems, and to adopt more or less strict criteria to apply the patentability standards (Correa, 2011).

43. Disregard for patent standards of 'novelty', 'inventive step' and 'usefulness' has resulted in undermining the quality of patents being issued. A lax inventive step allows the grant of patents that extend existing monopolies and guarantee markets for international firms in developing countries, thus making it harder for local firms to overcome constraints (Correa, op,cit).

44. In the case of the USA, it has been found that an inadequate search of previous patents and publications leads patent examiners to overlook novelty and inventive step problems; in addition, courts have shown a proclivity to weaken the obviousness test (ibid). The National Academies of the United States, for instance, have taken up the criticism levelled by many academics and sectors of industry and have expressed their concern about the lax application of the patentability standards, especially as regards non-obviousness and usefulness, in the examination and granting of patents (ibid) (See Correa's detailed arguments on this aspect in Box I.10).

#### Box 10: High Inventive Step – Promotes or Deters R&D?

It has been argued that a high inventive step precludes disclosure of essential information on the state of R&D in industries because in the absence of a patent, small inventions are not disclosed and each inventor has to necessarily personally arrive at all the required complementary expertise to be able to get a patent. Hence low level of disclosures lead to duplicate R&D costs and can be avoided through the grant of patents based on a low inventive step.

The counter to this argument is that a lower standard of inventive step is dysfunctional for both cumulative (sequential) innovations (such as biotechnology, where disclosure of previous state-of-the-art' is important) and complementary inventions (where each invention is a step towards a new technological frontier). In both cumulative and complementary innovations, standards of inventive step not only determine how many innovative pieces of the puzzle need to fall in place for a new technology, but also how small these individual rights can be, and how it can be shared between the different inventors.

From a public health perspective, the objective of an innovation-oriented patent regime in a developing country context should be to promote competition amongst local firms (and local and foreign firms) in order to ensure the availability and affordability of drugs within a balanced and supportive framework. The interest of building local capacity is better achieved in a regime based on strict patentability criteria. Setting a high inventive step will help prevent the strategic use of patents by multinational companies to block the generic industry.

Source: (Correa , 2011)

### I.5.2. Excessive Patenting

45. The basic argument for the strengthening of patent protection in developing countries has been that patents may provide the necessary incentives to foster local innovation. In the pharmaceutical sector, in particular, most of patenting is motivated by strategic reasons, namely

to restrict generic competition, rather than to protect genuine innovations, the traditional motivation for acquiring patents (Correa, 2011).

46. Although there may be other reasons for delays to generic entry, the successful implementation of these strategies may have the effect of delaying or blocking such entry. The strategies observed include filing for up to 1,300 patents EU-wide in relation to a single medicine (so-called "patent clusters"), engaging in disputes with generic companies leading to nearly 700 cases of reported patent litigation, concluding settlement agreements with generic companies which may delay generic entry and intervening in national procedures for the approval of generic medicines. The additional costs caused by delays to generic entry can be very significant for the public health budgets and ultimately the consumer'. The European Commission estimated a loss of around three billion Euros due to delays in the entry of generic products caused by misuse of the patent system (Correa op.cit). These developments lead to concerns about the WTO-TRIPS itself (Box I.11).

**Box 11: The Basic Argument against TRIPS**

Médecins sans Frontières (MSF), together with other non-governmental organizations (NGOs), formulated the following concerns related to TRIPS:

- Increased patent protection leads to higher drug prices. The number of new essential drugs under patent protection will increase, but the drugs will remain out of reach to people in developing countries because of high prices. As a result, the access gap between developed and developing countries will widen.
- Enforcement of WTO rules will have a negative effect on local manufacturing capacity and will remove a source of generic, innovative, quality drugs on which developing countries depend.

Source: (Hoen, 2003)

### I.5.3 Ineffective Implementation

#### *Salts and Polymorphs*

47. Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should not be allowed under normal circumstances due to non fulfilment of patent criteria in its true spirit. Even though patent laws of various countries recognise this on paper the implementation has been quite unsuccessful (Correa, 2011).

48. For example in India, section 3 of the Patent Act has been widely wrongly implemented by patent offices. There are a significant number of patents covering salts, polymorphs and combinations that are also not patentable under section 3 (d) as they are considered to be the same substance unless they differ significantly in properties with regard to efficacy. Claims covering compositions and formulations are often claims for a new use of a known substance that are not patentable under section 3 (d) of the Indian Patent Act. In addition, a number of method of treatment' claims, that are excluded from patentability under section 3 (i), were also granted (Correa, op.cit)

### I.5.4. Patent Database

49. Resolution 61.21 of the 2008 World Health Assembly, urged the WHO to: "compile,

50. maintain and update a user-friendly global database which contains public information on the administrative status of health-related patents, including supporting the existing efforts for determining the patent status of health products in order to strengthen national capacities for analysis of the information contained in those databases and improve the quality of patents." (World Health Organization, 2008),

51. Even though in the past two years patent information in an electronically search-able format has become increasingly available, the lack of easily accessible patent information continues to be a particularly serious problem, particularly for those that would be able and willing to file an opposition to the grant of the patent. In Argentina, for instance, the generic name of the medicine was not mentioned in the information published by the patent office for 80 per cent of the granted patents (Correa, 2011).

#### 1.5.5. Markush Claims

52. Markush claims are claims that include a general formula with multiple options that allow for the protection, under a single patent, of up to several millions of molecules. This is detrimental as a single patent may potentially limit or block research and development on and the commercialization of an extremely large number of products. In the case of Argentina, around 50 per cent of the patents granted in the 2000-2007 period were based on Markush-claims. In India, at least 630 out of the 1432 product patents granted in the examined period contained Markush claims (Correa, Pharmaceutical Innovation, Incremental Patenting and Compulsory Licensing, 2011).

53. The issue is further intensified by ‘selection patents’. In some jurisdictions (including India) after a Markush claim has been granted, it is possible to apply for a patent called ‘selection patent’ on a selection of the molecules originally covered in such a way that protection may be extended for an additional patent term, normally 20 years from the filing date (Correa, Pharmaceutical Innovation, Incremental Patenting and Compulsory Licensing, 2011).

#### 1.5.6. Evergreening Patents

54. Patents over minor incremental developments are termed as ‘evergreening’ patents and may be used to exclude generic competition and thereby block access to affordable drugs. According to a Guide of the Canadian Intellectual Property Office, for instance, 90 per cent of all patented inventions were minor improvements on existing patented devices (Correa, Pharmaceutical Innovation, Incremental Patenting and Compulsory Licensing, 2011).

55. Article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) states:

- (i) where such use is authorized to permit the exploitation of a patent ("the second patent") which cannot be exploited without infringing another patent ("the first patent"), the following additional conditions shall apply:
- (ii) the invention claimed in the second patent shall involve an important technical advance of considerable economic significance in relation to the invention claimed in the first patent;
- (iii) the owner of the first patent shall be entitled to a cross-licence on reasonable terms to use the invention claimed in the second patent; and
- (iv) the use authorized in respect of the first patent shall be non-assignable except with the assignment of the second patent.

56. The criteria that the ‘second patent shall involve an important technical advance of considerable economic significance in relation to the invention claimed in the first patent’ is often subjected to slack standards. By blocking legitimate generic competition, which normally lowers prices and makes medicines more affordable, the grant of such patents may force governments to grant compulsory licenses, whenever patent owners charge high prices and/or refuse to grant voluntary licenses on reasonable commercial terms. Although compulsory licenses/government use is legitimate under international law, their application has faced considerable resistance from developed countries’ governments and retaliations from the pharmaceutical industry. A basic question that arises out in these cases is whether the grant of

the patent was justified in the first place and whether governments can avoid the various costs (including of political nature) associated to the grant of compulsory licenses if they applied more rigorous standards in examining the respective patent applications (Correa, 2011).

57. It is said that the Indian Patent Act was amended in 2005 to introduce, inter alia, a special section 3(d) aimed at avoiding 'evergreening' patents. Indeed the recent Supreme Court order in April 2013 in connection with the proposed patent on beta- crystalline / oral version of the anti cancer blockbuster 'Gleevac' (imatinib mesylate) of Novartis was rejected on the ground that it did not meet the test of 'efficacy' and 'significant' therapeutic benefits. The focus of the case was on 'incremental innovations' than on the evergreening of patents..

58. Section 3(d) has not operated as an absolute ban for the patenting of these types of innovations. Cases under Section 3(d) in India are considered on a case to case basis. Had there been a marginal improvement in therapeutic benefits over what Novartis claimed, the gradation of incrementality in innovation would have been different. A UNDP study found cases of patent applications that were unsuccessful under the 'more lenient patentability criteria' that prevail in the US, which were granted in India, despite the clear legislative intent of preventing evergreening (Correa, 2011). This again underscores the point that Section 3(d) of Indian Patent Law does not see 'evergreening' and 'incremental innovation' as concomitant processes.

#### 1.5.7. Bilateral and Regional Free Trade Agreements

59. The deadlock of the Doha Round at the WTO has led to an increasing number of bilateral and regional free trade agreements. Many developed countries tend to include so-called TRIPS plus provisions in these agreements, that is, levels of intellectual property protection that exceed the minimum standards required by the TRIPS Agreement. TRIPS plus provisions, that may have an impact on public health or may hamper the use of flexibilities, have included placing restrictions and limitations on the right to issue compulsory licences; providing for patent extensions or supplementary protection; requiring drug regulatory authorities to consider the patent status of medicines before granting marketing authorizations to generic manufacturers; requiring test data protection that restricts the use of clinical test data on pharmaceutical products by drug regulatory authorities for the approval of generic medicines for a certain period of time; and allowing patent holders to restrict parallel imports, which may prevent developing countries from buying medicines from the most affordable international source (MDG Gap Task Force, 2012).

#### 1.5.8. Pressure on Developing Countries

60. In several instances it has been seen that the possible grant of a compulsory license triggers a strong reaction and lobbying from the pharmaceutical industry, as well as from governments (Box I.12).

#### **Box I.12: Big Pharma vs. Nelson Mandela: Trade Dispute in South Africa**

In February 1998, the South African Pharmaceutical Manufacturers Association and 40 (later 39, as a result of a merger) mostly multinational pharmaceutical manufacturers brought a suit against the government of South Africa, alleging that the Medicines and Related Substances Control Amendment Act No. 90 of 1997 (—Amendment Act II) violated TRIPS and the South African constitution. The Amendment Act introduces a legal framework to increase the availability of affordable medicines in South Africa. Provisions included in the Amendment Act are generic substitution of off-patent medicines, transparent pricing for all medicines, and the parallel importation of patented medicines.

At the start of the litigation, the drug companies could rely on the support of their home governments. For its part, the United States stated introduction of trade sanctions, aiming to force the South African government to repeal the Amendment Act. In 1998, the European Commission joined the United States in pressuring South Africa to repeal the legislation. However later, on realizing the larger public implications, the

United States changed its policies at the end of 1999. By the time the case finally reached the courtroom in May 2000, the drug companies could no longer count on the support of their home governments.

Eventually, the strong international pressure over the companies' legal challenge of a developing country's medicines law and the companies' weak legal position caused the companies to unconditionally drop the case in April 2001.

The widely publicized South African court case brought two key issues out into the international arena. First, the interpretation of the flexibilities of TRIPS and their use for public health purposes needed clarification to ensure that developing countries could use its provisions without the threat of legal or political challenge. Second, it became clear that industrialized countries that exercised trade pressures to defend the interest of their multinational industries could no longer exert pressure without repercussions at home.

Source: Based on Hoen, 2003

61. Developing countries are under pressure from industrialized countries and the pharmaceutical industry to implement patent legislation that goes beyond the obligations of TRIPS. This is often referred to as —TRIPS plus. TRIPS plus is a non-technical term which refers to efforts to extend patent life beyond the twenty-year TRIPS minimum, to tighten patent protection, to limit compulsory licensing in ways not required by TRIPS, or to limit exceptions which facilitate prompt introduction of generics (Hoen, 2003).

## I.6. WTO-TRIPS - POLICY MEASURES TO OVERCOME BARRIERS

### I.6.1. Prioritizing Public Health

62. Article 30 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) recognises the necessity of exceptions to patent rights conferred, where it states: Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.

63. Article 8 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) recognises measures to protect public health where it states:

(a) Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement.

(b) Appropriate measures, provided that they are consistent with the provisions of this Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.

64. The Doha Declaration further reiterates the right of nations to prioritize public health, where it states: We agree that the TRIPS Agreement does not and should not prevent Members from taking measures to protect public health. Accordingly, while reiterating our commitment to the TRIPS Agreement, we affirm that the Agreement can and should be interpreted and implemented in a manner supportive of WTO Members' right to protect public health and, in particular, to promote access to medicines for all (WTO, 2001). Indeed the French Patent Law has interesting provisions for acting when patented essential medicines that are not well supplied ( Box I.13)



**Box I.13: French Patent Law: Differentiating Pharmaceutical Products**

The French patent law provides an interesting example of a patent law that differentiates the treatment of pharmaceutical products on public health grounds. It provides that:

—Where the interest of public health demand, patents granted for medicines or for processes for obtaining medicines, for products necessary in obtaining such medicines or for processes for manufacturing such products may be subject to ex officio licences in accordance with Article L. 613-16 in the event of such medicines being made available to the public in insufficient quantity or quality or at (abnormally high prices) by order of the Minister responsible for industrial property at the request of the Minister responsible for health.

Source: (Correa, 2002)

65. TRIPs Article 8, outlining the principles of the TRIPs, permits Members to adopt measures necessary to protect public health. TRIPs Articles 30 and 31 relate to flexibilities, and fail to provide any reference to TRIPs Article 8 or the acceptable bases upon which Members may exercise the provisions. Paragraph 4 of the Doha Declaration obviates this analysis by specifically stating that Members have the right to use TRIPs flexibilities in order to protect the public health (Murthy, 2002).

#### I.6.2. Compulsory Licensing

66. A compulsory license is a license for a patented product issued by the government to a third party without the patent holder's permission. In return, the government grants the patent holder what it believes to be reasonable compensation. The justifications for issuing compulsory licenses include reducing an issuing country's dependence on imports, increasing the number of competitors in the marketplace, and protecting and developing local industry. However, the reason that resonates with the highest moral tone, and is most often cited by developing countries and activists, is that compulsory licenses result in increased access to critical lifesaving medicines (Murthy, 2002).

67. Article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) enlists the provisions for compulsory licences' use by the government or third parties authorized by the government, where it states:

- (a) authorization of such use shall be considered on its individual merits;
- (b) such use may only be permitted if, prior to such use, the proposed user has made efforts to obtain authorization from the right holder on reasonable commercial terms and conditions and that such efforts have not been successful within a reasonable period of time. This requirement may be waived by a Member in the case of a national emergency or other circumstance of extreme urgency or in cases of public non commercial use. In situations of national emergency or other circumstances of extreme urgency, the right holder shall, nevertheless, be notified as soon as reasonably practicable.

68. In the case of public non-commercial use, where the government or contractor, without making a patent search, knows or has demonstrable grounds to know that a valid patent is or will be used by or for the government, the right holder shall be informed promptly.

69. Developing countries have recently begun to enact legislation with provisions that allow for practices such as compulsory licensing and parallel importing of pharmaceuticals. The pharmaceutical industry opposes such legislation because the industry views legislation in developing countries as supportive of patent infringement practices as the norm rather than the exception (Murthy, 2002).

70. In 2012 the Indian Controller of Patents issued, at the request of an Indian generic company, the first compulsory licence under the Indian Patents Act for a treatment for liver and kidney cancer (sorafenib). The request for the compulsory licence was based on the Indian Patents Act that allows interested persons to apply for the grant of a compulsory licence on the grounds, among others, that it is not available at a reasonably affordable price (MDG Gap Task Force, 2012).

71. Thorpe (2002) summarizes the grounds on which compulsory Licensing is resorted by different countries and the number of compulsory licensing cases in the world 12 years ago. The details are provided in the Table below.

<b>Table : Grounds for Compulsory Licensing in Developing Countries and LDCs</b>		
<b>Grounds for compulsory licences in developing countries and LDCs</b>		
<b>Grounds for granting compulsory licences</b>	<b>Countries providing such grounds</b>	<b>Total</b>
Failure to exploit or exploit on reasonable terms	16 + OAPI	32
Public interest	8 + Andean	13
National emergency or health emergency	8 + Andean	13
Remedy anti-competitive practices, unfair competition	6 + Andean	11
Failure to obtain licence under reasonable terms	4	4
Failure to work domestically	2	2
No apparent provisions	2	2

Source: Thorpe, 2002.

72. There are interesting specifics of cases involving compulsory licensing reported by O'Carroll (2005.) for Kenya and Hoen (2003) in respect of Brazil. The details may be seen in the ensuing Boxes I.14 and I.15.

**Box I.14: Kenya and Compulsory Licensing**

This case has been based on O'Carroll's study of Kenya.

Kenya is not classified as a least-developed country, and is already required to be TRIPS-compliant. Kenya's Industrial Property Act came into force in 2002. The Kenyan Industrial Property Act gives patent holders the right to exclude others from making, using, selling, or importing the patented object, and from using a patented process, or making, using, selling or importing the product of a patented process. These protections last for a period of twenty years from the date of filing of the application. Kenya is a member of ARIPO, and patents granted by ARIPO designating Kenya have effect in Kenya unless the Kenya has indicated that a patent shall not

have effect in Kenya.

Provisions are made in the Act for compulsory licensing. Under section 58,

—The rights under the patent shall be limited by the provisions on compulsory licences for reasons of public interest or based on interdependence of patents and by the provisions on State exploitation of patented inventions. || After

four years from the filing date, or three years from the grant of the patent, whichever period is longer, any person can apply for a compulsory licence to exploit the invention on the grounds that the market is not being supplied on reasonable terms in Kenya. In order to acquire a compulsory licence, the applicant must show that he has been unable to attain a voluntary licence on reasonable commercial terms. This requirement is waived in the case of a

—national emergency or other circumstances of extreme urgency provided the owner of the patent shall be so notified as soon as is reasonably practicable. ||

The Minister can authorise the importation, manufacture, supply or utilisation of a patented substance, without the payment of compensation to the owner

of the patent. The suspension of payment provision is unlikely to be useful for the purposes of importing under a compulsory licence. Even if applied to drugs manufactured domestically, this provision would violate TRIPS if it denied adequate remuneration to patent holders with respect to compulsory licences granted under Article 31.

In order to import generic drugs, under both domestic law and TRIPS, Kenya would be required to issue a compulsory licence. In addition to actually issuing such a licence, Kenya must notify the TRIPS Council of the issuance of that licence. As a Member state that is not a least-developed country, Kenya must also both notify the TRIPS Council of the names of the drugs to be imported, and demonstrate that it lacks the domestic capacity to manufacture the drugs that it intends to import.

Source: (O'Carroll, 2005\)

#### **Box 1.15: United States vs. Brazil: The Brazilian AIDS Programme**

Since the mid-1990s, Brazil has offered comprehensive AIDS care, including universal access to antiretroviral (ARV) treatment. In 2001, 105,000 people with HIV/AIDS received ARV treatment. The Brazilian AIDS programme reduced AIDS-related mortality by more than 50% between 1996 and 1999. In two years, Brazil saved US\$ 472 million in hospital costs and treatment costs for AIDS-related infections. At the core of the success of Brazil's AIDS programme is the ability to produce medicines locally. Brazil has also been able to negotiate lower prices for patented drugs by using the threat of production under a compulsory license. Article 68 of the Brazilian patent law allows for compulsory licensing, which allows a patent to be used without the consent of the patent holder.

The Brazil AIDS programme serves as a model for some developing countries that are able to produce medicines locally, and Brazil has offered a cooperation agreement, including technology transfer, to developing countries for the production of generic ARV drugs.

In February 2001, the United States took Brazil to the WTO Dispute Settlement Body (DSB) over Article 68 of the Brazilian intellectual property law. Under that provision, Brazil requires holders of Brazilian patents to manufacture the product in question within Brazil – a so-called —local working requirement. If the company does not fulfil this requirement, the patent shall be subject to compulsory licensing after three years, unless the patent holder can show that it is not economically feasible to produce in Brazil or can otherwise show that the requirement to produce locally is not reasonable. If the company is allowed to work its patent by importation instead of manufacturing in Brazil, parallel import by others will be permitted.

The United States argued that the Brazilian law discriminated against United States owners of Brazilian patents and that it curtailed patent holders' rights. The United States claimed that the Brazilian law violated Article 27.1 and Article 28.1 of TRIPS. Brazil argued that Article 68 was in line with the text and the spirit of TRIPS, including Article 5.4 of the Paris Convention, which allows for compulsory licensing if there is a failure to work a patent. Article 2.1 of TRIPS incorporates relevant articles of the Paris Convention.

The United States action came under fierce pressure from the international NGO community, which feared it would have a detrimental effect on Brazil's successful AIDS programme. Brazil has been vocal internationally in the debates on access to medicines, and on several occasions, including the G-8, the Roundtable of the European Commission, and WHO meetings, Brazil has offered support to developing countries to help them increase manufacturing capacity by transferring technology and know-how. NGOs feared that the United States action could have a negative effect on other countries' ability to accept Brazil's offer of assistance. On June 25, 2001, in a joint statement with Brazil, the United States announced that it would withdraw the WTO panel against Brazil.

Source: (Hoen, 2003)

### I.6.3. Freedom of Interpretation

73. Under TRIPS, the most expeditious avenue for a country to issue a compulsory license is to claim a national emergency. The Doha Declaration provides Members the "right to determine what constitutes a national emergency (Murthy, 2002).

74. Each Member has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, it being understood that public health crises, including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics, can represent a national emergency or other circumstances of extreme urgency (WTO 2001).

75. The effect of the provisions in the TRIPS Agreement that are relevant to the exhaustion of intellectual property rights is to leave each Member free to establish its own regime for such exhaustion without challenge, subject to the MFN and national treatment provisions of Articles 3 and 4 (WTO, 2001).

### I.6.4. Time Extensions

76. Least developed countries were provided lenient time extensions to enforce the TRIPS provisions, initially till 2005 which was further extended to 2016 in the Doha Declaration. Paragraph 7 of the Doha Declaration states: The least-developed country Members will not be obliged, with respect to pharmaceutical products, to implement or apply Sections 5 and 7 of Part II of the TRIPS Agreement or to enforce rights provided for under these Sections until 1 January 2016, without prejudice to the right of least-developed country Members to seek other extensions of the transition periods as provided for in Article 66.1 of the TRIPS Agreement. We instruct the Council for TRIPS to take the necessary action to give effect to this pursuant to Article 66.1 of the TRIPS Agreement (WTO, op.cit ).

77. An important practical aspect is to determine which LDCs that can effectively benefit from paragraph 7 of the Doha Declaration. Out of thirty African LDCs, only two do not currently grant patents for pharmaceuticals. These would be, in principle, the only African LDCs that can benefit from this paragraph, unless they amend their legislation. LDCs that already grant pharmaceutical patents could amend their legislation and not grant product patents until 2016, since they are not constrained by the "freezing clause" of Article 65.5 of the TRIPS Agreement (Correa, Implications of the Doha Declaration on the Trips Agreement and Public Health, 2002).

#### I.6.5. Doha Declaration Paragraph 6

78. Paragraph 6 of the Doha Declaration states:

79. “We recognize that WTO members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement. We instruct the Council for TRIPS to find an expeditious solution to this problem and to report to the General Council before the end of 2002.” (WTO, 2001).

80. The basic problem underlying paragraph 6 is that many developing countries lack or have an insufficient capacity to manufacture medicines on their own. Manufacturing capacities in pharmaceuticals are distributed unevenly in the world. Not many countries have the capacity to produce both active ingredients and formulations, and very few countries maintain significant research and development capabilities. Previously, a member country where the price of patented products is high had the option of issuing a compulsory licence to permit import from countries such as India, which did not provide patent protections for pharmaceutical products, and produce generic versions at a fraction of the price of the patented product. Once the TRIPS Agreement became fully operative (after 2005), many countries faced difficulties in acquiring medicines at affordable prices (Correa, 2002).

81. A Member is free to grant a compulsory licence for the importation of goods which are under patent in its own territory, as long as the imported goods have been produced in a country where they are not patented, or where the term of protection has expired. However, when a patent exists in the potential supplier country, the patent owner may block exports to the country in need of the medicines (Correa, 2002). Moreover, since Article 31 (f) requires that a compulsory licensee predominantly supply the domestic market, that provision would prevent the granting of a compulsory licence exclusively or mainly to export to a country in need of certain medicines (Correa, op.cit)

82. The European Union and the USA along with developing countries have also proposed options to obviate the problems posed by Para 6 ( Box I.16).

#### **Box I.16: Proposals relating to implementation of Paragraph 6 discussed at the Council for TRIPS (March 2002)**

The EC and their Member States submitted two possible options to address the paragraph 6 problem:

- 1) An amendment to Article 31 of the TRIPS Agreement in order to carve out an exception to Article 31 (f) for exports under compulsory licences, under certain conditions, of products needed to combat serious public health problems; or
- 2) An interpretation of the limited exceptions clause of Article 30 of the TRIPS Agreement in a way to allow production for export, to certain countries and under certain conditions, of products needed to combat serious public health problems;

Option (1) would be subject to three conditions: criteria ensuring that importing countries actually face serious public health problems, safeguards against re-exportation of the cut-price generics, particularly to rich countries, and reporting requirements that would inform trading partners of such action.

Option (2) would be subject to two minimum conditions: the entirety of the product must be exported to the country with the public health problem, and re-export from the importing country would be prohibited.

3) The USA proposed a moratorium whereby WTO Members would agree not to bring a WTO complaint against countries that export some medicines to countries in need, so long as certain other conditions are met.

On behalf of the African Group, Brazil, Cuba, Dominican Republic, Ecuador, Honduras, India, Indonesia, Jamaica, Malaysia, Sri Lanka and Thailand, Kenya made a statement suggesting, as possible options, an amendment to Article 31 in order to

eliminate paragraph "f", or to develop an authoritative interpretation that would recognize the right of Members to allow the production without the consent of the patent holder to address public health needs in another country, under Article 30 of the TRIPS Agreement.

Source: (Correa, 2002)

83. The chief difference is that while developing countries would like to see an amendment to Article 31 in order to eliminate paragraph "f", or to develop an authoritative interpretation that would recognize the right of Members to allow the production without the consent of the patent holder to address public health needs in another country, under Article 30 of the TRIPS Agreement, developed countries would like the medicines in question to be related to serious public health problems in developing countries, and transferred to developing countries after being subject to tight safeguards against possibilities of re-exportation,

## I.7. WTO-TRIPS – INEFFECTIVENESS OF POLICY MEASURES

### I.7.1. Legal Barriers

84. The use of TRIPS flexibilities is not common and one reason for this is that many countries have yet to amend their national laws to incorporate them fully. In a study of 95 countries, only about half of the countries were found to adjust their patent legislation to allow for the use of a patented invention without the authorization of the patent owner to obtain marketing approval of a generic product before the patent expired. This exception would allow generic products to enter the market more quickly after patent expiry (MDG Gap Task Force, 2012).

### I.7.2. Ambiguity and Uncertainty

#### *I.7.2.1. Narrow Scope*

85. The focus of the Doha Declaration on addressing epidemics is narrower than the broad public health focus originally sought by developing countries. Much of the public attention surrounding compulsory licensing and other TRIPs flexibilities concerning pharmaceuticals have concentrated on HIV/AIDS. Developing countries sought a broader mandate to exercise TRIPs flexibilities for public health concerns as a whole. The drafters intended the Declaration to clarify, remove uncertainties, and provide guidance in this area. Unfortunately, the text fails to achieve this goal because of internal inconsistencies (Murthy, 2002).

#### *I.7.2.2. Ambiguity of Terms*

86. Terms such as —public health have not been explicitly defined in TRIPS. A patent holder's country could challenge another country's decision by asserting that the stated public health event is not the type of TRIPs public health event that allows for the issuance of a compulsory license. In such a situation, a WTO Panel would need to interpret the term "public health" within TRIPs. Accordingly the public health event, from the above hypothetical, would have to cause a national emergency or disrupt sectors vital to the socio- economic welfare of the nation for the country to have a valid basis to issue a compulsory license (Murthy, 2002).

87. In the Doha Declaration, paragraphs 1 and 5(c) seemingly define a "public health" event as an epidemic, but paragraph 4 makes no effort to narrow this focus to anything less than public health concerns as a whole (Murthy, 2002).

### *1.7.2.3. Flexibilities May Be Disputed*

88. Countries hesitate to make use of the TRIPS flexibilities due to uncertain terms and uncertainty with respect to the outcome of a judicial review upon being challenged. Article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) states:

the legal validity of any decision relating to the authorization of such use shall be subject to judicial review or other independent review by a distinct higher authority in that Member

89. While the Doha Declaration notifies Members about how a WTO dispute settlement body may interpret the previously ambiguous terms and issues, the Declaration does not restrict Members' rights to use the dispute settlement procedure, with the exception of paragraph 5(d) of the Declaration. Consequently, Developed Member governments may still bring complaints before the Dispute Settlement Body regarding the very terms and issues addressed in the Declaration (Murthy, 2002).

### *1.7.2.4. Territorial limitations*

90. Article 31 of the TRIPS, on its face, does not indicate that the term "third parties" should be construed to exclude foreign pharmaceutical manufacturers." However the principle of territoriality currently functions to exclude non-domestic manufacturers from inclusion within the term "third parties" (Murthy, 2002).

91. Article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (2001) states:

any such use shall be authorized predominantly for the supply of the domestic market of the Member authorizing such use

92. Territoriality is grounded in the notion that every government has sovereignty within its borders or territories. The current legal framework of TRIPs prohibits a Member government from granting a compulsory license to a manufacturer in a foreign Member's territory, because doing so interferes with the inventor's patent rights in that foreign Member country. This type of interference constitutes a violation of the principle of territoriality (Murthy, 2002).

93. The Doha Declaration recognized that WTO Members with insufficient or no manufacturing capacities in the pharmaceutical sector could face difficulties in making effective use of compulsory licensing under the TRIPS Agreement. It instructed the Council for TRIPS to find an expeditious solution to this problem (WTO, 2001) .

## **I.8. RECOMMENDATIONS TO OVERCOME BARRIERS TO THE TRANSFER OF TECHNOLOGY**

94. The main recommendation that emerges from our survey and review of literature of the IPR scenario in relation to the drugs and pharmaceutical sector is regarding that importance of adopting a rigorous criterion to assess the novelty and inventive step of patent applications relating to pharmaceuticals in developing countries.

95. Where sunk costs on Research and Development (R&D ) are voluminous and the risks of not being able to realize 'promising new and effective' products are high, the pace of innovation may come down irrespective of whether patent protection exists or not. Consequently the effort should be to have Joint R&D programmes on critical tropical diseases where the burden of investment in R&D is pooled amongst public and private agencies and the risks as well as Patents, associated with non realization of new products is shared by Parties making R&D investments in new molecules..

96. A proper and effective regime of differential pricing needs to be worked out, through detailed empirical investigations on how this is possible within the present capacity utilization dynamics of pharma firms that have invented the medicines in the first place. In case these firms have great potential to expand the production of patented medicines of essential significance to developing countries, they may be mandated and incentivized to differentially price their products for developing countries as well.

97. At the national level, countries should be encouraged to make full use of the Doha Declaration in the process of adjusting national intellectual property laws to become compliant with TRIPS. This will require substantial advice and technical assistance from institutions like WIPO and WTO. While the spirit of the Doha Declaration is to tailor intellectual property laws to national needs, the practice has been to encourage developing countries to go beyond the minimum requirements and speed up the process to become TRIPS-compliant. In addition to increasing their interaction with countries, WIPO and WTO will have to increase their level of collaboration with the public health community, including the WHO, which has become heavily involved in trade discussions as a result of the process that led to the Doha Declaration (ibid). More recently, the WIPO, WHO and WTO have strengthened their cooperation and practical coordination on issues around public health, intellectual property and trade. The WHO Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property (GSPOA), the WIPO Development Agenda and the WTO Declaration on the TRIPS agreement and public health provide the broader context for an informal and practical trilateral cooperation at the working level (WIPO, 2013c).

98. A flaw of the Doha Declaration is that it does not resolve the problem of production for export from markets that provide patents to countries that do not grant pharmaceutical patents (and subsequently do not grant compulsory licenses). This is of particular importance now that the least-developed WTO Members can delay the granting of pharmaceutical product patents until 2016.

99. It will also be a challenge to find ways to make the Doha Declaration on TRIPS and Public Health operational at the regional and national levels. A classic example is the Bangui Agreement, the regional intellectual property agreement for francophone Africa, which was adopted in 1977 and revised in 1999 to ensure TRIPS compatibility, but includes typical TRIPS plus provisions that are not in line with the Doha Declaration (Hoen op.cit).

100. Governments should also carefully consider problems relating to sufficiency of disclosure, particularly in the case of the so-called Markush claims (often used in chemistry, whereby multiple "functionally equivalent" chemical entities are allowed in one or more parts of a given compound) so as to ensure that the granting of patents with such claims does not become a constraint for research on new compounds or an undue restriction to competition.

101. Similarly, claims on second indications of pharmaceutical products, which are equivalent to methods of treatment, should be deemed non-patentable due to lack of novelty and industrial applicability (ibid)

102. In order to improve the transparency of the patent system, the international non-proprietary name (INN) of drugs, when known at the time of filing of a patent application, should be mandatorily disclosed in its title and abstract (ibid). Some pharmaceutical bulletins which favour this are Australian Prescriber (Australia), Bodhi (India), Buleti Groc (Spain), Dialogo sui Farmaci (Italy), Drug and Health (Bangladesh) etc (ISDB, 2006). Countries like Argentina, Bolivia, Brazil allow for INN names but are not mandatory, whereas Chile requires it at the discretion of the patient and the pharmacist, on the other hand in Ecuador providing for INN has been made mandatory (Homedes, Linares and Ulgade, 2005)



103. Compulsory licenses and government use are important tools that governments can and should use when required to ensure access to affordable medicines. The possible invalidation of patents granted should be considered (and legal action taken, where appropriate) before initiating or in parallel to the procedures for obtaining compulsory licenses/government use (ibid)

104. Patent claims relating to formulations or compositions, salts, ethers, esters and combinations should be allowed in narrowly defined, exceptional cases. Polymorphs and isomers (when the racemic mixture was already disclosed) should not be patentable.

#### I.8.1. Nanotechnology patents :

105. WIPO suggests that while inventions in the field of nanotechnology appear to qualify for patent protection, subject to the fulfillment of the relevant conditions of patentability, certain issues that need further consideration, including for example the following:

- One problem, which is, to a certain extent, shared with a number of other emerging technologies is that the granted claims are overly broad, due at least in part to a lack of available prior art, which could allow patent holders to lock up huge areas of technology. In this context, there is also a perceived risk of overlapping patents.
- Concerning the general conditions of patentability, the question may arise as to whether the reproduction of a known product or structure at an atomic scale would meet the requirements of novelty or, more importantly, inventive step.

106. An issue related to the previous one concerns the question of whether the rights of a patent granted on a product without specification of the size of the invention could either be considered infringed by the corresponding nanotechnology invention or form the basis for requesting royalties from the inventor of that invention. (WIPO, 2013a)

#### I.9. CONCISE SUMMARY OF RECOMMENDATIONS

107. A proper and effective regime of differential pricing needs to be worked out, through detailed empirical investigations on how this is possible within the present capacity utilization dynamics of pharma firms that have invented the medicines in the first place

108. At the national level, countries should be encouraged to make full use of the Doha Declaration in the process of adjusting national intellectual property laws to become compliant with TRIPS. This will require substantial advice and technical assistance from institutions like WIPO and WTO.

109. Find ways to make the Doha Declaration on TRIPS and Public Health operational at the regional and national levels.

110. Governments should also carefully consider problems relating to sufficiency of disclosure, particularly in the case of the so-called Markush claims

111. Compulsory licenses and government use are important tools that governments can and should use when required to ensure access to affordable medicines. The possible invalidation of patents granted should be considered (and legal action taken, where appropriate) before initiating or in parallel to the procedures for obtaining compulsory licenses/government use (ibid)

112. WIPO suggests that while inventions in the field of nanotechnology appear to qualify for patent protection, subject to the fulfillment of the relevant conditions of patentability, certain issues that such as granted claims that are broad in scope , novelty aspect a known product that is reduced to nano scale are to be carefully considered to avoid monopoly tendencies.

## **APPENDIX II. CASE STUDY ON INTELLECTUAL PROPERTY RIGHTS, TECHNOLOGY TRANSFER IN THE TRANSFER OF CLIMATE FRIENDLY TECHNOLOGIES:ISSUES, TRENDS AND SUGGESTIONS**

### **II.1. INTRODUCTION**

113. In the words of the UN Secretary General, Mr. Ban Ki Moon, "Climate change is one of the most complex, multifaceted and serious threats the world faces. The response to this threat is fundamentally linked to pressing concerns of sustainable development and global fairness; of economy, poverty reduction and society; and of the world we want to hand down to our children."(Moon, 2007).

114. Climate change is a reality today and urgent action against anthropogenic climate change is needed. Such action against climate change is broadly classified into Mitigation and Adaptation activities in international parlance. Mitigation focuses on slowing down global warming by reducing the level of greenhouse gases in the atmosphere. The mitigation techniques include promoting the market for renewable energy sources, such as bio-fuels, biomass, wind, solar and hydro power, low carbon building materials and emerging technologies which capture carbon at the point of release into the atmosphere and store it. Adaptation involves dealing with the existing or anticipated effects of climate change, particularly in the developing, least developed and small island countries, which are most severely affected by adverse impacts of climate change. In addition to "soft" technologies, such as adoption of climate resilient crop rotation practices, hard technologies of 'adaptation' include improved irrigation techniques to cope with drought, and adoption of new plant varieties that are resistant to droughts.

115. Nearly all climate action activities call for technological innovations that can render production efficient with least impact on greenhouse build up in the environment. Rather the most advanced climate smart technologies ought to be back-stopping in nature with zero GHG emissions being their operational impact. Such innovations may be indigenous or could be provided by private firms, research institutions both public and private which may not necessarily be located within the same national borders. This paper looks at technology transfer in Climate Smart Technologies from a cross-border perspective. The paper initially touches upon the key decisions taken in recent years at international forums where climate action is being deliberated. The paper looks at key features that can guide the process of transfer of technology in climate friendly technologies. Such systems, when adopted worldwide can ensure great mitigation and adaptation potential. The paper proceeds to explore the major barriers to the transfer of technology and the role of intellectual property rights. The paper examines arguments made by researchers on the factors that constrain technology flows. Data on patents are analysed for select climate relevant technologies in the renewable power generation sector. Finally the article concludes exploring alternate mechanisms for better technology transfer as proposed by experts.

### **II.2. TECHNOLOGY TRANSFER AND CLIMATE SMART TECHNOLOGIES (CSTS)**

116. Technology transfer in the context of climate change represents a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change and embraces different stakeholders such as Governments, private sector entities, financial institutions, NGOs and research/education institutions(IPCC, 2001). Technology transfer (TT) processes involve primary flows and dual flows. The primary flow is of tangible technologies or intangible "know-how" from developed countries to developing countries. These flows also partake of flows of financial resources that are designed to facilitate TT (Yang, 2009).

117. The way technology is traded depends on the nature of the technology involved. It can take the form of Intellectual Property (patents, designs) or intangibles (know-how, capacity building etc.) or it can be embodied in a product and financial flows. So technology transactions can range from pure licensing to complicated collaborative agreements.

118. Researchers have tried to differentiate trans-border climate action projects by identifying the institutional setting and market structure of a given transaction. If technology was shared by a private firm through commercial trade channels or through foreign direct investments (FDI), the firm sharing the technology is referred to as a “provider”. If public entities were engaged in CDM, Joint Implementation or a capacity building programme, they are referred to as a “donors” (Yang, 2009).

119. The International Environmental Technology Centre of the UNEP (2013) describes Environmentally Sound Technologies (ESTs) as technologies that have the potential for significantly improved environmental performance relative to other technologies. ESTs protect the environment, are less polluting, use resources in a sustainable manner, recycle more of their wastes and products, and handle all residual wastes in a more environmentally acceptable way than the technologies for which they are substitutes. This notion applies to climate smart technologies as well.

#### II.2.1. Modes of Technology transfer in CSTs

120. Technology transfer could occur in various ways, depending on the nature of technology in question, the recipient-side conditions. The latter may include among others institutional, social and financial factors. Some of the existing modes of technology of CSTs are as follows:

##### *II.2.1.1. Sale or Assignment of IP Rights (Transfer of Rights): A*

121. Sale by the owner of all his or its exclusive rights to a patented invention and the purchase of those rights by another person or legal entity. When an original inventor, who is an individual or a legal entity transfers such exclusive rights, an assignment of such rights is said to take place. A similar principle applies to other intellectual property subject to sale, like trademarks and industrial designs etc.

##### *II.2.1.2. Purchase / Import Model:*

122. The environmental technology is purchased or imported upfront by making a down payment that covers supply price. With particular relevance to Carbon capture technologies Damodaran (2011), suggests the supply price of a CST subject to the ‘purchase/ Import Model to be as below.

$$\text{Supply Price} = \text{Sunk costs} + \text{Patent related Expenses} + \text{Return on Capital} + \text{Premium.}$$

##### *II.2.1.3. Licensing:*

123. This is the third mode of technology transfer. The owner leases her technology to a customer for a specified period of time. Licences (Permission to Use) may be exclusive or non-exclusive. An exclusive licence is one where the licensee has the exclusive right to do certain things to the exclusion of all others including the licensor. On the other hand, several non-exclusive licences may be granted to different licensees in respect of the same technology. A special variant of licensing is that of WTO TRIPS sanctioned ‘Compulsory licences’ regime which may be granted under the provisions of local laws and executive action, when demand for a technology or its product is not being met on reasonable terms and this is against public interest.

*II.2.1.4. Joint Ventures (JV):*

124. A partnership involving either a private or public entity to pursue a business agenda involving a technology, product or service. A JV involves joint pooling of finances through shareholding and employees. Public-private partnership based JVs can contribute to advanced evolution of technologies and its eventual use by sharing of R&D expenses and sharing of patents. Sometimes a JV can be Contractual in nature.

*II.2.1.5. Know-How Contract (Tangible & Intangible):*

125. It is possible to include provisions concerning know-how in a document that is separate from a license contract or within it. Documents, photographs, blueprints, computer cards, and microfilm, among others, are illustrations of tangible forms. This tangible information is referred to as technical information or data. Intangible know-how transferred may include industrial training to the recipient or witnessing of a production line first-hand by the intended beneficiary.

*II.2.1.6. Franchise/Distributorship (Licensing of Trademark):*

126. Franchise essentially is a business arrangement whereby the reputation, technical information and expertise of one party are combined with the investment of another party for the purpose of selling goods or rendering services directly to the consumer.

*II.2.1.7. Consultancy Arrangements:*

127. An individual consultant or a firm of consultants will give advice and render other services concerning the planning for, and the actual acquisition of, a given technology. This arrangement might be necessary for such enterprises, entities and governments that wish to acquire technology from enterprises in other countries

*II.2.1.8. Turn-Key Project:*

128. A situation which may require two or more different business arrangements, and hence the legal methods that they reflect, can be combined in such a way as to entrust the planning, construction and operation of a factory to a single technology supplier, or to a very limited number of technology suppliers.

129. Apart from the above, the recipient may well acquire technology in some other manner and reverse engineer it to understand the workings of a technology. The legality of such action depends on whether the technology is protected or not.

## II.3. UNFCCC AND TECHNOLOGY TRANSFER

130. The United Nations Framework Convention on Climate Change (UNFCCC), a framework convention to deal with climate change and limit average global temperature increase was formed by international treaty in 1992. International action on climate change began with the World climate conference in 1979 and followed by the Inter-governmental panel on climate change (IPCC) in 1988, which published its first assessment in 1990. Later at the Earth Summit at Rio <sup>15</sup> parties signed the text for conventions on climate change (UNFCCC). The Parties later formed the Kyoto Protocol in 1997 after two years of negotiations to effectively respond to climate change. This protocol bound developed countries to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020. As on today the UNFCCC has 195 parties and the Kyoto Protocol, 191 parties. The Conference of the Parties (COP), which meets every year to review the implementation of the Convention, is the highest decision-making body. It also serves as the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

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<sup>15</sup> UN Conference on Environment & Development, 1992, Rio de Janeiro, Brazil.

131. Article 4 in the text of the UNFCCC convention broadly lists the climate action Commitments of all parties under a principle of common but differentiated responsibilities. The provisions of the Convention on the development and transfer of technologies are articulated by Article 4, paragraphs 1(c) and 5. Paragraph 1(c) of the Convention mentions that '*All Parties shall...Promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors*'. In addition all parties to the Convention shall co-operate in scientific, technological and technical research and development of data archives related to the climate system (Paragraph 1(g)). It is also agreed that all parties shall cooperate in the full, open and prompt exchange of information related to the climate system and climate change (paragraph 1(h)).

132. Article 4.3 notes that developed country parties and other developed parties included in Annex II shall provide such financial resources, including those that facilitate transfer of CST, needed by the developing country Parties to meet the agreed full incremental costs of implementing climate action measures.

133. Article 4.5 states that developed countries and parties in Annex II shall take all practicable steps to promote and finance the transfer of, or access to, environmentally sound technologies and know-how to developing country Parties. It goes on to say that 'Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties'.

134. Article 4.7 goes onto note that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties. The extent to which developing country Parties will implement their commitments depend upon effective implementation related to financial resources and transfer of technology of developed country Parties.

135. Apart from commitments of the parties, the UNFCCC articles established subsidiary bodies for scientific and technological advice (SBSTA) and a subsidiary body for Implementation (SBI) which amongst their many tasks would 'Identify innovative, efficient and state-of-the-art technologies and know-how and advise on the ways and means of promoting development and/or transferring such technologies'. The SBSTA and SBI provide recommendations for draft decisions, which are forwarded to the annual Conference of Parties(COP) for consideration and adoption. Since COP 13, issues related to the development and transfer of technologies, have been considered by both of the subsidiaries.

136. Article 11 of the Convention provides for setting up a Financial Mechanism for provision of financial resources on a grant or concessional basis, including for the transfer of technology. These financial mechanisms include the Global Environmental facility which was originally formed in 1991 as World Bank's pilot program, but which was subsequently restructured during the Rio-Earth Summit in 1994 to serve as the financing facility for the UNFCCC .At the COP16, held in Cancun, Parties established a Green Climate Fund (GCF) (Decision 1/CP.16) which would be the operating entity of the financial mechanism of the Convention.

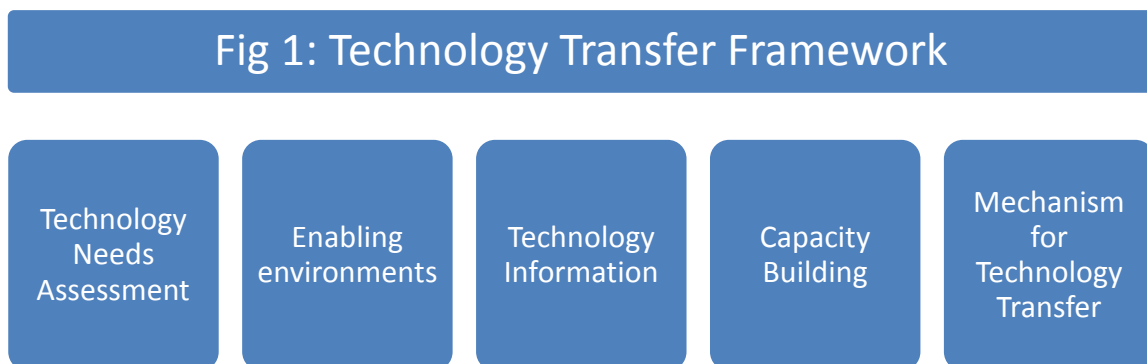
### II.3.1 MILESTONES IN TECHNOLOGY TRANSFER AT UNFCCC

137. Technology transfer had been part of international deliberations since the first meeting of the COP. But various key decisions and milestones were achieved progressively during each COP. The evolution of the key decisions concerning transfer of technologies is presented below.

- The Berlin mandate undertaken between COP 1 – COP 4 dealt with various issues such as setting up Projects inventory, financing, establishing a network of centres and held discussions on adaptation technologies.

- A consultative process was set in motion under the Buenos Aires Plan of Actions, to achieve agreement on a technology transfer framework. Regional workshops were held in Asia, Africa and Latin America between COP 4- COP 7.
- The Marrakesh accords reached by Parties at COP 7 adopted a technology transfer framework (via Decision 4/CP.7). The intent was to develop meaningful and effective actions to increase and improve the transfer of and access to environmentally sound technologies (ESTs) and know-how. The framework contained five key themes namely; technology needs assessments (TNAs), technology information, enabling environments, capacity building and the mechanisms for technology transfer(Fig 1). An expert group on technology transfer (EGTT) was formed comprising 20 experts with 3 members each from Latin America & the Caribbean, Asia & the Pacific and Africa, 7 members from Annex I countries, 3 members from international organisations and one member from Small Island developing states.
- The Bali Action Plan adopted at COP 13, reconstituted the EGTT for 5 years and adopted actions which enhance the implementation of the technology transfer framework. The Poznan strategic program agreed at COP 14, placed further emphasis on the Global Environmental Facility to scale up the level of investment in technology transfer in order to help developing countries address their needs for environmentally sound technologies. Three funding windows were made available for TNAs, Pilot priority technology projects and for the dissemination of GEF experience and successfully demonstrated technologies (See Fig 2).An initial funding level of USD 50 million was made available for this, of which USD 35 million was contributed from the GEF trust fund and USD 15 million from Special Climate Change Fund (SCCF).

**Figure II.1 Technology Transfer Framework**



**Figure II.2 Five Themes of UNFCCC Technology Transfer**



#### II.3.1.1. Technology Needs assessments (TNAs):

138. As on date, 95 TNAs which were funded by GEF are completed/ A Handbook for conducting TNAs was prepared which gives specific guidance on identifying technology needs for mitigation of and adaptation and to assist sector and technology prioritization processes. Two synthesis reports were generated which highlight technology priority needs and identify specific barriers to technology transfer and suggests measures to address them.

#### II.3.1.2. Technology Information:

139. This component of the technology framework was meant to facilitate the flow of information to improve development and transfer of technologies. The secretariat implemented a technology clearing house (TT: CLEAR), to facilitate the implementation of this theme.

#### II.3.1.3. Enabling Environment:

140. The Enabling Environment component focuses on government actions and policies which act as technical, legal and administrative barriers to technology transfer. The motive for this component was to identify conducive environments for private sector and public sector technology transfer such as adoption of appropriate regulatory frameworks that have transparency. A technical paper was commissioned by the UNFCCC secretariat and a workshop on enabling environments was held and a senior level round-table discussion was organized at COP 9.

#### II.3.1.4. Mechanisms for technology transfer:

141. The EGTT mandate to implement the technology framework was enhanced by addition of sub-themes on innovative financing and in developing a long-term strategy for technology development and transfer.

142. More recently at the Cancun agreements COP 16, 2010, Parties formed a Technology Mechanism, comprising a Technology Executive Committee (TEC) and a Climate Technology Centre and Network (CTCN), with the objective of enhancing action on technology development and transfer. This marked 'a step to move beyond the 'conventional' approach to technology that was based essentially on capacity building and technology needs assessments to a more 'dynamic' arrangement that fosters public-private partnerships; promoting innovation; catalysing the use of technology road maps or action plans; mobilizing national, regional and international technology centres and network; and facilitating joint R&D activities' as per UNFCCC (2013). A Green Climate Fund (GCF) was also established (via Decision 1/CP.16) which would be the operating entity of the financial mechanism of the Convention. Also, with the Cancun agreements, mandate for the EGTT for implementing the technology transfer framework has ended and the work is now handled by the Technology Executive Committee. At the Durban COP17, Parties finalised the governance and modalities of functioning of the TEC and the GCF.

#### II.3.1.5. Latest developments at Doha, COP 18

109. At the recently concluded COP at Doha in December 2012, about twenty six decisions were reached by the Parties. Some of the key decisions are highlighted.

143. • In pursuance of the Bali Action plan, the parties agreed on a work program which focuses on 'results-based financing' where ways and means were to be explored to make transfer payments based on results-based actions, to incentivize non-carbon benefits and to improve results-based finance.

- The parties agreed to advance the Durban Platform for Enhanced action, agreed at the COP 17, and which focused on making parties agree to a revised Kyoto or any similar new protocol concerning global emissions by 2015.
- The parties sought to establish an international mechanism to address loss and damage to especially vulnerable countries by the next COP.

- The long-term finance work program was extended by one year to highlight the scale up needed for USD 100 billion-a-year for mitigation actions and a 5th review of the financial mechanism would be carried out as per convention articles.
- Parties agreed to the modalities concerning the functional relationship among the COP, the Technology Executive Committee and the GEF.
- A decision concerning the location of the Green Climate Fund was also reached. The GCF is to be located in Songdo, South Korea.
- It was agreed that a UNEP led consortium would host the CTCN for the initial five years, with a possible renewal decided in the future at COP 23. The role and functions of personnel and the advisory board of the CTCN are highlighted in a MOU. The director of the CTCN was to report to the UNEP's executive director; whereas the advisory board of the CTCN will have equal representation from Annex I and non-Annex I country government representatives along with TEC, Green Fund and NGO representatives. UNEP shall receive budgetary contribution towards the CTCN expenses from the UNFCCC finance mechanism and various private and philanthropic sources.
- The Climate Technology Centre and the Technology Executive Committee are requested to establishing procedures for a joint annual report at forthcoming COPs. The COP provides guidance to the GEF to meet the total cost incurred for preparing National Adaptation Plan process for Least Developed countries from the GEF's Least Developed Countries (LDC) fund. Other developing countries to be supported using the Special Climate Change Fund (SCCF).
- An eight-year Doha work program is approved on education, training, public awareness and public participation to meet via Article 6, the objectives of the convention. This progress of this program will be reviewed by 2020.
- The COP resolved to produce a prototype web-based registry of national mitigation actions of developing countries before the COP 19.

### II.3.2 FINANCING TECHNOLOGY TRANSFER

144. Flows in Technology Transfer could involve (a) direct public financing for technology projects, (b) private flows through Foreign Direct Investment, (c) Joint-Ventures, (d) Co-operative research & Co-production arrangements. In practice there are difficulties in actually quantifying the technology transfer, unless a proxy such as financial flows is used as suggested by IPCC(2001). These financial flows may include Official Development Assistance, Foreign Direct Investment into equity or as commercial lending to projects involving ESTs.

145. The Global Environment Facility has served as an operating entity of the financial mechanism of the UNFCCC since the first Conference of Parties. Over the years, with successive replenishments of the facility every four years, the facility focused on various aspects of the transfer of Environmentally Sound Technologies. The Pilot program of GEF 1991-1994 focused on diverse technologies that could stabilize GHG concentrations in the atmosphere. After its restructuring (GEF 1), the facility promoted the use of commercialised or nearly commercialised technologies (which until then, were not disseminated in developing or transition countries) through long-term operational programs to support climate mitigation and program for cost-effective short-term Response measures. In later operational programs, between 1998 and 2007, mature and profitable technologies like energy efficiency and renewable energy were supported by the GEF. The fund tried to overcome human, institutional, technological, policy, or financial barriers to dissemination. So these projects were termed barrier removal projects, GEF (2012). In the fourth replenishment (GEF-4), six major technology transfer objectives were in focus i.e. Industrial and Building Energy efficiency, Market-approach for renewable energy, bio-mass based energy production, urban transport and land-use, land-



use change and forestry (LULUCF). In this period, the GEF supported the Poznan Strategic program which is elaborated in more detail below.

146. The last completed replenishment phase, GEF-5(2010-2014), received funding pledges of USD 1.4 billion. This phase has dual objectives which focuses on giving technology push to innovative technologies which are in the stage of 'market demonstration' or 'pre-commercialisation'. GEF 5 also focused on addressing barrier to transfer of technologies to developing countries, that are otherwise commercially available.

#### II.3.2.1 Poznan Strategic program on Technology Transfer:

147. At the fourteenth conference of parties to the UNFCCC, the Global Environment facility was invited to focus on four broad themes related to technology transfer. The GEF was asked to expeditiously facilitate preparation of projects for implementation a strategic program to help address the developing countries need for CSTs. The GEF had to support technology needs assessments of every Party in collaboration with the EGTT, the UNFCCC secretariat and the Climate Technology Initiative. It also had to prepare for a long-term implementation by identifying ways to fill pre-identified gaps related to private sector investment and promoting innovative project development in Environmentally Sound technologies. The GEF also had to report on progress achieved to both the SBSTA and SBI annual sessions.

148. The Poznan Strategic Program provided funding windows to support Technology Needs Assessments (TNAs), and pilot priority technology projects linked to TNAs and provide funding to disseminate GEF experience in respect of successfully demonstrated CSTs.

##### *II.3.2.1.1. Pilot Priority Projects:*

149. Fourteen proposals of technology transfer pilot projects were identified and funding amounting to USD 58 million from the GEF and another USD 195 million in co-financing<sup>16</sup> was provided. Of these 14 projects, 5 are in project implementation phase, 7 are yet to receive GEF agency endorsement and one project was cancelled. The technologies involved in these projects include renewable energy, energy efficiency, transport, agricultural irrigation, composting and Carbon Capture and Storage.

##### *II.3.2.1.2. Technology Needs Assessments:*

150. The GEF allocated USD 9 million to support and assist 36 developing countries in developing and/or updating their Technology Needs Assessments (TNAs). UNEP is the GEF agency carrying out this work under a Technology Needs Assessment project. UNEP's Division of Technology, Industry and Economics (DTIE) and the UNEP Risoe Centre<sup>17</sup> have undertaken the implementation of this project. The support envisages that countries go beyond TNAs into preparing what are national Technology Action Plans (TAP) which will prioritize technologies, and recommend a framework for the diffusion of these technologies and identify good technology transfer projects and links to financing sources. So far, GEF supported countries have submitted 12 draft TNAs and 7 TAP reports.

##### *II.3.2.1.3. Long-Term Implementation Strategy:*

151. The GEF's work mandate includes promotion of measures for long-term implementation of ESTs. Under this work program, the GEF is providing support to the Climate Technology Centres and Climate technology networks. It has established a Pilot Asia-Pacific Climate

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<sup>16</sup> Co-financing comprise project resources committed by the GEF Agencies (UNDP, UNIDO etc.), governments, other multilateral & bilateral sources, the private sector, civil society organizations(CSOs) and the beneficiaries themselves. Includes grants, loans, guarantees, in-kind support

<sup>17</sup> Located within Danish Technical University, it is a research and advisory institution and a UNEP collaborating centre on Energy.

Technology Network secretariat (Bangkok) and Finance Center (Manila). It is also piloting priority technology projects that promote, deploy and transfer innovative low-carbon technologies, such as Solar chills and promoting business models for scaling solar energy in India, to name a few.

152. Another key focus for the GEF's long-term strategy work includes promotion of Public Private Partnerships for Technology transfer. The GEF along with the International Finance Corporation (IFC) has established a GEF Earth Fund to engage with the private sector. It began with a USD 50 million pilot PPP initiatives in 2007 and currently supports portfolios of projects called Platforms which address a specific environmental problem, or leverages a particular financial instrument. The IFC is the executing agency that is currently handling a USD 5 million Platform Global Market Transformation for Efficient Lighting.

#### *II.3.2.1.4. Disseminating Experiences:*

153. The GEF disseminates information about successful EST program implementation to generate awareness about own role in the technology transfer process and to spread this information to a wider range of countries and audiences. It conducts Expanded Constituency Workshops (ECWs) which includes GEF focal points; focal points from the main GEF supported Conventions, representatives from civil society and representatives from the GEF Secretariat and the GEF Agencies. It also conducts side events at COPs and most importantly generates case studies on successful Environmentally Sound Technology transfer projects.

#### II.3.3 Current State of Investment in Renewables:

154. Foreign Direct Investment flows into the renewable sector increased from USD 55 billion in 2010 to USD 77 billion in 2011 .New global investment in renewable power and fuel in 2011 currently stands at USD 257.5 billion as highlighted in a report by Frankfurt School of Finance and Management (2012), of which \$168 billion was invested in developed countries and the remaining in developing countries. The US and Italy led investments through their Asset-financing and small-scale PV financing respectively. India showed the highest yearly growth of 62% in 2010-2011,<sup>18</sup> with the US following next with a 57% rise in investment. The breakup of such new investments may be made in terms of value chain activities. Investments in technology development, include venture capital, government & corporate R&D. Equipment manufacturing,

on the other hand receives funds from private equity and public markets. Projects take up funds made available through Asset finance and small distributed capacity projects. The rest of the investment is made into small project R&D activities.

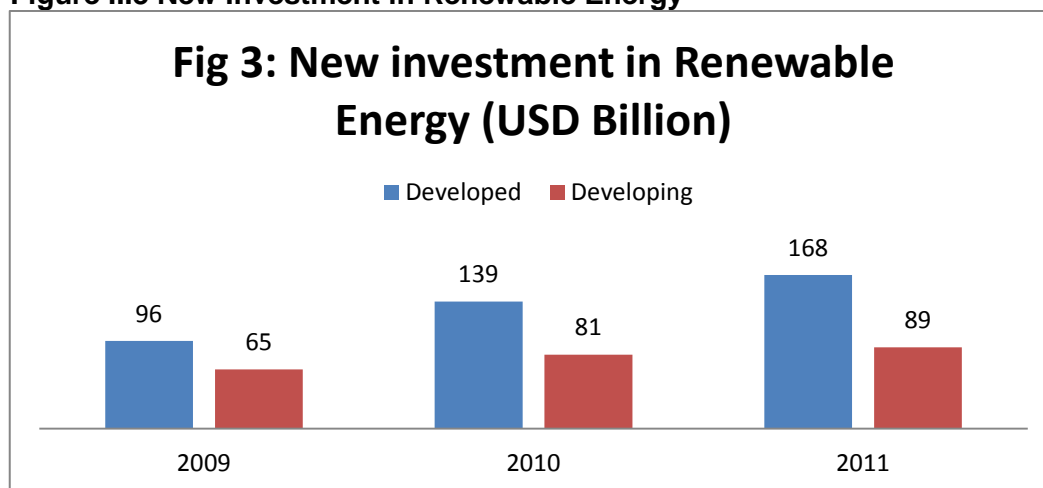
155. Solar and Small hydro were the only technologies which had a positive growth rate in new investments. Net investments fell in the rest of the technologies.

156. See Figures 3 and 4 for figures of net investments in Renewable Energy during 2009-11 and technology wise category of investment in Renewables in 2011. The trends are promising, though inadequate compared to potential demand for renewable technologies.

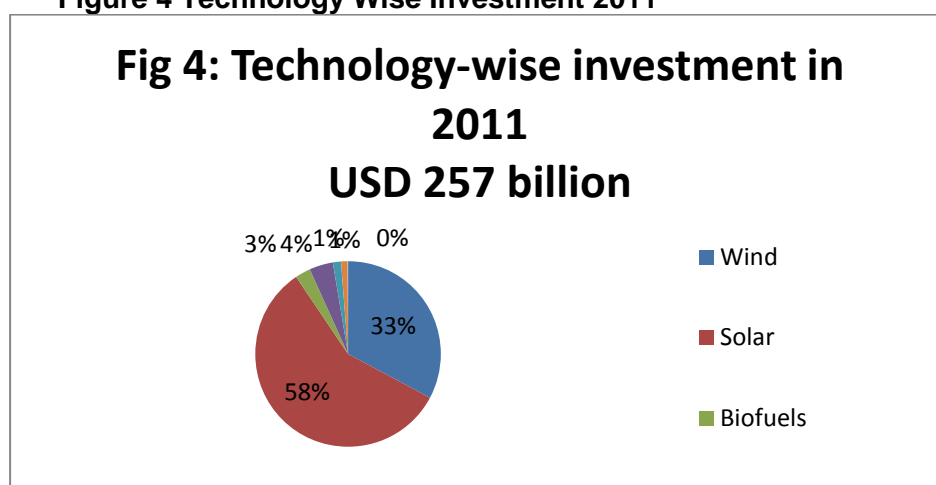
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<sup>18</sup> Data from fDi Markets OCO INSIGHT 2012.

**Figure II.3 New Investment in Renewable Energy**



**Figure 4 Technology Wise Investment 2011**



#### II.4. BARRIERS TO ENVIRONMENTAL TECHNOLOGY TRANSFER

157. The IPCC Working Group III generated a special report in 2000 on Methodological and Technological issues in Technology Transfer under request from SBSTA. This report highlights the common pathways and barriers for technology transfer in exhaustive detail. The IPCC report identifies that Technology Transfer pathways could involve Direct Government Assistance, Direct Purchases, Licensing, Foreign Direct Investment, Joint Ventures, and Co-operative research & Co-production arrangements. It goes on to highlight a list of important barriers, which could impede the transfer of Climate Sound technologies. That list is adapted as per policy tool recommendations and is provided under the broad themes of “Enabling environment” and “Financing & Participation”.

##### II.4.1 Enabling Environment

158. The IPCC report identified a set of policy tools under the theme “Enabling Environment” which if addressed will improve Technology Transfer in ESTs.

##### *II.4.1.1. National systems of Innovation and Technology infrastructure:*

159. Insufficient human and institutional capabilities could mean a lack of knowledge with the local private industry and a lack of educational and skill institutions. This leads to an inability to assess, select, import, develop and adapt appropriate CSTs. It also means that there is no industry-government collaboration. The report suggests that countries build local firm’s capabilities for innovation and develop technical and scientific institutions.

*II.4.1.2. Social Infrastructure & participatory approach:*

160. Historically, depending on whether or not NGOs and aid-receivers chose technology path for development, NGOs and social organizations may not have the capacity to replicate technology transfers. Therefore it is necessary to have policies to build new private sector focused social organizations with skills to achieve technology replication.

*II.4.1.3. Macroeconomic Policy framework:*

161. An underdeveloped financial sector, high import duties, high or uncertain inflation or interest rates, uncertain stability of tax and tariff policies, investment risk coupled with low private sector involvement due to lack of access to capital, inadequate financial strength of smaller firms and subsidized prices for energy are notable barriers listed under this category. To address this, the report notes the need for direct (grants, loan guarantees) and indirect (tax credits and currency regulations) financial support along with better investment and trade policies and better financial regulation.

*II.4.1.4. Sustainable Markets for Climate Sound Technologies:*

162. Lack of consumer awareness and acceptance of relevant technologies and uncertainty in markets for technologies coupled with high transaction costs also form notable barriers. Conducting consumer education campaigns and developing SME capacity to handle adaptation technologies and targeted purchasing by public sector can alter market demand and improve technology supply.

*II.4.1.5. National Legal Institutions:*

163. A country with poor intellectual property rights protection record and lax legal processes to enforce contracts and property law is unlikely to receive technology. Strengthening of legal institutions and making legal and administrative processes transparent will reduce this risk.

*II.4.1.6. Codes Standards and Certification:*

164. There is a lack of technical standards and institutions, which support such standards through testing and certification, which forms a formidable barrier. This leads to improper assessment of producer quality resulting in choice of an inefficient technology. Lack of guidance on cash discount rates is also an obstacle to project implementation connected to CSTs. It is therefore important for countries to develop an institutional framework to address these issues.

*II.4.1.7. Equity, Social Impact and rights to productive resources:*

165. Some stakeholders are made worse-off by technology transfer. Therefore countries must create analytical tools for assessing such social impact and compensate affected stakeholders. Every technology transfer program must identify the impact it has on property rights, including land, water and forest.

*II.4.1.8. Research and Technology Development:*

166. Insufficient investment in Science, Education and R&D must be addressed by providing targeted research grants and building public research laboratories.

**II.4.2 Financing & Participation**

167. Under the theme "Financing & Participation", the IPCC report lists the following policy tools to improve Technology Transfer in ESTs.

*II.4.2.1. Public Sector Finance and Investment:*

168. Uncertainty about future energy prices, unproven technology and high costs of developing new public infrastructure, can cause constraints in access to capital. The public sector must provide direct finance, or provide access to overseas development assistance or multi-lateral development finance.

*II.4.2.2. Private-Sector Finance and Investment:*

169. The private sector, which finds it difficult to handle high front-end costs, must be supported by mechanisms such as microcredit, leasing, venture capital and project finance.

170. Private-Firm Investments: Private firms make significant investment decisions themselves in certain sectors like buildings, transport and energy. Internal decisions within firms may delay adoption of new technology due to market prices, regulations and external macro-economic conditions. Incentives to firms to make environmentally sound investments, such as energy taxes, investment tax credits, and emissions fees will address this problem.

*II.4.2.3. Public-Private Partnership:*

171. Build Own and Transfer (BOT) mechanism has proven to be a very successful mechanism for high-climate impact sectors like transport, oil & gas and power. The same BOT programs support the use of climate unfriendly technologies due to their insistence on proven technology, for example, coal based generation is preferred as compared to renewable sources. This can be termed as a failure to internalize environmental costs of using a proven but climate unfriendly technology. Developing technical partnership programs and informational initiatives and voluntary-agreements with the private sector, which is a form of self-regulation, can lead to successful PPPs. An example of voluntary agreement is the US Environmental Protection Agency's Green Lights program under which private firms invest in energy-efficient lighting in return for technical expertise and gaining on public relations.

*II.4.2.4. Technology Intermediaries:*

172. Firms may lack the capacity to contract and conduct technology transfers and may lack credible information on potential partners. The creation of information networks, advisory centers, databases and libraries and having intermediaries perform technology services like energy audit services etc. can help address the technology transfer barrier.

*II.4.2.5. GEF - Lessons Learnt from Successful CST Transfer:*

173. *Financing Incremental Costs:* The GEF notes that it is particularly important to finance technical assistance and provide initial investment support to cover the cost differential (incremental costs) between new and existing technologies. This will enable countries to undertake innovative pilot project designs buyoff-setting high initial transaction costs.

174. *Technology projects must address barriers:* Pilot CST projects and demonstrations are needed to demonstrate ways to address barriers to technology in a tangible manner. For example, GEF supported a project in Bangladesh, which was replicating a brick-making project in China. This project addressed technical, capacity, and commercialization barriers. In Hungary, local lenders, due to lack of experience, were reluctant to lend to energy efficiency projects. The GEF co-financed an energy efficiency-lending program where it addressed these institutional and economic barriers by expanding loan guarantees to the lenders and technical assistance through IFC support.

175. *Commitment of local partners:* Often technology projects span multiple phases and go onto different years. Therefore commitments from local and national partners are needed plan and implement various activities of the project.

176. *Engagement of Private Sector:* With the presence of a clear business model, the private sector can be engaged in various ways, either as a clean technology supplier, EPC contractor or as financial service providers. Such engagement is always beneficial for technology transfer.

177. *Understanding Technology Options:* It is necessary for funding agencies to understand relative merits of different CSTs. Different technologies might have different financial, environmental, geographic and capacity needs. Replication of such technologies might need long-term capital commitments and may build path-dependency.

178. *Follow Comprehensive approach:* The GEF notes that successful technology transfers more often had multiple reinforcing components like policy support in the form of renewable portfolio standards, investment incentives like feed-in tariff, tax credits for investment and production and capacity building at national, sectoral and firm level.

#### II.4.3 Successful Case Studies

179. In spite of existing barriers, continued financing by the GEF and co-financing from national, private and other donor agencies resulted in few demonstrable climate technology initiatives. A few success stories are highlighted. These cases are drawn from India, Egypt, East Africa and China and apply to energy efficient and renewable energy technologies.

#### **BOX-II.1: Concentrated Solar - Al-Kuraymat Integrated Solar Combined Thermal Plant**

Location: Al-Kuraymat, 92 km from Cairo, Egypt.

Funding: GEF (Grant - USD 50 million to cover incremental costs), Japan Bank for International Cooperation (Soft loan - JPY 10.67 billion), New and Renewable Energy Authority (NREA), Egypt (Local Currency)

Rationale: Integrated solar combined cycle systems utilise both solar and fossil fuel based energy to generate power. Worldwide they have reached commercial readiness and can produce electricity at costs of \$0.20/kilowatt hour (kWh) and are suitable for base load power generation. But there are not many integrated combined plants which

Evolution and Implementation: In the pre-feasibility phase in 1997, three of the dominant CSP technologies were studied with financial help from the EU. Parabolic trough reflectors were compared against dish-collectors and central-tower receiver technologies. In this phase, as part of a Capacity building exercise, 5 engineers from NREA were trained in the US and Spain on CSP technology operation and maintenance. Site selection was made possible by technical assistance by the IEA and Solar PACES. Kuraymat site was ideal due to its proximity to power-grid lines, water and natural gas source and above all good solar radiation (2400 watt-per-m<sup>2</sup>) all around the year. In 1999, formal feasibility study for an 'Integrated Solar Combined Cycle System' (ISCC) commenced when NREA awarded a contract to a German firm, which again in 2003, assisted in preparing Request for Proposal for EPC and O&M and their evaluation and negotiations.

The process was taken up in parallel for the *Solar island* and the *Combined Cycleisland*. The process completed in 2007 with award of combined cycle island contract to Iberdrola Ingeniería y Construcción (JPY 17.43 billion plus Egyptian Pound 282 million) and solar island plant contract to OSRAM Construction Industries (USD 74 million plus Egyptian Pound 210 million). After completion in 2011, the plant is rated at a capacity of 126 MW, of which 20 MW is generated through solar sources and the rest through fossil fuel portion. The solar field is about 130,800 square metres and generates heat at 393<sup>0</sup>C. The project is estimated to add an 80-85 GWh of renewable power over a conventional IGCC system and reduced carbon emissions of about 149,975 tonnes over the entire project's life. As per GEF (2012, p. 12), the Al-Kuraymat project has demonstrated that CSP technologies for an ISCC are relatively mature and can provide power when the sun is down and thereby reduce complexity associated with storage and grid-integration. Clarity on the business models and the role of the local governments when a project is privately-financed and competitive bidding to select EPC contractors, supportive local policies like tax credits for financial attractiveness and involvement of local power firms to reduce technical risk are cited as success factors and best practices to be used elsewhere.

Source: Transfer of Environmentally Sound Technologies: Case Studies from the GEF Climate Change Portfolio, p. 8-10

### **BOX –II.2 Fuel Cell Buses- China**

Location: Beijing and Shanghai, China

Funding: GEF (USD 11.6 million) and Co-financing (USD 23 million)

Rationale: Fuel Cell Buses (FCBs) are clean energy transport technologies that are nearing commercial readiness but need demonstration projects to verify performance, assess potential, and determine needs for co-located hydrogen supplies and fuelling infrastructure GEF (2012, p. 26). China's problems with urbanisation and growing need mass transport and a presence of a national hydrogen energy vision and road map made it a suitable location for this technology demonstration project. The project was intended to demonstrate the effectiveness of FCBs for urban transport, and the possibility of refueling infrastructure in Chinese cities and to measure and verify any reduction in air pollution due to FCBs. This project was intended to encourage local manufacturers to reduce costs by scaling production.

Project Evaluation and Implementation: The project was planned to be undertaken in four phases. In the first feasibility phase 1998-2001, Chinese experts collected data and analyzed it to design the overall project. Between 2002 and 2011, public transport companies of Beijing and Shanghai put 6 FCBs into operation. In the proposed third phase (2012-2020), other cities will also be selected to demonstrate FCBs.

Three manufacturers Daimler-Chrysler, Beiqi Foton Motor Company and Shanghai Automotive Industry Corporation, with different underlying technologies and suppliers demonstrated these technologies so far. A hydrogen refueling station, which can serve 8-10 buses for three-four times a week, was built inside the Yongfeng High Technology Park, Beijing. The three FCB companies put together ran a total of 170,888 Km, carrying 223,211 passengers and avoided an estimated 1,010 tonnes of CO<sub>2</sub> emission equivalents.

The GEF notes that investment needs of fuel cell technologies are substantial and an early identification of this need and assessment of alternative technologies is needed for a cleaner urban transport solution (GEF, 2012, p. 29).

Source: Transfer of Environmentally Sound Technologies: Case Studies from the GEF Climate Change

### **Box II.3 – Greening the Tea Industry in East Africa**

Location: East Africa Region (Kenya, Uganda, Tanzania, Burundi, Rwanda, Malawi, Zambia, Mozambique)

Funding: GEF (USD 3.42 million) and Co-financing (USD 25.61 million)

Rationale: The Tea processing and export industry in Eastern Africa is a crucial industry, earning a high share of export earnings (almost 20% for Kenya and 12% for Rwanda) and employing 1.1 million people directly and providing livelihood support to 4 million more people indirectly in aforementioned countries. At the same time, tea processing is as energy-intensive as the Steel industry, with electric power needed for cutting, tearing, rolling, fans, transport, sieving, lighting etc. and thermal energy needed for drying and withering the tea leaves. The proposed program moreover fit with GEF's strategic priorities to enable "Access to Local Financing Resources for Renewable Energy and Energy Efficiency" and improve "Power Sector Policy Framework Supportive of Renewable Energy and Energy Efficiency" (GEF Secretariat, 2006), by reducing 0.76 tonnes of CO<sub>2</sub> equivalent over 20 years.

Project Implementation: Under this on-going project, 19 tea factory sites, working under the aegis of the East African Tea Trade Association (EATTA) will have access to clean and reliable electricity from small hydropower for their processing needs, as a substitute for expensive and unreliable electricity from the grid and diesel backup power. Tea plantations are generally located in areas receiving 1200 to 2500 mm of rainfall per year and can be potential sites for small hydropower of capacity 0.3 to 5

MW. This project expects to invest USD 22 million in at least 6 pilot projects to produce 10 MW of power. Reports submitted to the GEF council outline five major outcomes that this financing program aims to achieve. The outcomes that the project aims to bring about are to boost investment confidence in small hydro sector, to enhance technical capacity to construct small hydro plants and fabricate associated equipment, put in place PPP models for rural electrification, to make the local regulatory environment conducive to rural electrification, and make power purchase agreements viable in the small hydro sector. The project partners include, the UNEP, as the implementation agency of the GEF, the African Development Bank (AfDB) and Pro-Invest, a 10-million EU development fund for Africa, Caribbean and the Pacific.

As per the plan, at least 6 projects in four different countries would be chosen for demonstration where at least one project would have a rural electrification component and at least one other project will have public-private partnership. The programme is ongoing.

Source: GEF website ([http://www.thegef.org/gef/gef\\_projects\\_funding](http://www.thegef.org/gef/gef_projects_funding)); Project Executive Summary, GEF Council Submission, GFL/2328-2721-PMS: GF/4010/5 Final Draft, April 2006

#### **Box II.4 – Energy Efficiency improvement in Steel rerolling mills, India**

Location: Six geographical steel rerolling industry clusters, India

Funding: GEF (USD 7.03 million) and Co-financing (USD 25.11 million)

Rationale: India is the fifth largest Steel producer in the world and stands as the most energy-intensive among the top five. Steel rerolling industry is unique to India with over 1200 mills in operation. Information and knowledge barriers prevented a widespread adoption of energy-efficient and environmentally friendly technologies in small and medium scale mills. The project sought to reduce GHG emissions by providing technical assistance in adopting 'EcoTech' technologies, which are energy efficient, and at the same time economically viable under local conditions. Savings of nine PetaJoules (2500 GWh) of energy and 37 tonnes of CO<sub>2</sub> emission reduction were expected in 20 years. Moreover, the cluster organisation of this industry meant faster penetration of any industry best practice.

Project Implementation: The project has successfully concluded with different initiatives succeeding. The project identified 19 EcoTech technologies which are suited to different plant sizes and throughput are identified, a cluster mapping exercise was undertaken which identified technologies for a geographic cluster and as on September 2009, 47% of the identified mills commissioned their respective improvements and audit agencies approved 31% of such industries for release of capital subsidy. The project also identified 10 technology packages for re-heating furnaces of which 5 were low-end such as use of Coal-Bed methane and biomass as a fuel source and 5 other technologies were high-end with technologies like a regenerative burner and oxy-fuel combustion system. The Ministry of Steel of the Government of India, along with UNDP implemented the program.

Source: Project Executive Summary, PIMS 1515, GEF Council WP submission, April 2003 and Project Website ([www.undpgefsteel.gov.in](http://www.undpgefsteel.gov.in))

## II.5. INTELLECTUAL PROPERTY RIGHTS AND CST TRANSFER

180. Climate smart technologies (CST) are mostly concerned with products and processes and thereby render patents, industrial designs, utility models and trade secrets as the only IPRs of interest and further study. Sui-generis rights, especially those that relate to plant breeder's rights, which are meant to protect intellectual property over drought, heat and pest resistant crop varieties are important in the context of climate smart technology analysis. The focus in this section will be to study the extent of IP protection in climate and environmentally sound technologies and their possible impact on technology transfer.



181. In the international context understanding IPRs is even more important due to the cross-border nature of technology and finance flows in ESTs. Maskus (2010), highlighted at least two problems with respect to international technology transfer. First is an issue of asymmetric information. Technology transfer involves an exchange of information between those that have it and those that do not. The former cannot fully reveal their knowledge without destroying the basis for trade and partners cannot fully determine the value of the information before buying it. This can lead to large transactions costs that reduce market-based technology transfers. Secondly, externalities may arise if the costs and benefits of technology exchange are not fully internalized by those involved. A major share of benefits to recipient countries is likely to arise from uncompensated spillovers that occur when imitation, trade, licensing, and FDI and inter-firm movement of technical personnel takes place. When such spillovers occur multinational firms may hold back, generating a sub-optimal global allocation of investment resources.

182. Majority of IPRs related to international trade are governed by WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), negotiated in the Uruguay Round during 1986-94. However, within this framework, flexible mechanisms exist which enable transfer of critical technologies. Within the text of the TRIPS agreement, Article 7 recognizes that the protection and enforcement of intellectual property rights should contribute to the transfer and dissemination of technology. Article 66.2 requires developed-country members to provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country members, so as to enable them to create a sound and viable technological base. Also of particular interest is Article 30 and 31, which grant exceptions to rights conferred and use without the authorization of patent holder.

183. At the outset, it may appear that any IPR can constitute a barrier to transfer of environmentally sound technologies. The grant of exclusive rights and placing market monopoly with an innovator through grant of a patent may be contrary to the provision of a public good, such as a clean environment.

184. Khor (2012), notes that IPRs as a real barrier may depend on the patent-status, commercial viability of patented technology, cost-effectiveness of alternatives, level of competition and the prices at which it is sold, and the reasonableness in licensing terms. Moreover, his article categorizes known issues with technology transfer with non-patented (public domain), patented as well as future technologies.

#### II.5.1 Determinants of Technology Licensing and Transfer

185. Many researchers have conducted detailed econometric analysis of the nature and extent of transfer of technology concerning climate friendly technologies.

186. Antoine Dechezleprêtre et.al (2007) in their study on 644 CDM projects found out that technology transfers take place in 44% of CDM projects, accounting for 84% of the expected annual CO<sub>2</sub> emissions reductions. These transfers mainly concern two areas. The first is end-of-pipe destruction of non-CO<sub>2</sub> greenhouse gas with high global warming potential, such as HFCs, CH<sub>4</sub> and N<sub>2</sub>O. This concerns the chemicals industry, the agricultural sector and the waste management sector. The second is wind power. Other projects, such as electricity production from biomass or energy efficiency measures in the industry sector, mainly rely on local technologies.

187. What is interesting in this study is that it shows that only 12% of CDM projects in India include an ITT, compared to 40%, 59% and 68% for Brazil, China and Mexico, respectively. The authors explain that India may have a better ability to diffuse domestic technology.

188. In the econometric analysis, the authors have used a binary response model which included factors such as the project size, the credit buyers, the availability of similar technology within the host country, the presence of subsidiary of a technology transfer company and

macro-economic variable conditions such as GDP growth rate, population, FDI inflows, merchandise trade (export, import) and finally technological capability measured by the ArColIndex produced by Archibugi (2004).

189. The authors note that in the energy and chemicals sector, presence of high technological capability of the host industry improves technology transfer, whereas it is not so in the agricultural sector. The authors recommend that large scale projects are implemented, preferably with the technology company's subsidiary along with assured credit buyers to improve chances of technology transfers.

190. One of the trends observed in this paper is that projects that reduce Hydro-flouro-carbons (HFCs) involve technology transfer because they are a better good source of Certified Emission Reduction credits (CERs) as compared to CO<sub>2</sub> reduction projects. Interestingly, FDI inflows do not affect the level of technology transfer, which is contrary to a priori assumption that it might have a positive impact.

191. In a similar vein, Kim (2006) conducted empirical analysis on how firm-level characteristics influences technology transfer. A study on US traded firms concluded that, the stock of technological knowledge of the licensor, a firm's prior exposure to licensing, the rate of growth of its primary sector, the strength of IPR protection, and the nature of the technology to be important determinants of the propensity to sell technology through nonexclusive licenses. A key point of this study was that smaller firms with simpler technologies sell through exclusive licenses and large firms having complex technologies engage in cross licensing.

192. Instead of converting technological transfers to GHG control efforts which is a flow variable, the transfers can go to an environmental investment sector in the recipient region. The technological stocks from the investment contribute to GHG mitigations Nordhaus (2006).

#### *II.5.1.1. Constraints in transfer and licensing*

193. *Non-Patented Technology:* A non-patented technology could imply that a recipient may have to pay royalty or license fee for more than 20 years since there is no expiry term, as would be the case of a patent and therefore a technology can enjoy unlimited-time protection. An inventor can choose to protect a technology through well-guarded trade secrets, which are difficult to work-around and enjoy protection under the tenets of contractual law in most countries.

194. *Black-Box Problem:* A threshold problem wherein the technology recipient will not want to buy technology about which he/ she does not know enough, whereas, the technology supplier is unwilling to share more information for fear of revealing non-patented trade secrets.

195. *Rights to Improvements:* A common contention in all technology transfer process is the perspective on rights over an improvement made "downstream" by the other party after the technology transfer process is completed. The licensor perspective is that the value of downstream improvements was not factored into the license price initially and he sees an entitlement of further fee or royalty. A licensee on the other hand may feel that the technology may be rendered obsolete or diminished in value when a licensor improves the technology.(Schroeder, 2013)

196. *Joint Inventions:* Technology transfers may include some element of development, customization or changes to the underlying technologies themselves. The contention between parties could be on the rights to IP developed as part of technology transfer process.

197. *Patent Indemnifications:* Disagreement over who bears the indemnifications or liability from patents is another factor contributing to low levels of technology transfer.

## II.5.2 Trends and ownership of EST patents

198. In climate related-technologies, Khor(op.cit), notes that developed countries have an overwhelming dominance in patents world-wide, with the EU, US and Japan together holding 76.7% of renewable energy patents, whereas, China and Korea together held a meager 5.2% share. (Lee et.al 2009) report on the patent ownership of six renewable energy technologies, including wind, solar PV, concentrated solar power, biomass to electricity, cleaner coal and CCS) concludes that the US, Japan and Germany are the foremost in innovation.

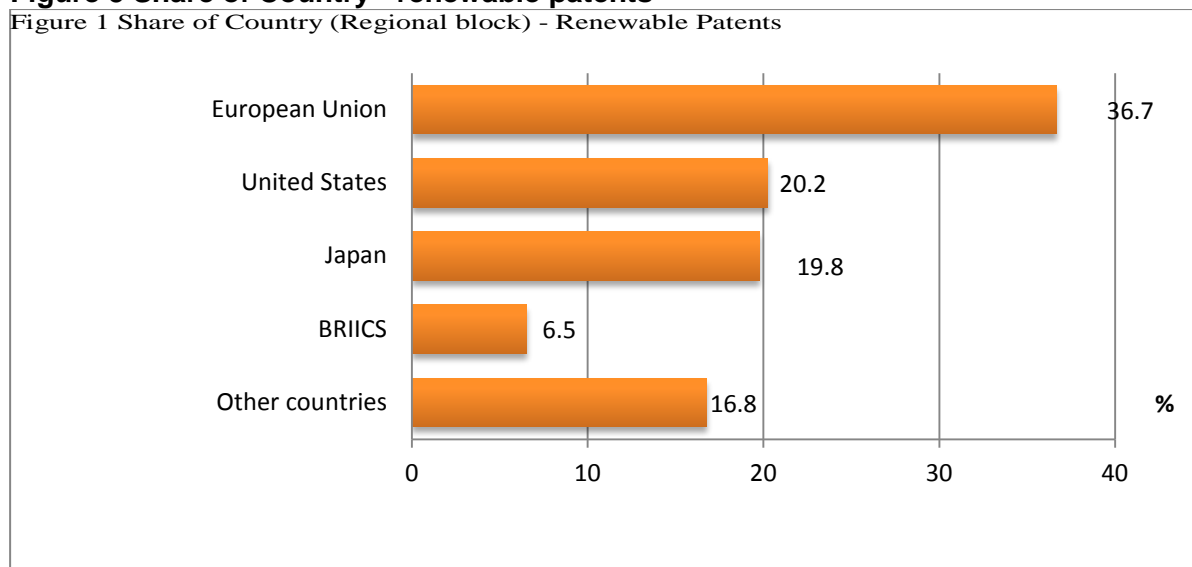
199. Carbon Capture and Storage technologies (CCS) which has sub-sector breakups of technologies such as Amine adsorption, membrane technologies, oxy-fuel combustion, IGCC and carbon sequestration is dominated by patents related to capture processes and methods, as noted by (Damodaran, 2011, pp. 5-6). An analysis of patents pertaining to CCS technologies filed at US, EU, Japanese and Australian patent offices reveals that carbon capture technologies form slightly greater than a quarter percent of such patent filings (Ibid).

200. In automobile pollution technologies, the BRIICs countries had only 0.7% shares whereas the EU (49%), Japan (31%) and the US (14%) held highest share. In agriculture, concerning climate-resistant plant variety patents, (ETC Group, 2008) notes that “six gene-related companies and their two biotech partners control 201 or 77% of the 261 patent families”.

201. A South Centre (2009) report on TRIPS flexibilities highlights that barriers to transfer can range from high royalty fees, refusal to license, “ever-greening of patents”, and increased patent litigation and impediments to innovation. Figures 5 and 6 carry details of the Patents held over CSTs by European Union, BRICS countries, Japan and USA and the patents obtaining over different classes of renewable energy. Figure 7 shows the growth in patents in CSTs during the period from 1995-2005. It is clear that CSTs are dominantly produced in developed countries.

### Figure 5 Share of Country - renewable patents

Figure 1 Share of Country (Regional block) - Renewable Patents



Source: OECD, Compendium of Patents 2008

Figure 6 Share of Patents in Renewable Energy

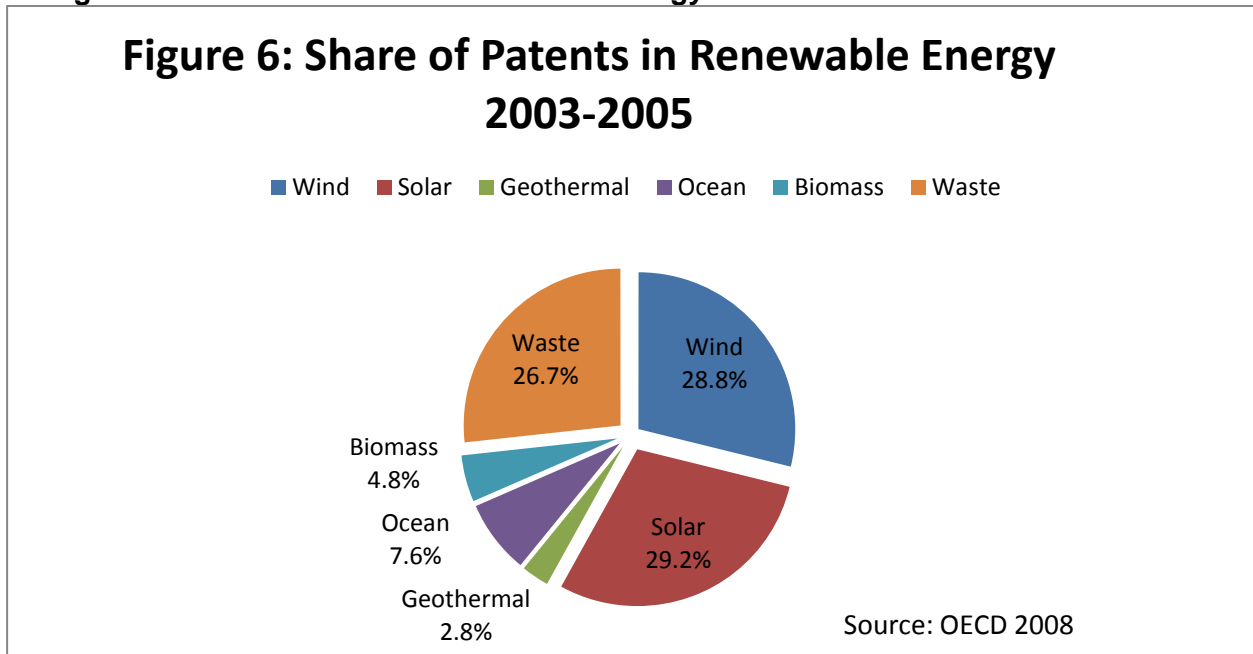
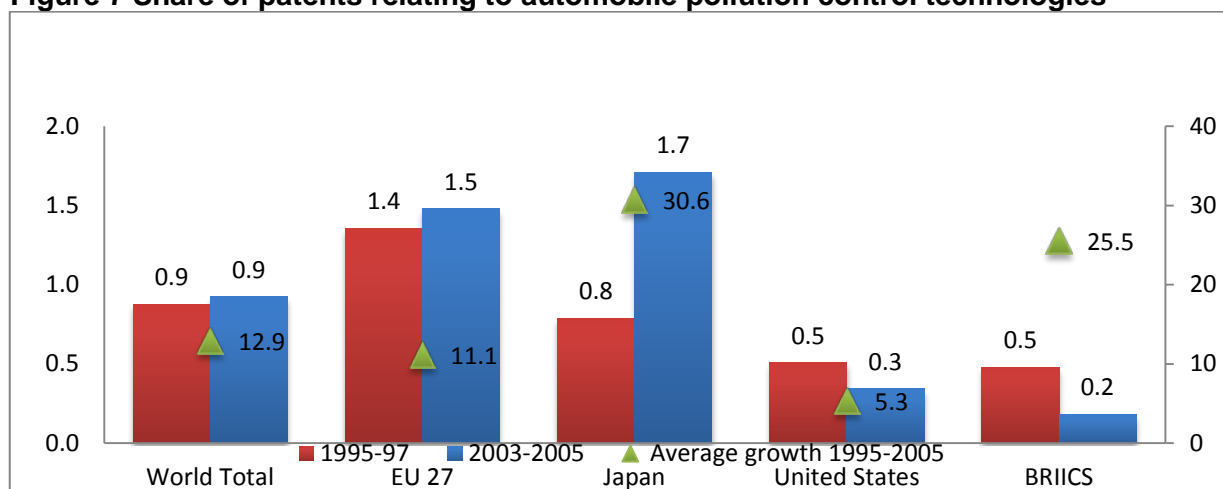


Figure 7 Share of patents relating to automobile pollution control technologies



Source: OECD, Compendium of Patents 2008

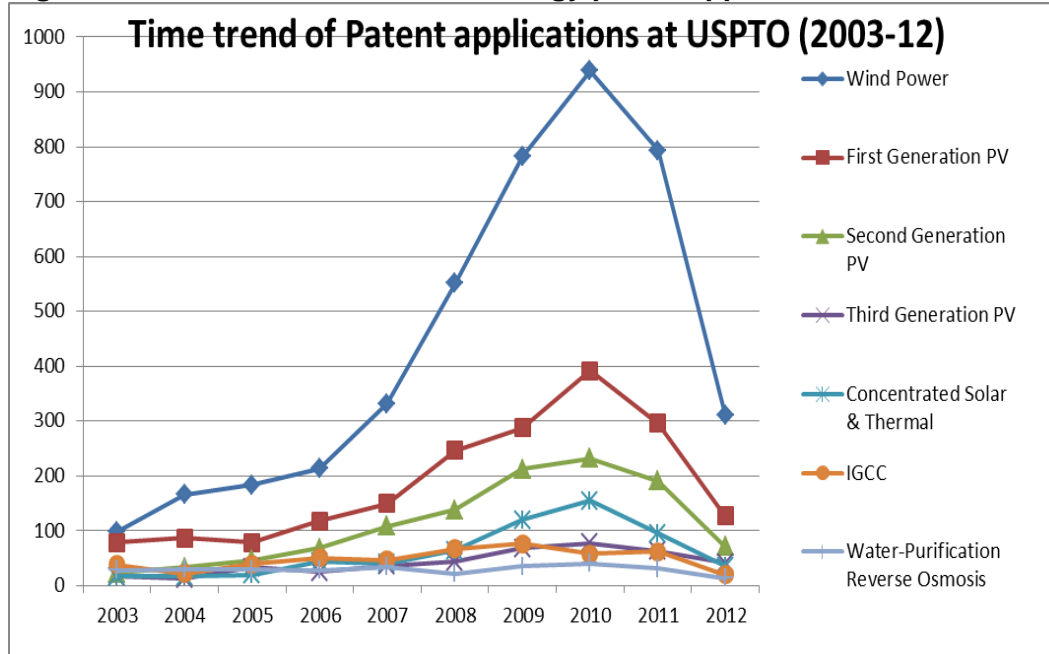
#### II.5.2.1. Analysis of USPTO and EPO Data

202. Over the past decade 2003-2012, there has been a trend of increasing patents in almost all of the Climate Sound Technologies. An analysis of patent applications made at the USPTO highlights that patent trends were roughly the same in prominent technologies with a gradual rise between 2003 and 2007 and an increased application rate from 2008 to 2010 and a fall in the past two years as compared to previous years.

203. For the purposes of clarity, a classification of Solar Photovoltaic (PV) technologies was done as per IRENA (2012), working paper. The classification includes, First generation photovoltaic cells which are in commercial use includes crystalline Silicon (c-Si) either single or polycrystalline, Second generation cells which are in early market deployment phase include thin-film PV technologies which include amorphous and micro morph Silicon (a-Si), Cadmium Telluride (CdTe), Copper-Indium-Diselenide (CIS) and Copper-Indium-Gallium-Diselenide (CIGS) systems. Finally, the Third generation of PV cells is those under development and demonstration, which includes PV, cells for Concentrated Solar applications, including multi-junction cells and Organic and other Dye-Sensitized cells.

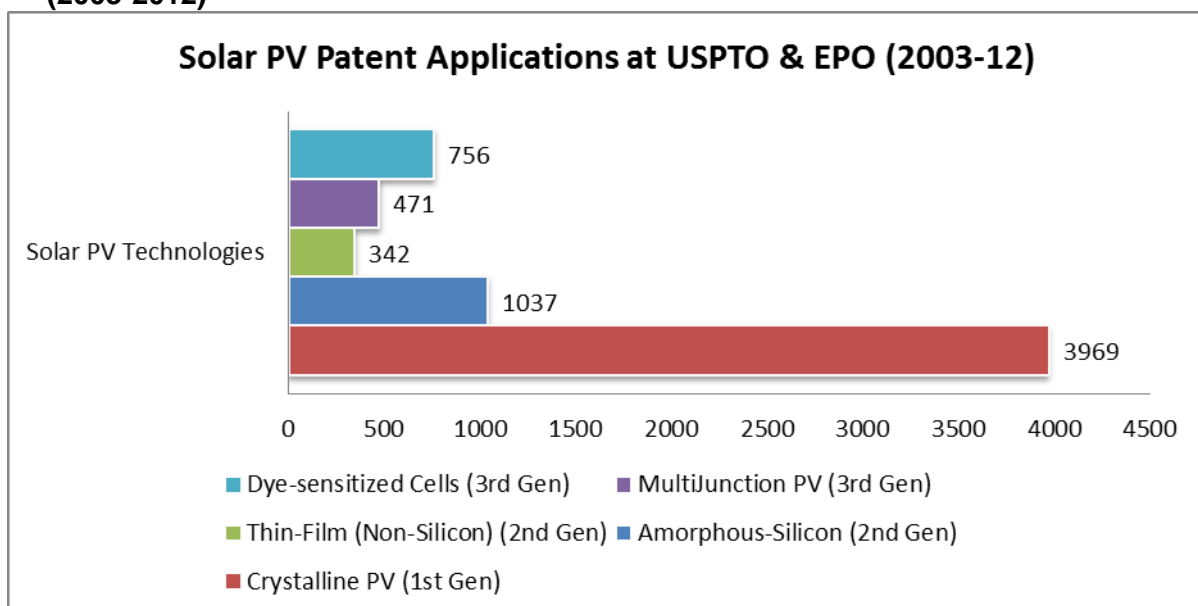
204. The patent application trends for a select group of technologies displayed below include solar photovoltaic, concentrated solar for thermal and power generation, wind-related (both drive-train and blade manufacturing related), water purification systems using reverse-osmosis and IGCC related technologies.

**Figure 8 Trends in select EST technology patent applications at USPTO**

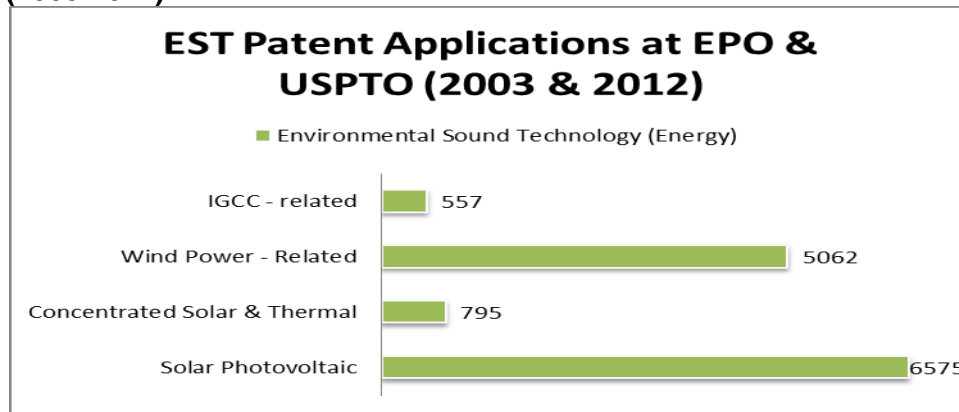


205. AS Figures 8 and 9 demonstrate, in terms of numbers, most patent applications in the past decade were in the solar photovoltaic technologies, of which crystalline PV still formed a major proportion, but thin-film technologies and dye-sensitized cells came close in recent years in terms of annual numbers. Solar PV is followed by Wind-related and Concentrated Solar related technologies and reheat technologies used in combined cycle power plants. Fig 10 , which illustrates the USPTO and EPO patent applications during 2003-12 , express the simple fact that the lion's share of patents is cornered by wind sector patents in both US and Europe.

**Figure 9 Break up of Solar PV technology patent applications at both EPO and USPTO (2003-2012)**



**Figure 10 Technology Wise Breakup of EST patent applications at EPO and USPTO (2003-2012)**



206. Analysis of the top assignees for the patents in the past decade reveals that the concentration of patents in the wind and combined cycle power is highly skewed, with the top five assignees in the applications being close to 47% and 54% respectively. Proposed Wind related patent assignees were large power engineering companies based in the US, Denmark, Germany, Japan and Spain. IGCC technology patent assignees mostly are private firms from the US, France, Japan, Germany and Italy.

207. In the past decade, between 2003 and 2012, there is an even spread in assignees for solar photovoltaic patents across all the three above-mentioned generation technologies. However, apart from a handful of electronic firms in South Korea, most of assignees came mostly from the developed countries, which notably included public universities and government departments in the US. Most assignees for thin-film technologies (second-generation) are firms in the US. Among third generation photovoltaic systems, assignees for multi-junction cells, touted for concentrated photovoltaic are from the US and Germany. Assignees to Dye-sensitized cell systems were again mostly from South Korea, Japan, Taiwanese and included a few Chinese firms.

208. For, Concentrated solar power on the other hand there was only one Japanese firm among the top ten assignees, and majority of assignees are firms from Germany, the US, France and Spain. Assignees for Reverse osmosis based filtration patents, are mostly firms in the US engaged in businesses as wide as mining to health and nutrition. Some European firms are exclusively in the business of water purification.

## II.6. RECOMMENDATIONS TO OVERCOME IPR-RELATED BARRIERS

209. Researchers hold differing views on whether IPRs and specifically patent protection restricts access to CSTs. Maskus (2010) contends that there little evidence to support significant limitations to international technology transfer. (See Maskus: "Transfer of Technology to Developing Countries: Unilateral and Multilateral Policy Options", World Bank Policy Research Working Paper 3332, June 2004) wherein he develops a typology of countries with appropriate policy rules of thumb Maskus goes on to state that it is unlikely that an international agreement on a compulsory licensing regime could achieve significant transfer of technology. Khor (2012, p. 2) is of the view that IPRs is a barrier to technology transfer depending on whether or not a particular technology is patented, or whether there are viable and cost-effective substitutes or alternatives, the degree of competition, the prices at which the technology is sold, and the degree of reasonableness in terms of licensing. and According to Khor op.cit , by far patents constitute a barrier to technology transfer as evident by the reluctance on the part of proprietary firms to transfer technology in respect of CFC replacement gases to India and South Korea in the 1990s.

210. Maskus' view is in diametric opposition to Khor's. He proposes that the extension of the patent term must be granted to compensate for regulatory delay caused by national patent authorities. He also suggests that a promise of patent term extension tied to licensing and technology transfer commitments will enable positive technology transfer. While banishing the argument that ESTs must be excluded from patent eligibility, the author notes that expedited patent examinations in respect of ESTs and employment of a differential fee for initial examination and during renewal could also form part of the solution for regulatory delays.

211. A suggestion is made by the Maskus regarding 'wild-card patents', where firms are permitted to extend patents on an invention of their choice within their patent portfolios, in return for commercializing a second environmental technology, for which the original patent was intended and for technologies, which were socially desirable but had no economic incentive for commercialization. The growth of multiple and overlapping patents on a final technology may restrict an EST licensee's to navigate multiple patent owners and negotiate several licenses. Therefore the solution for this is for public institutions to develop patent landscapes, wherein, ownership claims on issued patents, and the overlaps in complementary technologies, and ownership details are broken down by private and public institutions.

212. The author also suggests 'voluntary patent pools' where patent holders, including firms, universities and research institutions, would deposit their IP for particular adaptation and mitigation needs. Users acquire the needed technology licenses from the pool in return for payments of royalties on ex ante agreed rates, which could be differentiated on behalf of deployment in developing countries.

213. These measures when taken along with other public measures such as publicly financed fiscal supports for local technology needs and adaptation, while at the same time raising the global costs of using carbon-based energy resources and improving the climate for investments in poor countries, will help improve flows of ESTs across borders.

214. Khor (2012, pp. 14-19) proposes various treatments to lower barriers to technology transfer. Broadly they may be categorised as ex-ante and a few ex-post measures vis a vis grant of patents. A few are listed below.

215. Regulation of voluntary licensing was one of the suggested chief ex post measure, where patents continue to be filed as before, but national legislation would regulate the time limit for a license refusal, and deciding a reasonable rate of royalty payment and a regulation on other licensing conditions imposed on the licensee such as prevention of exports.

216. The TRIPS agreement has other flexible mechanisms than compulsory licensing, such as 'Parallel importation', where imports of a patented product or technology, which is currently marketed in one country, may be done without the explicit approval of the IPR holder. For example, a patented drug in country A may sell for \$500, but the same drug in country B may sell for \$100 owing to local competition. Then, an import of this drug from country B into country A need not take the IPR owner's explicit approval.

217. Exemption from Patentability for ESTs may be one mechanism, which can be further explored. Such a proposal was already made by India in 1996 at the WTO's committee meeting on trade and environment. Such exclusions on patentability may be restricted to developing countries, and the innovation costs may be recouped from sales in the developed countries. This mechanism rests on the principle of self-preservation wherein a consensus to view global climate change as an emergency in international relations.

218. Khor also suggests forming a 'Global technology pool for climate change' where owners of ESTs must place IPRs in a mandatory pool. The technologies are then made available to developing country firms on payment of a low compensation and on standard terms.

Compliance of EST owners can be achieved through a relevant law or policy, making public funding for R&D conditional on such compliance.

219. Finally, but more importantly, the possibility of publicly funded technologies is discussed. Government funding for R&D is high in the OECD countries, such funding must result in at least a partial ownership of resultant patents. These governments can then influence technology flows to developing countries. Additionally, governments can compile an inventory of publicly funded technologies to prevent non-patent protection, such as trade secrets, cartelization etc. and to improve the pace of innovation by efficient sharing of information about innovations. The author quotes the example of National Institutes of Health (NIH) in the US, which are obligated to publicize their research in return for public funding.

220. An interesting policy brief for ICTSD prepared by Abdul Lateef (2012) discusses the evolution of IPR related phrases within the UN conference outcomes between the two Rio conferences in 1992 and 2012. In the context of evolution of WTO TRIPS and its related flexibilities, Lateef highlights the paradoxical case where bilateral cooperation in green technologies was achieved even when a multilateral agreement was out of reach. He also highlights the polarized 'pro/against' IPR opinions that UN parties took at the UN conferences, which led to a stalemate for a prolonged period. He concludes by highlighting mechanisms for transfer of green technologies, which include fast tracking of green patents, fostering open innovation by private firms and cultivating bilateral relationships. Some of these conclusions hold immense practical value when one considers the pace of climate change.

221. Finally Damodaran (2011) highlights the importance of exploring the possibility of publicly driven processes to develop ESTs and low carbon technologies , with financial assistance provided by international multilateral funding or national Public Funding agencies. These processes can be driven by Joint Ventures and Public-Private Partnerships models that involve industrial units and Public Agencies from the North and the South.

## II.7. CONCISE LIST OF RECOMMENDATIONS:

222. Explore possibilities for securing an international agreement on a compulsory licensing regime could achieve significant transfer of technology

223. . Explore avenues for extension in patent to compensate for regulatory delays and tie the same to licensing and technology transfer commitments to enable positive technology transfer.

224. Set up voluntary patent pools' where patent holders, including firms, universities and research institutions, would deposit their IP for particular adaptation and mitigation needs

225. Establish a 'Global technology pool for climate change' where owners of ESTs must place IPRs in a mandatory pool. The technologies could be made available to developing country firms on payment of a low compensation and on standard terms.

226. Explore the possibility of publicly driven processes to develop ESTs and low carbon technologies with financial assistance provided by international multilateral funding or national Public Funding agencies. These processes can be driven by Joint Ventures and Public-Private Partnerships models that involve industrial units and Public Agencies from the North and the South.

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[Annex II follows]

**REVIEW OF STUDY (A): A. DAMODARAN, “ECONOMICS OF IP AND INTERNATIONAL TECHNOLOGY TRANSFER”**

**REVIEWER: PROF. FRANCESCO LISSONI, BOCCONI UNIVERSITY, MILAN, ITALY**

**STRUCTURE**

The study comes in the form of three papers, but it is not clear whether, in the author's intentions, they should be read jointly or separately. On one hand, the three papers are summed up by one and only executive summary and presented as complementary. On the other hand, their contents overlap considerably, in some cases even literally, with the same sentences or sequence of sentences to be found in more than paper (compare, for example, paragraphs from 327 to 344 in paper 3 to parr. 165 to 176 in paper 1; or parr. 25,27 and 29 in paper 1 to parr.202,203, and 201 in paper). This makes the joint reading of the three paper considerably harder, both because of their length and their lack of distinctive focus (times and again, the reader is brought back to issues that have already been discussed, and presented with policy recommendations that had been put already put forward).

Another major issue with the study is that it goes at great length in discussing IPR-unrelated policy issues. This is especially the case with the funding of investment in clean technologies in paper 3: while there is clearly a connection with IP issues, this is lost in the excessive details provided on financial issues and the description of successful/unsuccessful funding schemes.

Readability is also affected by several lapses in the use of English language and by the absence of a list of acronyms at the end of the study (the author does not spare their use, and often explain their meaning well after having introduced them, or does not explain them at all). Finally, some boxes are overly long or contain the same material one can find in the text. Boxes should be dedicated either to concise exposition of case studies (as with box 3.6) or to technical digressions.

**MAIN IPR CONTRIBUTION & IPR GUIDANCE FOR POLICYMAKERS**

The study's strength lies in the analysis of existing legal margins, within TRIPs, for the use of patents as an international technology transfer tool. See in particular section 13 of study 1, where recommendations are put forward on how to use compulsory licensing (and the arguing of its non-exceptionality) and on the possibility to combine international programs for fighting climate change with patent pooling. The insistence on looking for room of manoeuvre within TRIPs, rather than proposing a reform of TRIPs (a much harder-to-accomplish objective), makes the recommendations both sensible and practical.

**ELEMENTS MISSING**

Generally speaking, the study relies too heavily on just a few sources, which are cited times and again, and are themselves surveys of original research papers (several of which are cited as summarized in the survey and not as a result of direct reading). Most notably, the author refers to his own work, as well as to Arora (2009), Correa (2011), and WIPO (2009a) (for full references, see the References section in the study; notice that this is at times incomplete or inaccurate – a few references are missing or reported inaccurately – and it contains several duplicates). This implies that some topics not included in these sources are not covered. For example, when it comes to discussing the use of IP in university-industry technology transfer

there is no discussion of the possibility of anti-commons effects<sup>19</sup> nor of the endangering of universities' research exemptions<sup>20</sup>; and there is no trace of the ongoing debate concerning the malfunctioning of IPRs as property rights (IPRs as a source of uncertainty)<sup>21</sup>. At the same time, some topics are covered, which have little relevance for development of international technology transfer (e.g. patent trolls).

#### OVERALL ASSESSMENT/RECOMMENDATION

The study could be considerably shortened and sharpened, while at the same time extended to some topics that, in its present version, are disregarded. The paper could also be improved by elaborating more on its strong points, most notably its discussion of margins of flexibility within TRIPs for the use of patents as technology transfer tool. In this respect, a more structured discussion would help, as well as some discussion on how such use of patents could obviate to uncertainty deriving from excessive litigation (as it may occur in the absence of public coordination).

[End of Annex II and of document]

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<sup>19</sup> See: Heller M. A., Eisenberg R.S. (1998), "Can Patents Deter Innovation? The Anticommons in Biomedical Research", *Science*. 280: 698-701; Murray F., Stern S. (2007) "Do formal intellectual property rights hinder the free flow of scientific knowledge?: An empirical test of the anti-commons hypothesis", *J. of Econ. Behav. & Org.* 63/4, pp.648-687; Murray F., Aghion P., Dewatripont M., Kolev J., Stern S. (2009) "Of Mice and Academics: Examining the Effect of Openness on Innovation", NBER working paper 14819, Cambridge MA

<sup>20</sup> See: Eisenberg R.S. (2003). *Patent Swords and Shields*. *Science*, 299, 1018-1019

<sup>21</sup> See: Bessen J., Meurer M.J. (2008) *Patent failure: How judges, bureaucrats, and lawyers put innovators at risk*. Princeton University Press.