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Development and transfer of technologies

Report on the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention

Note by the secretariat

Summary

This note presents the report on the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention. The report presents a synthesis of available information on practical steps taken by Parties and relevant organizations in each of the five areas of focus set out in section IV of the terms of reference for the review and assessment. It presents lessons learned, good practices, challenges faced and remaining gaps identified in the implementation of Article 4, paragraphs 1(c) and 5, and of decisions 4/CP.7, 3/CP.13 and 4/CP.13.

CONTENTS

Annex

I. Introduction

A. Background

1. The Subsidiary Body for Implementation (SBI), at its twenty-ninth session, agreed[1] on the terms of reference for the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention.[2] The Conference of the Parties (COP), by its decision 2/CP.14, paragraph 3, invited Parties and relevant organizations to make submissions to the secretariat, by 16 February 2009, based on the areas of focus set out in section IV of those terms of reference.

2. The SBI, at its thirtieth session, noted the views[3] submitted by Parties and relevant organizations on the areas of focus set out in section IV of the terms of reference for the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention, as well as the synthesis report of these views[4] prepared by the secretariat. It also noted the draft interim report[5] prepared by the secretariat on the progress of the review and assessment.

3. The SBI, at that same session, agreed[6] to consider matters relating to the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention at its thirty-second session, in accordance with the terms of reference referred to in decision 2/CP.14, taking into account submissions from Parties and relevant organizations,[7] the updated synthesis report on these submissions,[8] and all relevant work of the Expert Group on Technology Transfer (EGTT), including the final report by the EGTT on performance indicators.[9]

B. Mandate

4. The SBI, at its thirtieth session, requested[10] the secretariat to initiate activities identified in paragraph 19[11] of the draft interim report referred to in paragraph 2 above, and to initiate preparatory work required, as appropriate, to support the timely completion of the review referred to in paragraph 3 above, including through the preparation of a list of data gaps relative to the performance indicators once they were finalized.

C. Scope of the report

5. This report presents a compilation and synthesis of available information on practical steps taken by Parties and relevant organizations in the process of the development and transfer of technologies in the five areas of focus set out in section IV of the terms of reference referred to in paragraph 1 above. It presents lessons learned, good practices, challenges faced and remaining gaps identified in the

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1 FCCC/SBI/2008/19, paragraph 74.
2 These terms of reference are contained in annex I to document FCCC/SBI/2008/19.
3 FCCC/SBI/2009/MISC.4.
4 FCCC/SBI/2009/INF.1.
5 FCCC/SBI/2009/INF.4.
6 FCCC/SBI/2009/8, paragraph 73.
7 FCCC/SBI/2010/MISC.3, FCCC/SBI/2009/MISC.4, FCCC/SBI/2008/MISC.1 and Add.1, and FCCC/SBI/2008/7.
8 FCCC/SBI/2010/INF.6.
9 FCCC/SB/2009/4.
10 FCCC/SBI/2009/8, paragraph 74 (b).
11 This work involves further analysing the information contained in a number of sources, with a view to identifying lessons learned, good practices, challenges faced and the remaining gaps identified in the implementation of Article 4, paragraphs 1(c) and 5, of the Convention, and of decisions 4/CP.7, 3/CP.13 and 4/CP.13, as per the terms of reference.

implementation of Article 4, paragraphs 1(c) and 5, of the Convention, and of decisions 4/CP.7, 3/CP.13 and 4/CP.13.

6. The performance indicators developed by the EGTT to monitor and evaluate the effectiveness of the implementation of the framework for meaningful and effective actions to enhance the implementation of Article 4, paragraph 5, of the Convention (hereinafter referred to as the technology transfer framework) were among the tools used for the review. The report on information required for using the performance indicators to support the review[12] reports on data availability and includes an overview of data gaps relative to each performance indicator. That report will be considered by the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its thirty-second session.

D. Possible action by the Subsidiary Body for Implementation

7. The SBI may wish to consider this report and determine any further actions arising from it.

E. Scope of the work

8. The main objectives of the work are:

(a) To review and assess the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention;

(b) To provide constructive inputs to the work related to development and transfer of technologies undertaken by the SBI, the SBSTA, the EGTT and the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA).

9. The review and assessment draws upon related ongoing processes under and outside of the Convention and its Kyoto Protocol to gain insight into:

(a) Lessons learned from, and good practices in, the implementation of Article 4, paragraphs 1(c) and 5, of the Convention, and of decisions 4/CP.7, 3/CP.13 and 4/CP.13;

(b) The challenges faced and the remaining gaps identified in the implementation of Article 4, paragraphs 1(c) and 5, and of decisions 4/CP.7, 3/CP.13 and 4/CP.13.

10. As specified in the areas of focus set out in section IV of the terms of reference, the review and assessment covers the practical steps taken by Parties and other relevant participants in the process of the development and transfer of technologies, and comprises the following tasks:

(a) Review the extent to which actions have promoted and supported institutional systems and regulatory and legislative frameworks needed to scale up development and transfer of technologies;

(b) Review the range of practical actions taken, and identify possible actions to promote innovative public and/or private partnerships and cooperation with the private sector, and consider steps that governments, the business sector and academia can take to facilitate effective participation by the private sector;

(c) Review the mechanisms and processes developed to enhance cooperation with relevant intergovernmental processes;

(d) Review efforts to promote collaborative research on, and development and deployment of, technologies for mitigation and adaptation;

[12] FCCC/SBSTA/2010/INF.3.

(e) Review the adequacy and timeliness of the financial support provided, within the context of Article 4, paragraphs 1(c) and 5, of the Convention, for the purposes of development and transfer of technologies, the related activities and their results.

II. Background

11. The United Nations Conference on Environment and Development held in 1992 in Rio de Janeiro, Brazil, established Agenda 21 and the three Rio Conventions: the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). Chapter 34 of Agenda 21 focuses on the transfer of environmentally sound technologies (ESTs), technology cooperation and capacity-building, which provided a basis for most of the early decisions on the development and transfer of technologies under the Convention.

12. The UNFCCC, which entered into force in 1994, provides an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. The provisions of the Convention relevant to the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, are shown in the box below.

Relevant provisions of the Convention

Article 4, paragraph 1(c), of the Convention: All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, 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.

Article 4, paragraph 5, of the Convention: 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.

13. Since 1994, at each session of the COP, Parties have taken decisions on the development and transfer of ESTs. These decisions have laid down specific actions to be undertaken by Parties, the subsidiary bodies, the EGTT and the secretariat to promote the development and transfer of ESTs. Four main periods can be identified in the evolution of the issue of the development and transfer of ESTs over time:

(a) COP 1 up to COP 4: the Berlin Mandate and work on technology transfer (decision 13/CP.1);

(b) COP 4 up to COP 7: the Buenos Aires Plan of Action and the consultative process on technology transfer (decision 4/CP.4);

(c) COP 7 up to COP 12: the Marrakesh Accords and the implementation of the technology transfer framework, contained in the annex to decision 4/CP.7;

(d) COP 13 up to COP 15: the Bali Action Plan and the implementation of the technology transfer framework, complemented by the set of actions set out in annex I to decision 3/CP.13. Also during this period, a fifth stage in the evolution of the issue emerged, with Parties defining a new Technology Mechanism within the negotiations under the AWG-LCA.

14. By its decision 6/CP.10, the COP initiated a process to review and enhance the implementation of the technology transfer framework, and it requested the EGTT to make relevant recommendations. In response to this mandate, the EGTT conducted a review of the implementation of the framework and assessed the progress of work in various areas under each of the framework's key themes. The results of this assessment are contained in document FCCC/SBSTA/2006/INF.4, which describes progress in, and the effectiveness of, the implementation of the technology transfer framework and identifies gaps and barriers to further progress.

15. The COP, by its decision 3/CP.13, agreed with the EGTT that the five themes listed in the technology transfer framework, as contained in the annex to decision 4/CP.7, and the structure, definitions and purpose of that framework, continued to provide a solid basis for enhancing the implementation of Article 4, paragraph 5, of the Convention. By the same decision, the COP also adopted the set of actions contained in annex I to that decision, covering the period until the end of 2012 or COP 18.

III. Methodology

16. The approach for the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention was to follow an integrated review process covering practical steps taken by Parties and relevant organizations in the process of the development and transfer of technologies in the five areas of focus referred to in paragraph 10 (a–e) above. Numerous sources were reviewed in order to identify and collect relevant information. In addition, the set of 40 performance indicators to monitor and evaluate the effectiveness of the implementation of the technology transfer framework developed by the EGTT was among the tools used for the review, to the extent possible. The following describes the steps taken in the review process.

1. Identification of relevant information sources and review of documentation

17. The first step in the review process consisted in identifying relevant information sources, including those listed in the draft interim report on the progress of the review and assessment.[13] The UNFCCC technology transfer information clearing house (TT:CLEAR) was also used for collecting and identifying relevant information and data sources. Relevant information also included that required for using the 40 performance indicators contained in the final report by the EGTT on performance indicators[14] to support this review and assessment. The complete list of documents used during the preparation of this report as part of the review is contained in the annex to this document.

2. Review matrix

18. A review matrix based on the five areas of focus was used to gather information on the practical steps taken by Parties and relevant organizations to implement Article 4, paragraphs 1(c) and 5, of the Convention. Regarding the assessment of the use of the 40 performance indicators, a review matrix

[13] FCCC/SBI/2009/INF.4.
[14] FCCC/SB/2009/4.

based on the 40 indicators identified by the EGTT was used to collect the available data and identify data gaps. This matrix presented the data sources and means of data collection for each of the 40 indicators, thereby not only providing a basis for the data collection, but also identifying any data gaps relative to the 40 indicators.

3. Online survey

19. An online survey was conducted on Parties not included in Annex I to the Convention (non-Annex I Parties) in order to capture the most recent information on the use of the performance indicators specific to those Parties. The aim of this survey was to gather complementary data on eight of the 40 performance indicators, as well as to identify data gaps relative to these eight performance indicators. The survey garnered responses from 11 Parties.

4. Written questionnaires

20. Written questionnaires were sent to the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) in order to collect relevant information on the use of the performance indicators.

IV. Practical steps taken by Parties and relevant organizations

21. Based on the documentation reviewed, this chapter presents a compilation and synthesis of the preliminary information and data available, covering practical steps taken by Parties and other relevant organizations in the process of the development and transfer of technologies in the five areas of focus.

22. This chapter does not cover all of the activities undertaken by Parties and relevant organizations, but rather provides a summary of these activities and draws upon examples, particularly those that have been provided by Parties and other relevant organizations in their submissions.[15]

A. Extent to which actions have promoted and supported institutional systems and regulatory and legislative frameworks needed to scale up development and transfer of technologies

23. This area of focus covers the steps taken by Parties and relevant participants at the national and international levels to promote and support national institutional systems and regulatory and legislative frameworks. It includes means of creating and promoting enabling environments and means of removing institutional and legislative barriers to the transfer of ESTs at the national and international levels.

1. Steps taken by Parties and other relevant participants

National level

24. Several Parties reported in their national communications, submissions to the secretariat and technology needs assessments (TNAs) actions that have promoted and supported institutional systems and regulatory and legislative frameworks. These actions include the mainstreaming of climate change issues and concerns into national energy-policy frameworks, such as in Ghana, Guyana and Malawi, as well as the development of legislative frameworks and national action plans for the implementation of activities to mitigate or adapt to climate change.[16]

25. For instance, Australia reported that it was implementing a comprehensive set of climate change, energy- and technology-based legislative frameworks, which are also supported by targeted policies and measures. Canada reported several measures to establish and strengthen a domestic technology system that combines institution-building, skills development, and collaborative partnership models. The Czech

[15] FCCC/SBI/2010/MISC.3, FCCC/SBI/2009/MISC.4, FCCC/SBI/2008/MISC.1 and Add.1, and FCCC/SBI/2008/7.
[16] FCCC/SBSTA/2009/INF.1.

Republic, on behalf of the European Community (EC) and its member States, also reported actions, including approaches and mechanisms, taken by the EC and its member States in this area. These actions included, for instance, the Environmental Technologies Action Plan of the European Union (EU), which has identified 25 actions to overcome barriers to the development and introduction of ESTs, including unfavourable regulations and standards. The development of road maps for key technologies was also reported by Parties (Japan and Australia) in this context.[17]

26. As described in the second synthesis report on technology needs identified by non-Annex I Parties,[18] measures to address existing barriers to implementing needed technologies, including regulatory, legislative and institutional barriers, were identified by 50 Parties. A total of 14 Parties identified measures to address barriers for each different technology and 14 Parties presented some general measures possibly suitable for overcoming barriers in all of the identified sectors.

27. Most of the TNAs underlined the role of governments in helping to remove barriers to the transfer of ESTs through the formulation of effective policies, regulations, standards, codes and other measures. However, as is evident from the second synthesis report referred to in paragraph 26 above, there is limited information available on the actions taken by Parties to remove the barriers that have been identified.

International level: bilateral

28. Parties engage in a range of bilateral activities for the promotion and support of institutional systems and regulatory and legislative frameworks needed to scale up the development and transfer of technologies. However, few of these have been reported by Parties in their submissions.

29. Japan reported on actions to exchange information on policies through bilateral dialogue with developing countries, with a view to improving energy efficiency by sharing energy-conservation policies and supporting effective systems. Canada reported steps taken to assist developing countries directly with their technology needs, including technology transfer projects for climate change development of which capacity-building is a component. The EU also reported in its submission a range of bilateral activities that either directly or indirectly involve the provision of support for the enhancement of institutional systems and regulatory and legislative frameworks needed to scale up the development and transfer of technologies.

International level: multilateral

30. According to the second Climate Change Program Study (2004) by the Office of Monitoring and Evaluation of the GEF, the operational strategy of the GEF, focusing on the removal of barriers to energy efficiency and renewable-energy technologies, was considered successful, particularly in relation to energy efficiency. However, the need to identify and categorize the key potential barriers to be addressed remains, as does the need for better integration of barrier removal strategies with strategies that buy down the costs of mitigation technologies. These conclusions have informed the approach embodied in the revised strategy of the GEF in the climate change focal area. As part of the fourth replenishment of the GEF, the climate change strategy for mitigation was revised to focus primarily on six strategic programmes to promote: energy efficiency in buildings and appliances; industrial energy efficiency; market-based approaches for renewable energy; sustainable energy production from biomass; sustainable innovative systems for urban transport; and management of land use, land-use change and forestry as a means to protect carbon stocks and reduce greenhouse gas (GHG) emissions.

[17] FCCC/SBI/2009/MISC.4.
[18] FCCC/SBSTA/2009/INF.1, paragraph 131.

31. As reported by the GEF, since its inception in 1991, the GEF has allocated USD 2.7 billion to support more than 40 climate-friendly technologies in almost 100 developing countries. Most of the initiatives supported strove towards reducing institutional, legislative and regulatory barriers to the development and transfer of technologies.

32. UNDP provides support for training and capacity-building activities and for tools designed to assist in the development and evaluation of projects, such as the United Nations Millennium Development Goal (MDG) Carbon Facility, which offers a comprehensive package of services for preparing GHG emission reduction projects and getting them to market.

33. Through the Risø Centre on Energy, Climate and Sustainable Development, UNEP provides technical and financial support to developing countries so that they can participate in clean development mechanism (CDM) projects and other international efforts to address climate change and promote sustainable development. The capacity development for the CDM projects implemented jointly with UNDP, the World Bank and the United Nations Industrial Development Organization (UNIDO) are currently assisting 32 developing countries.

34. UNIDO provides technical assistance by strengthening capacities and skills at various levels in the area of technology management. It also supports capacity-building activities, especially through its energy-efficiency programme, renewable-energy programme, and CDM and joint implementation (JI) projects. Furthermore, UNIDO supports training activities to prepare developing countries for the transfer of technologies aimed at mitigating and adapting to climate change, in addition to training activities in methodologies and tools, from the optimization of industrial energy systems to the preparation and financing of technology transfer projects.

35. The EU reported participation in activities related to human and institutional capacity-building in developing countries in Latin America, Africa and Asia, which facilitate the development and establishment of national institutional systems appropriate for the development, deployment and diffusion of climate technologies. In addition, EU member States reported the development of activities implemented jointly projects in 12 developing countries.

36. There are many regional and international technology organizations and initiatives that provide assistance and promote effective enabling environments for technologies for mitigation and adaptation. In the area of the deployment and diffusion of renewable energies, the International Renewable Energy Agency (IRENA), founded in January 2009, provides practical advice and support to both industrialized and developing countries, helps them to improve their regulatory frameworks and builds capacity.

2. Good practices and lessons learned

37. The following good practices and lessons learned could be identified from the practical steps taken by Parties described in paragraphs 24–36 above:

(a) Enabling activities are an essential component of successful technology-related initiatives in both developed and developing countries;

(b) Enabling environments are a critical element for the successful and long-term development, deployment and diffusion of technologies. Domestic regulatory and policy frameworks should provide clear signals and appropriate incentives to the relevant stakeholders involved in the technology transfer process, including the private sector;

(c) Institutional and legislative barriers to the widespread commercialization and dissemination of clean technologies can be identified and overcome by carefully designed demonstration projects, particularly when combined with predictable financing

and government policies that facilitate the further adoption of technologies. Well-placed demonstration or pilot activities can stimulate interest and build confidence in promising new technologies. Demonstrations also help to build human resources and the institutions needed to support large-scale deployment of technologies. Such pilot projects could be supported at the national, but also at the regional and international, level;

(d) Large differences between countries remain, with some countries at the forefront of innovative institutional systems and regulatory and legislative frameworks to enhance the development and transfer of technologies, while others require significant support in order to introduce the enabling environment necessary to further promote technology development and transfer. Multilateral initiatives aimed at enhancing institutional systems and regulatory and legislative frameworks need to be country driven and based on national circumstances.

3. Challenges and remaining gaps

38. Several challenges remain in this area of focus, especially regarding efforts to support the improvement of policy frameworks, institutions and other dimensions of the enabling environment that are fundamental to obtaining financing for technology transfer.

39. Lack of access to information, market failures and imperfections, absence of skilled human capital, weak institutional frameworks, and legal, social and regulatory constraints are frequently cited as barriers to the establishment of the enabling environment.

40. At the national level, institutional systems and regulatory and legislative frameworks are frequently fragmented and poorly financed in developing countries. Governments must play an essential role by setting policies favourable to the adoption of ESTs.[19]

41. Developing countries need more tailored responses in order to facilitate technology transfer. However, what remains common to all cases is the desirability of a supportive regulatory framework, and enabling environment more generally, together with the circulation of knowledge and capabilities among individuals and institutions in host countries.[20]

42. Human resources, institutions, policies and regulatory structures, and financial and investment instruments all need to be enhanced as new technologies are introduced and absorbed by economies large and small, in both developed and developing countries.

43. Among the efforts of the United Nations that could be strengthened is the promotion of national and regional markets for ESTs, especially in an environment that will foster local production, with the endogenous development of technologies as the eventual aim. Also, it appears that the United Nations system could place more emphasis on promoting the development of comprehensive national plans and international assistance programmes, both of which need to combine climate change issues with those related to the environment, sustainable development and achieving the MDGs.

44. Many mitigation technologies are available at the commercial or near-commercial stage in all relevant sectors. In developing countries, new and additional technological, financial and capacity-

[19] GEF. 2008b. *Transfer of Environmentally Sound Technologies – The GEF Experience*. Available at <http://www.thegef.org/gef/sites/thegef.org/files/publication/GEF_TTbrochure_final-lores.pdf>.

[20] GEF. 2008a. *Elaboration of a Strategic Program to Scale up the Level of Investment in the Transfer of Environmentally Sound Technologies.* Available at <http://www.gefweb.org/uploadedFiles/Documents/Council_Documents__(PDF_DOC)/GEF_C34/C.34.5%20Technology%20Transfer%2010.14.08.pdf>.

building support, combined with supportive national policies, will be needed to stimulate private-sector investment in technologies for mitigation and adaptation.

45. Technology transfer is affected by a wide range of barriers, including a lack of capacity to operate and maintain the technology and the absence of institutional structures or regulations, which inhibit adoption. These barriers differ by technology and country. International mechanisms and funding for capacity-building and the creation of enabling environments may be needed to accelerate the adoption of near-commercial mitigation technologies in developing countries.[21]

4. Key findings

46. Several Parties reported actions that have promoted and supported institutional systems and regulatory and legislative frameworks, such as the mainstreaming of climate change issues and concerns into national energy-policy frameworks, and the development of legislative frameworks and national action plans for the implementation of activities to mitigate or adapt to climate change.

47. Measures to address existing barriers to implementing needed technologies, including regulatory, legislative and institutional barriers, were identified by 50 Parties in their TNAs, including measures to address barriers for each different technology and measures possibly suitable for overcoming barriers in all of the identified sectors. However, there is limited information available on the actions taken by Parties to remove the barriers that have been identified.

48. Parties identified institutional and regulatory barriers in their TNAs and the need for international mechanisms and funding to remove these barriers in order to accelerate the adoption and diffusion of near-commercial mitigation technologies in developing countries.

49. At the international level, bilateral and multilateral agencies reported providing specific support to, and conducting integrated activities within the context of, climate technology projects, which help to promote and support institutional, regulatory and legislative frameworks.

50. However, considering the estimates of financing needs prepared by the EGTT[22] and the needs identified by developing countries, past and current support was and is inadequate and will need to be scaled up. Some Parties reported that the resources provided to promote and support institutional, regulatory and legislative frameworks have not grown at the rate required to effectively address the challenge of climate change.

51. There is also an indication that national institutional systems and regulatory and legislative frameworks are frequently fragmented in developing countries and that support to enhance enabling environments is still needed in many developing countries.

B. Range of practical actions taken and possible actions to promote innovative public and/or private partnerships and cooperation with the private sector, and steps that governments, the business sector and academia can take to facilitate effective participation by the private sector

52. Under this area of focus, activities and initiatives at the national and international levels that have been implemented and potential activities and initiatives that can promote public and/or private partnerships and cooperation between the public and private sectors are assessed. Steps that governments, the business sector and academia could take to facilitate effective participation by the private sector are also considered.

[21] FCCC/TP/2008/7, paragraph 23.
[22] FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.

1. Practical actions taken by Parties

National level

53. At the national level, several Parties are engaged in actions to promote public–private partnerships in the area of technology development and transfer. Parties identified specific projects to promote public- and private-sector partnerships for the diffusion of energy efficiency and renewable-energy technologies.

54. With regard to Parties included in Annex I to the Convention (Annex I Parties), many highlighted, in their national communications, the prominent role of the private sector in enhancing the transfer of technologies to developing countries. A total of 15 Parties provided information on policies and programmes aimed at providing market incentives to involve the private sector in projects and programmes relating to the transfer of technologies to developing countries. While seven Parties included a separate section on the role of the private sector in the transfer of technologies, most of the other Parties reported relevant information on the role of the private sector in their general description of activities relating to the transfer of technologies.

55. The relevant policies and programmes reported by Parties included partnerships with private-sector organizations and enterprises, programmes to encourage the private sector to participate in technology transfer projects, programmes to leverage private-sector research and development (R&D) activities, and direct financial incentives, such as export credits.

56. Among the initiatives reported by Parties to facilitate private-sector participation in the transfer of ESTs, the following main categories could be identified:[23]

(a) Public–private partnerships;

(b) Financial incentives for projects and programmes: grants, soft loans, export credit guarantees, equity investments and venture capital (VC);

(c) Financing and business development services provided in developing countries;

(d) Networking and matchmaking between enterprises in industrialized countries and enterprises in developing countries;

(e) Support for activities to promote investment: market studies, feasibility studies, job-related training and temporary management;

(f) Promotion of technology transfer to developing countries: clean-energy information systems and trade missions;

(g) Assistance to governments in developing countries for the creation of enabling environments to ensure that the private sector can operate in a regulated market.

International level

57. The EGTT has initiated several activities to engage the private sector in its work relating to innovative options for financing the development and transfer of technologies. In addition to raising private-sector awareness of issues relating to the development and transfer of technologies in the context of climate change, the focus of the EGTT has been on enhancing the understanding between the private and public sectors of their respective needs and on identifying options for mobilizing private-sector

[23] FCCC/SBI/2007/INF.6/Add.2, paragraph 53.

capital. Among its various deliverables, the UNFCCC publication *Preparing and Presenting Proposals: A Guidebook on Preparing Technology Transfer Projects for Financing* (known as the practitioners' guide)[24] has provided a practical tool to project practitioners, and facilitated links between technology projects and public and private sources of financing.[25]

58. The secretariat has initiated a series of training workshops on preparing technology transfer projects for financing, building on the guidebook referred to in paragraph 57 above. Regional training workshops have been held around the world, and a training of trainers programme has also been established. An online training programme is in development and future delivery of these programmes is under consideration. There is significant demand from Parties for training in financing for technology programmes and policy initiatives, aimed at scaling up the project-based approach that has been implemented to date.

59. The EGTT has held a series of dialogues with the business community, involving members and representatives of the World Business Council for Sustainable Development (WBCSD) and the International Chamber of Commerce (ICC), in 2009 and 2010. The issues that are being addressed through the dialogue include the role of technology innovation centres, approaches to financing technology development and transfer, collaborative R&D, issues related to intellectual property, and how to create a policy environment that can stimulate greater private-sector investment in technologies for mitigation and adaptation.[26]

60. WBCSD has also undertaken several actions to promote closer cooperation with public and intergovernmental processes, including on technology transfer and development.[27] WBCSD has published several documents which have sought to create a basis for dialogue and action between the private and the public sector, including calls for the development and deployment of leading-edge technologies through partnerships and incentives, and an approach to mitigating long-term market risk and delivering secure benefits for large-scale, low-emission, new-technology projects.

61. The GEF Council adopted a strategy in June 2006 with guidelines aimed at enhancing engagement with the private sector. Consequently, a public–private partnership initiative (also known as the Earth Fund) was proposed and approved by the Council in June 2007, for which USD 50 million of GEF funding has been earmarked. In the climate change focal area, the majority of GEF projects have some aspect of engagement with the private sector. Most engagement with the private sector has been through procurement. In particular, energy efficiency and renewable-energy projects often engage small- and medium-sized enterprises in the recipient countries, which co-finance the GEF projects and are also beneficiaries of GEF support.

62. Other multilateral organizations have introduced ways of promoting public- and private-sector involvement in technology transfer, such as the Private Financing Advisory Network (PFAN) of the Climate Technology Initiative (CTI). PFAN offers a free consulting service to project sponsors and developers to help them raise private-sector financing by providing capacity-building in financial knowledge and the transfer of know-how. PFAN functions on a small scale but has recently secured additional resources enabling it to scale up significantly. It aims to leverage USD 500–700 million over three years with an annual budget of under USD 5 million.

63. The EU reported on the European Union emissions trading scheme, its scheme for the trading of GHG emission allowances, which is designed to provide an incentive for the private sector to take action

[24] Available at <http://ttclear.unfccc.int/ttclear/jsp/>.
[25] FCCC/SBSTA/2006/INF.4.
[26] FCCC/SB/2009/INF.6.
[27] WBCSD. 2009. *The Energy & Climate Focus Area*. Available at <http://www.wbcsd.org/DocRoot/3Qq5jg79d7v4IAKTdhJn/ExBrief%20Energy&Climate_mar10_4print.pdf>.

on climate change mitigation, including through development and transfer of climate technologies. The EU also reported a pilot instrument to involve the private sector in financing projects, namely the Global Energy Efficiency and Renewable Energy Fund, which is focused on energy efficiency and renewable-energy projects in developing countries and countries with economies in transition (EIT countries). The Innovation Relay Centre network, with 240 partners in 31 countries, provides transnational technology transfer services for small- and medium-sized enterprises and R&D institutions based on common methodologies and tools.

64. In order to exchange information on technology development and transfer and make the most up-to-date information on technologies for mitigation and adaptation available to public and private stakeholders, a pilot information sharing network between TT:CLEAR and national and regional technology information centres was established. The network includes TT:CLEAR, the Sustainable Alternatives Network, the Clean Energy Portal of Canada, the United States Climate Technology Cooperation Gateway, the International Technology Transfer Centre of China's Tsinghua University, the Caribbean Community Climate Change Centre, and Tunisia's International Centre for Environmental Technologies and Sahara and Sahel Observatory.

2. Good practices and lessons learned

65. Informal consultative processes, such as the dialogue of the EGTT with the business community, could continue; however, there is also a need for a more systematic, formal, action-orientated engagement of the private sector. The existing processes could also involve other stakeholders within the UNFCCC process, as well as experts from non-governmental organizations (NGOs) and academia.

66. Project proposals that have been prepared often lack key information that is required to obtain international or private financing, such as risk and cash flow analyses. Establishing such information requires specialist skills and capacities that may be in short supply. Without this information, project developers find it difficult to efficiently target potential private and/or public funders. However, even if such information is made available, identified projects are often too small to attract international finance owing to high transaction costs and high perceived investment risks. Nevertheless, some pilot projects have demonstrated innovative options for funding small-scale technology development and transfer projects, and further efforts are needed to design and implement public–private mechanisms to replicate and scale up these successful projects.

67. With regard to promoting more private-sector investments, in 2004, Canada hosted the UNFCCC workshop on innovative options for financing the development and transfer of technologies. Key findings of this workshop included:

(a) Transparency, allowing risk to be measured and managed, is paramount to attracting investment for technology-related activities;

(b) Partnerships at all levels are vital to achieving successful projects in developing countries. Local partnerships in particular are essential, including those between national and subnational governments, investors, donors, NGOs, service providers, entrepreneurs and end-users;

(c) 'Parachute' projects, which do not have local engagement, are unlikely to survive in the long term;

(d) Financing for a particular technology is not a 'bolt-on' element to be secured in the final stages of project development, but rather must be embedded early on in order to ensure both the engagement of financing partners and the success of the project. Road maps and TNAs can help to identify the need for financing;

(e) Capacity-building for project development is needed to attract investment financing, and essential for removing barriers to the mobilization of domestic capital for foreign direct investment;

(f) Clear definition and protection of intellectual property rights (IPRs) is necessary to attract private-sector investment capital in any country;

(g) Project-building can increase the attractiveness of a proposal.

3. Challenges and remaining gaps

68. The public sector plays a key role in providing an environment conducive to private-sector investments, as most technologies are owned by the private sector. Public funds are needed to leverage private-sector funding for developing and transferring ESTs. However, the high cost of technologies, the difficulties faced in accessing finance and the high perceived risks of investing in new technologies in developed and developing countries impede the mobilization of private-sector capital.

69. Another challenge is associated with the resistance of the private sector to participation in technology development and transfer if it is felt that this would expose the company to strategic risks that may enable a potential competitor to gain a competitive advantage. Public funds could also help to reduce this perceived risk.

70. Given the magnitude of the investment required, the involvement of the private sector in technology development and transfer is crucial, and approaches should be explored that engage and leverage the participation of the private sector. Such approaches could include establishing innovative public–private partnerships, as well as developing risk assessment and management tools that will support private-sector investments during the critical financing stages of technology development and transfer.

71. To further encourage private-sector financing, international activities could focus on identifying new ways of incorporating the perspective of the private sector as partners in efforts to advance and accelerate technology development and transfer. A potential option for enhancing the institutional arrangements for technology under the Convention in this regard could be the development of a private-sector advisory group. This advisory group could support mitigation and adaptation actions taken by developing country Parties by removing barriers and promoting technology transfer and diffusion, focusing on key sectors. The advisory group could include relevant experts and business leaders and representatives (e.g. international business associations).

72. Furthermore, innovative approaches to the use of the intellectual property regime as a tool for accelerating access to and the development and transfer of technologies could be explored in partnership with the private sector, so as to increase the incentives for private-sector participation in technology development and transfer in developing countries. In this regard, enhancing the business environment through better use of IPRs will be important for promoting the sustainable development of technologies by technology innovators in developing countries.

73. UNEP[28] has identified two important gaps in the early stages of VC financing as technologies move from the R&D to the demonstration stage, and beyond to the deployment stage. VC and private-equity financing are crucial during these stages owing to the high risks still inherent in the technologies and the businesses that are bringing them to the market.

[28] Sustainable Energy Finance Alliance. 2008. *Public Venture Capital Study*. Paris, France: UNEP.

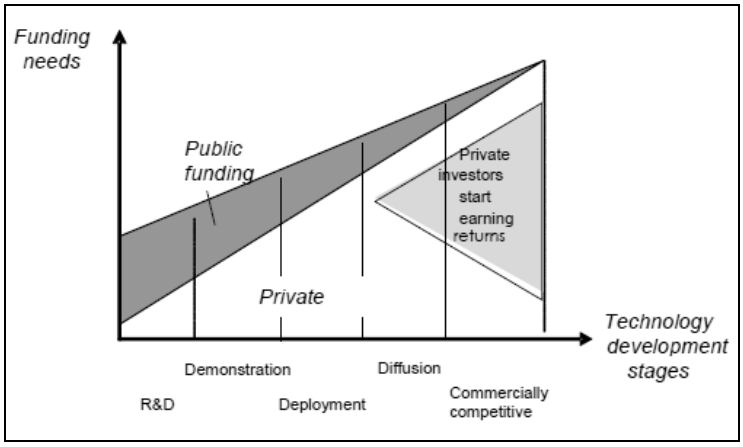
4. Steps that governments, the business sector and academia can take to facilitate effective participation by the private sector

74. Supporting and guiding private-sector investment in new infrastructure, technologies and best practices must be a top priority for all Parties, international financial institutions, relevant multilateral institutions and the private financial community. At least 60 per cent of investments to address climate change come from the private sector, only 25 per cent of which private-sector investment flows presently occur in developing countries. Governments and public institutions should cooperate efficiently to facilitate the orderly growth of this investment profile.[29]

75. According to ICC,[30] the transition between the research, development, demonstration, deployment and commercialization[31] phases is neither automatic nor necessarily linear, with many technologies failing at each phase. To induce private-sector investment in innovation in the field of technology, governments need to create a framework that will value the public benefits that are achieved or, alternatively, directly support, on a grant or concessional basis, R&D-, demonstration- and deployment-related investments and activities to help move innovations forward to a point where they are commercial.

76. Figure 1 below shows that, in general, the involvement of public and private financing changes with the stage of maturity of the technology. The public share of the financing is typically highest at the early stages of development, while private financing becomes easier to attract as the technology matures, when the commercial potential is easier to assess and the length of time until sales begin is shorter. Parties noted that public and private spending on R&D have been decreasing over recent decades. Several Parties stressed that the public sector has a crucial role to play in reversing this trend by using public funding in R&D to leverage private investments in R&D and by providing incentives to the private sector to scale up its investment in R&D in relation to ESTs.[32]

Figure 1. The roles of the public and private sectors in financing technology development



Source: FCCC/TP/2008/7, figure 1.
Abbreviation: R&D = research and development.

[29] GEF. 2008a.
[30] ICC. 2008. *Technology Development and Deployment to address Climate Change*. Prepared by the Commission on Environment and Energy and the Commission on Intellectual Property. Available at <http://www.iccwbo.org/uploadedFiles/ICC/policy/Environment/081128%20ICC%20Tech%20and%20Climate213%2061.pdf>.
[31] 'Commercialization', the term used by ICC, could be considered as equivalent to the technology development stage of 'diffusion' used within the UNFCCC and described in documents FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.
[32] FCCC/AWGLCA/2008/CRP.8, paragraph 10.

77. Public- and private-sector VC funds could also play an important role in engaging the private sector in the development and transfer of technologies. According to the GEF, new VC funds, entirely focused on ESTs, are expanding rapidly throughout the world. Technology deployment requires different types of finance, of which VC is only one; however, this type of finance is suited to managing the risks associated with advanced technologies, can mobilize a variety of innovative financial instruments and, in doing so, has played an important role in transforming the clean-energy technology sector over the last decade. New roles for multilateral financial institutions in the VC community should be explored to more quickly scale up the level of investment in developing countries. New VC platforms might help to overcome recurring barriers to technology transfer and could include the establishment of public–private governance structures that could help moderate investment risks and other issues.[33]

5. Key findings

78. At the national level, several Parties have engaged in actions to promote public–private partnerships in the area of technology development and transfer. Many Annex I Parties highlighted the prominent role of the private sector in enhancing the transfer of technologies to developing countries. Relevant policies and programmes reported by Parties included partnerships with private-sector organizations and enterprises.

79. The EGTT has initiated several activities to engage the private sector in its work relating to innovative options for financing the development and transfer of technologies, and held a series of dialogues with representatives of the private sector.

80. Several multilateral organizations have introduced ways of promoting public and private involvement in technology transfer. Relevant policies and programmes reported by some Parties included in Annex II to the Convention (Annex II Parties) included partnerships with private-sector parties and enterprises.

81. To further encourage private-sector financing, international activities could focus on identifying new ways of incorporating the perspective of private-sector representatives as partners in efforts to advance and accelerate technology development and transfer.

82. Supporting and guiding private-sector investment in new infrastructure, technologies and best practices must be a top priority for all Parties, international financial institutions, relevant multilateral institutions and the private financial community.

C. Mechanisms and processes developed to enhance cooperation with relevant intergovernmental processes

83. This area of focus includes the steps taken by Parties and relevant participants at the international level to develop mechanisms and processes to enhance cooperation with relevant intergovernmental processes. It includes the different mechanisms and processes initiated through other multilateral environmental agreements (MEAs) and international organizations.

1. Mechanisms and processes developed

International level: bilateral

84. Parties have taken a variety of bilateral approaches to enhancing cooperation with relevant intergovernmental processes including: agreements, working groups, activities and workshops. Parties reported bilateral agreements and working groups to facilitate technology transfer in a variety of sectors.

[33] GEF. 2008a.

These agreements serve as guidelines for business and government to work effectively with partner countries to increase international scientific and technological capacity.[34]

85. Some bilateral partnerships focus on technology development and transfer at the regional level. Such initiatives also exist at the sectoral and municipal levels, while other partnerships have a clear focus on specific technologies.[35] Partnerships with regard to technology transfer for adaptation are still quite limited; however, some Parties did report on cooperation with developing countries on technology development and transfer projects for adaptation.[36]

86. Workshops and training activities have also been used by Parties to promote intergovernmental processes. Canada reported that more than 40 workshops on renewable energy, energy efficiency and cogeneration have been scheduled across Canada and around the world. Japan has also promoted the 'co-benefits approach' in the Asia-Pacific Seminar on Climate Change, as well as in its Cool Earth Partnership Seminar.

International level: multilateral

87. Some of the mechanisms and processes developed to enhance cooperation stem from the Convention itself, such as those initiated by the EGTT to engage key organizations and partners in the implementation of the technology transfer framework, while other mechanisms and processes include partnerships, networks, programming and strategies.

88. In response to a request by the COP,[37] the EGTT consulted with other organizations on their contribution towards the implementation of the technology transfer framework. In addition, experts from other relevant international organizations were invited to the meetings of the EGTT to participate in discussions on topics relating to the rolling programme of work of the EGTT for 2008–2009, as well as on topics emerging in the negotiations under the AWG-LCA on technology development and transfer.[38]

89. The SBSTA, at its twentieth session, requested[39] the EGTT to explore possible ways to enhance synergy with other global conventions and processes where technology transfer and capacity-building for technology transfer are considered, in particular with CBD on its programme of work and its expert group on technology transfer and technical and scientific cooperation, UNCCD and the Montreal Protocol. The EGTT was also requested to consider the outcomes of the work of the Joint Liaison Group (JLG),[40] to encourage complementarity and avoid duplication of efforts, and to report on progress to the SBSTA at its twenty-second session. As a result, with the development of the CBD programme of work on technology transfer, with a similar structure to the UNFCCC technology transfer framework, this JLG facilitated cooperation.[41]

90. The Chief Executives Board of the United Nations established a Technology Transfer Working Group to enhance coherence and facilitate cooperation among organizations in the United Nations system on the development and transfer of technologies for mitigation and adaptation. The Technology Transfer Working Group has recently completed a survey on the technology development and transfer activities across the United Nations System.

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[34] FCCC/SBI/2009/MISC.4.
[35] FCCC/SBI/2007/INF.6/Add.2, paragraph 48.
[36] FCCC/SBI/2007/INF.6/Add.2.
[37] Decision 3/CP.13, paragraph 5.
[38] FCCC/SB/2009/INF.6, paragraph 41.
[39] FCCC/SBSTA/2004/6, paragraph 80 (b).
[40] A JLG, between the secretariats of CBD, the UNFCCC and UNCCD, was endorsed at SBSTA 14 in order to improve coordination and cooperation between these three MEAs.
[41] FCCC/SBSTA/2004/INF.19, paragraph 14.

91. The United Nations Department of Economic and Social Affairs (UN DESA) has, in recent years, organized global high-level events to promote dialogue and cooperation and to provide a forum for exchanging ideas and advancing important initiatives on technology development and transfer in the context of sustainable development, such as the Beijing High-level Conference on Climate Change in November 2008 and the Delhi High-level Conference on Climate Change in October 2009.

92. UNEP, UNIDO, the Information for Development Program (infoDev) and UNDP also have an extensive network of initiatives and centres supporting technology cooperation at the national, regional and international levels.

93. Since Parties reached agreement on the technology transfer framework at COP 7 in Marrakesh, Morocco, many technologies have been highlighted for international cooperation, including hydrogen technology, carbon capture and storage (CCS), renewables, advanced fossil-fuel technologies and civilian nuclear power. As a result, several initiatives and partnerships have been established as forums for cooperation between Parties on these technologies and for dialogue on policies, with some even providing for potential financing mechanisms for these technologies.[42]

94. Furthermore, the role of multilateral partnerships in fostering cooperation between developed and developing countries as a means to enhance the transfer of technologies has increased significantly.[43] Some of the multilateral partnerships reported include: the Asia-Pacific Partnership on Clean Development and Climate (APP),[44] the Renewable Energy and Energy Efficiency Partnership, CTI and the Ibero-American Network of Climate Change Offices.[45]

95. Technology development and transfer has increasingly gained support within international organizations. For example, the International Energy Agency (IEA) currently manages 42 Implementing Agreements, international agreements to cooperate in the area of energy technology, among its 24 member countries, which involve shared research, demonstration, deployment and analysis activities. The Group of 8 (G8) has also contributed to enhancing international technology development, particularly through its ability to mobilize the appropriate international partners to address identified gaps. In addition, the G8 process is cognisant of the work on technology transfer under the Convention, as the work of the EGTT and TT:CLEAR were noted in the climate change plan of action of the G8.[46] In response to the plan of action of the G8, IEA is consulting stakeholders on the establishment of a new global energy-technology platform that would aim to accelerate the development and transfer of climate change technologies.

2. Good practices and lessons learned

96. TNAs are an important tool within the UNFCCC process, used by developing countries to identify and prioritize technology needs at the national level. The UNDP handbook *Conducting Technology Needs Assessments for Climate Change* (hereinafter referred to as the UNDP handbook),[47] updated by the EGTT in collaboration with key partners (e.g. UNEP and UNDP), provides a useful tool for stakeholders involved in undertaking TNAs. However, while TNAs are a sound initiative, they have

[42] FCCC/SBSTA/2006/INF.4, paragraph 14.
[43] FCCC/SBI/2007/INF.6/Add.2, paragraph 27 (e).
[44] UN DESA. 2008. *Climate Change: Technology Development and Technology Transfer*. Background paper prepared for the Beijing High-level Conference on Climate Change: Technology Development and Technology Transfer, held in Beijing, China, on 7–8 November 2008. p.41. Available at <http://www.ccchina.gov.cn/bjctc/WebSite/bjctc/UpFile/File125.pdf>.
[45] Third national communication of Mexico. Available at <http://unfccc.int/resource/docs/natc/mexnc3e.pdf>.
[46] FCCC/SBSTA/2006/INF.4, paragraph 15.
[47] Gross R, Dougherty W and Kumarsingh K. 2004. *Conducting Technology Needs Assessments for Climate Change*. Available at <http://ttclear.unfccc.int/ttclear/html/TNAGuidelines.html>.

made little impact on the large-scale implementation of technology development and transfer projects. While many TNAs have identified potential implementation projects, there is currently no systematic approach to facilitating and financing the implementation of projects identified by developing country Parties in their TNAs.[48]

97. The expansion of networks for knowledge-sharing, climate- and technology-policy support, market assessment, linking and reinforcing national climate technology centres and the establishment of an innovative mechanism to promote cooperation on R&D and transfer of appropriate adaptation technologies to developing countries under the post-2012 framework have all been initiated.[49] However, these activities are occurring on a very limited basis and must be expanded significantly if they are to have the requisite impact.[50]

98. Efforts to build stronger links between various MEAs and the institutions that support these agreements have proven useful; however, these efforts have not been consistent and few formal relationships and mechanisms for coordination have emerged. Further efforts to strengthen the relationships between the wide range of intergovernmental processes and mechanisms would be valuable, particularly if those efforts could be sustained and supported within the UNFCCC process.

99. The proposed Technology Mechanism that is currently the subject of negotiation under the AWG-LCA would provide an opportunity to build on progress to date and significantly strengthen cooperation with relevant intergovernmental processes.

3. Challenges and remaining gaps

100. With regard to intergovernmental processes and mechanisms, the EGTT identified the need for a more systematic and coherent overview of the activities of other conventions and intergovernmental processes, including the Commission on Sustainable Development, in relation to technology development and transfer relating to climate change. It suggests that this could be achieved through the analysis and identification of potential synergy.[51] In addition, there is still little cooperation with regard to technology development and transfer in the field of technologies for adaptation, especially among MEAs, and, as such, there is a need for increased bilateral and multilateral cooperation and coordination.[52]

101. Given the scale of the challenge, all developing countries could consider and encourage the development of assessments in the manner of TNAs. There is also a need to ensure the integration of the various planning efforts that are either expected or being undertaken.[53] It is obviously more efficient and effective if technology assessments can be combined more directly with other planning processes in relation to mitigation and adaptation. Multiple planning processes may create an additional and unnecessary burden on developing country Parties. A more coherent approach to the implementation of mitigation and adaptation plans could prove beneficial.

102. In support of the proposed Technology Mechanism, the secretariat could strengthen its efforts in preparing a regular synthesis of regional technology needs, as defined by countries within that region and as specified in national and international technology road maps and action plans. Such synthesis reports could identify areas where technologies could be aggregated to deliver economies of scale, and identify opportunities for the delivery of support to address issues of scale and urgency for mitigation and

[48] FCCC/SBI/2009/INF.1.
[49] FCCC/SBI/2009/INF.1, paragraph 22 (c).
[50] FCCC/SBI/2009/MISC.4.
[51] FCCC/SBSTA/2006/INF.4, paragraph 46.
[52] FCCC/SBSTA/2006/INF.4.
[53] With nationally appropriate mitigation actions, national adaptation plans, technology road maps, technology action plans and low-emission development strategies, for example.

adaptation. They could also help to identify and assess regional needs for collaborative R&D and capacity-building. Guidelines for the synthesis of technology needs could be periodically updated through the proposed Technology Mechanism with support from the secretariat and with guidance from Parties. There is also a crucial need to support countries in identifying, assessing and deploying TNAs and the activities involved in them.[54]

103. Partnerships are an important medium through which to support intergovernmental processes related to technology development and transfer; however, some Parties expressed that, in order to maximize the use of available resources, Parties should seek to strengthen existing processes and mechanisms and only create new arrangements where a clear gap or need can be identified.

4. Key findings

104. Parties have taken a variety of bilateral approaches to enhancing cooperation with relevant intergovernmental processes, including agreements, working groups, activities and workshops.

105. Some of the mechanisms and processes developed to enhance cooperation stem from the Convention itself, such as those initiated by the EGTT to engage key organizations and partners in the implementation of the technology transfer framework, while other mechanisms and processes include partnerships, networks, programming and strategies.

106. The role of multilateral partnerships in fostering cooperation between developed and developing countries as a means to enhance the transfer of technologies has increased significantly.

107. Efforts to build stronger links between various MEAs and the institutions that support these agreements have proven useful; however, these efforts have not been consistent and few formal relationships and mechanisms for coordination have emerged.

108. There is still little cooperation with regard to technology development and transfer in the field of technologies for adaptation, especially among MEAs, and, as such, there is a need for increased bilateral and multilateral cooperation and coordination.

D. Efforts to promote collaborative research on, and development and deployment of, technologies for mitigation and adaptation

109. This area of focus includes the steps taken by Parties and relevant participants at the national and international levels to promote collaborative research on, and development and deployment of, technologies for mitigation and adaptation.

1. Efforts to promote collaborative R&D in relation to technologies for mitigation and adaptation

National

110. A wide range of tools to promote collaborative R&D are currently employed, including: (a) grants for R&D; (b) institutions such as centres of excellence and technology innovation centres; (c) memoranda of understanding between governments; (d) major international programmes to advance technology development; (e) research projects and programmes within and between tertiary-education institutions; and (f) collaborative R&D projects undertaken by private-sector actors or partnerships, either on a purely voluntary basis or facilitated by national governments, and non-governmental and intergovernmental organizations.[55]

[54] FCCC/SBI/2009/MISC.4.
[55] EGTT. 2010. p.4.

111. At the national level, Parties are investing in national research organizations for R&D in relation to ESTs. These organizations collaborate with universities, the private sector and government agencies to support the development of technologies for mitigation and adaptation.[56] Parties reported that they were also establishing national partnerships with the private sector and have established research funds. In addition, Parties have provided opportunities for education through scholarships and exchange programmes and by attracting international research experts in technology development and transfer in a wide range of areas of technology.

International level: bilateral

112. A wide range of existing bilateral collaborative R&D initiatives have been established. Some Parties have extensive portfolios of bilateral programmes across many technologies for mitigation and adaptation. Bilateral activities are perhaps the dominant form of collaborative activity in R&D; however, there is limited information available on the extent of these bilateral activities, their areas of focus or the degree to which they are successful in meeting climate change related objectives.[57]

113. There has also been a considerable increase in South–South and triangular collaboration on R&D in recent years, although, as is the case for bilateral collaborative R&D more generally, data are limited and trends can only be observed through proxies such as patent data.

114. Regional collaborative R&D initiatives often have strong links with national programmes and research institutions and play an important role in a wide range of technological fields relevant to mitigation and adaptation to climate change. They are often designed to transfer knowledge and technological applications between specific geographical areas with common problems and opportunities, and are well placed to adapt technologies to suit local circumstances.

115. Providing opportunities for education has also been a way of enhancing R&D. Australia supports the longer-term development of new technical expertise in developing country partners through the extensive scholarship programme led by AusAID, the Australian Government's overseas aid programme, accounting for almost 5 per cent of total official development assistance (ODA) in 2007–2008.[58] The EU contributes to the development and transfer of technological know-how and related human and institutional capacity-building by means of international cooperation on higher education in technology. Through exchange programmes such as the EU–Asia Link, students from developing countries are able to enrol in undergraduate and graduate study programmes at European technical universities.

International level: multilateral

116. Global energy-related R&D is dominated by EU countries, Japan and the United States of America. These countries account for 90–95 per cent of the total R&D budget among the member countries of IEA.[59] There is no overall arrangement for facilitating or coordinating collaborative R&D on technologies for mitigation or adaptation. Existing coordination mechanisms are focused on sectors (such as the Implementing Agreements of IEA) or on regions (such as APP).

117. IEA elaborated a set of technology road maps for specific technologies. These road maps have highlighted the urgent need for greater international collaboration on R&D among countries. In many cases, the road maps identify priorities for R&D and needs for funding.

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[56] FCCC/SBI/2009/MISC.4.
[57] EGTT. 2010.
[58] FCCC/SBI/2009/MISC.4.
[59] FCCC/SBI/2009/MISC.4.

118. During 2009, the Major Economies Forum on Energy and Climate (MEF) undertook work to develop technology action plans for 10 types of technology all related to mitigation. These technology action plans draw heavily upon the work of IEA, with lead countries preparing each plan in consultation with other MEF countries. While the technology action plans are focused mainly on deployment and diffusion of existing technologies, they do also identify needs for R&D and strategies for enhancing collaborative R&D.

119. Multilateral organizations are also becoming more active in facilitating collaborative R&D activities.[60] Examples include: IRENA, which proposes to coordinate and promote collaborative R&D in relation to renewable-energy technologies; the Consultative Group on International Agricultural Research, which aims to coordinate and bring a strategic focus to global agricultural research, with a particular focus on food security; and APP, which aims to accelerate the development and transfer of clean-energy technologies.

120. Information on collaborative R&D activities in relation to technologies for adaptation is largely unavailable. However, most technologies for adaptation that have been identified in TNAs are commercially available. The application of these technologies is highly site dependent; therefore, the principal focus of R&D in this domain is to tailor the specific technology to the conditions and location in which it will be deployed. Thus, R&D in relation to the implementation of technologies for adaptation is often encompassed within the process of project development and implementation.

2. Efforts to promote deployment of technologies for mitigation and adaptation

National

121. Parties have introduced strategies and road maps as a means of enhancing the deployment of technologies. Since the development of innovative technology requires a large investment and a strategic approach to resolving technical challenges over a long period of time, it is important for each country to agree on the future direction of this development and to promote technology development while reviewing the current situation and progress using technology road maps. Such road maps have been promoted by Parties such as Japan, the EU, Australia and the United States.[61]

122. Funds have also been deployed to promote ESTs. Canada has committed funds to accelerating the development and market readiness of clean-energy technologies and to building the capacity of clean-technology entrepreneurs by helping them to form strategic relationships, formalize their business plans and build a critical mass of capability for sustainable development. Technology centres and networks of centres of excellence programmes have also contributed to the deployment of technology.[62]

International level: bilateral

123. IEA hosts many international technology-coordination programmes, known as Implementing Agreements. These allow member and non-member governments and organizations to collaborate in the area of energy technology according to an established set of rules.[63]

124. Colombia has implemented adaptation projects where collaborative and community research on, and development and deployment of, technologies for mitigation and adaptation have played an

[60] EGTT. 2010. p.13.
[61] FCCC/SBI/2009/MISC.4.
[62] Idem.
[63] Second national communication of the Democratic People's Republic of Korea. Available at <http://unfccc.int/resource/docs/natc/kornc02.pdf>.

important role. Its experiences have shown that endogenous technologies have to be taken into account for the technology transfer process to be successful.[64]

International level: multilateral

125. With regard to the deployment of technologies, the CDM contributes to technology development and transfer by financing projects that use technologies currently not available in the host countries. About 36 per cent of CDM projects, accounting for 59 per cent of the total annual emission reductions of all projects, claim to involve technology transfer. The extent of technology transfer varies greatly across project types: projects concerning agriculture, hydrofluorocarbons, landfill gas, nitrous oxide destruction or wind power are more likely to involve technology transfer, regardless of the projects' characteristics; while projects involving biomass, cement, hydropower or transport are more likely to use local technology.[65]

126. The mitigation technologies identified in TNAs are evenly distributed across sectors, with the exception of the other energy and forestry sectors (see table 1 below). Their distribution is also relatively even across the deployment, diffusion and commercially mature stages of technological maturity (see table 2 below). The GEF and the CDM have each supported about 30 per cent of the technologies. Support by the GEF for the technologies has been fairly even across sectors, with the exception of the forestry sector, and across the deployment, diffusion and commercially mature stages. CDM projects have concentrated on the industry, renewable energy and waste management sectors and on technologies at the diffusion stage.[66]

127. The work of the GEF in the climate change focal area has focused generally on the deployment and diffusion of ESTs. Mitigation projects at the GEF have focused on a single technology and the need to expand the capacity for its use and reach in the market.[67] The mitigation technologies supported by the GEF include a range of energy-efficiency technologies, as well as many renewable-energy technologies, and integrated systems involving more than one energy technology.[68]

[64] FCCC/SBI/2009/MISC.4.
[65] Seres S. 2008. Analysis of Technology Transfer in CDM Projects. Available at <http://cdm.unfccc.int/Reference/Reports/TTreport/TTrep08.pdf>.
[66] FCCC/SB/2009/2.
[67] GEF. 2008a.
[68] UNIDO and UN DESA. 2010. Survey of Technology Development and Transfer Activities by United Nations System Organizations in the Context of Climate Change. Preliminary Draft for Discussion.

Table 1. Distribution of mitigation technologies supported by the Global Environment Facility and the clean development mechanism, by sector

Sector	Technologies mentioned in TNAs (%)	Technologies supported by the GEF (%)	Technologies supported by the CDM (%)
Agriculture	75	25	12
Forestry	89	11	11
Renewables	50	44	56
Non-renewable energy	43	21	21
Industry	53	29	88
Buildings	63	34	20
Transportation	57	32	2
Waste management	67	22	44
Total	**59**	**31**	**29**

Abbreviations: CDM = clean development mechanism, GEF = Global Environment Facility, TNA = technology needs assessment.

Source: FCCC/SB/2009/2, table 12.

Table 2. Distribution of mitigation technologies supported by the Global Environment Facility and the clean development mechanism, by stage of technological maturity

Stage of technological maturity	Technologies mentioned in TNAs (%)	Technologies supported by the GEF (%)	Technologies supported by the CDM (%)
Research and development	0	0	0
Demonstration	42	17	4
Deployment	61	33	20
Diffusion	77	43	63
Commercially mature	76	36	36
Total	**59**	**31**	**29**

Abbreviations: CDM = clean development mechanism, GEF = Global Environment Facility, TNA = technology needs assessment.

Source: FCCC/SB/2009/2, table 13.

128. The World Bank's Carbon Finance Unit also contributes to the deployment of technologies, by using funding contributed by governments and corporations in industrialized countries to purchase project-based GHG emission reduction units in developing and EIT countries through one of its carbon funds or facilities on behalf of the contributor and within the framework of either the CDM or its JI arrangement. The World Bank also houses a global development financing programme, infoDev, which has launched a Climate Technology Program, involving the piloting of the 'climate technology innovation centre' concept and investigating country-specific interventions to accelerate the development, deployment and transfer of locally relevant climate technologies in middle- and low-income countries.[69]

129. Many regional, interregional and global projects are funded by UNDP under its environment and energy sector that deal with climate change (such as renewable-energy technologies and energy efficiency) and include elements of technology development and transfer.[70]

[69] Idem. p.21.
[70] Idem. p.21.

130. In working to mitigate climate change, the work of the programme on environmental technology assessment of UNEP focuses on increasing trade in ESTs and elaborating local projects aimed at developing clean-energy funds and energy service companies.[71]

131. Other initiatives and activities include: the role of the Food and Agriculture Organization of the United Nations with regard to agricultural technologies and the provision of support to extension services; the activities of the cleaner production centres of UNIDO, which cover activities in over 40 developing and EIT countries, investment and technology promotion offices, and centres of South–South cooperation; the activities of the cleaner production centres and collaborating centres of UNEP; and the role played by PFAN in providing assistance to project developers in the structuring of projects and the preparation of financing proposals to facilitate access to financing.[72]

132. In June 2005, the EU and the group of African, Caribbean and Pacific countries launched the Energy Facility with the general objective of contributing to achieving the MDGs (e.g. poverty reduction through increased access to sustainable energy services in rural and peri-urban areas). A total of 75 projects were selected following a call for proposals launched in 2006 for a total project cost of EUR 426 million, with EUR 196 million contributed by the EC. Most of the projects include the transfer of renewable-energy and/or energy-efficiency technologies.[73]

133. Technology development and transfer have been a major consideration in most adaptation projects implemented by the GEF. Because the portfolio of adaptation projects is still in its infancy, there is less experience with the successful development and transfer of adaptation technologies than with its mitigation programmes. Support by the GEF for adaptation activities has covered six different sectors: ecosystem management, agriculture, water management, disaster risk management, coastal zone management and health.[74]

134. GEF-administered funding for the transfer of adaptation technologies has gone to both 'soft' and 'hard' technologies. Soft technologies include: technical assistance for pilot demonstration activities; wetland and/or mangrove restoration; beach nourishment; and institutional support for knowledge transfer to decision makers on how to mainstream adaptation-related concerns into sectoral development planning. Hard technologies include: innovative irrigation systems; drought-resistant crops; investments in infrastructure for the purpose of 'climate proofing'; and the physical transfer of high-tech electronics for data logging and alert systems. Many pilot activities in relation to adaptation are also centred on improved management of current local or traditional knowledge and technologies, or on improved access to adaptation-relevant information which will increase the efficiency of current management.[75]

135. To a larger degree than for mitigation technologies, technologies for adaptation often have to be customized to suit local conditions and situations. The GEF is exploring a wide range of technologies for adaptation, which, unlike mitigation technologies, are very site specific and often require the enhancement of existing technologies so as to take into consideration the changing climate. Technologies for adaptation will play an increasingly important role in the overall dynamic of adapting to climate change, and these technologies will need to be used to improve the overall resilience of natural and human systems to climate change.[76]

136. Technology development and transfer are also components of a number of UNEP-led initiatives for adaptation, including: the Assessments of Impacts and Adaptations to Climate Change initiative, the

[71] Idem. p.23.
[72] GEF. 2008a. pp.48–53.
[73] FCCC/SBI/2009/MISC.4.
[74] GEF. 2008a. p.15.
[75] GEF. 2008b.
[76] GEF. 2008a. p.15.

Highland-Lowland Partnership for Climate Change Adaptation and Disaster Risk Reduction, and the development of a Global Climate Change Adaptation Network.

3. Good practices and lessons learned

Research and development

137. According to data from the Organisation for Economic Co-operation and Development (OECD), global spending on R&D during 2006 amounted to approximately USD 1,000 billion. Spending on R&D in relation to mitigation technologies is estimated at about USD 20 billion, approximately USD 6 billion (30 per cent) of which funded by government and approximately USD 13 billion (65 per cent) funded by business.[77]

138. Spending on R&D and patents are highly correlated. The technologies included in 13 patent families (wind, solar, geothermal, ocean energy, biomass, waste-to-energy, hydropower, methane destruction, climate-friendly cement, energy conservation in buildings, motor-vehicle fuel injection, energy-efficient lighting and CCS) represent nearly 50 per cent of all opportunities for GHG abatement. These families include all renewable-energy technologies, some energy-efficiency technologies and CCS, but exclude electrical vehicles, energy efficiency in industry, and clean coal because the patented technologies do not relate primarily to the reduction of GHG emissions.[78]

139. R&D in relation to technologies for adaptation consists largely of improving the design of particular technologies or adjusting existing technologies to suit local circumstances. The important result and primary benefit of R&D prior to the implementation of a technology is the avoidance of maladaptation. If the technology is not successfully calibrated to local conditions, the cost of the technology can easily outweigh the benefits and could increase the risks that it was designed to mitigate.[79]

140. The need to adapt to the impacts of climate change will create a market for some technologies for adaptation. But technologies for anticipatory adaptation, which is usually more cost-effective, need domestic policies or international financial incentives in place in order to create a market for them.

141. The Adaptation Fund will create a demand for the technologies used in the projects that it funds. How projects and programmes funded by the Adaptation Fund are implemented could affect the development of the technologies used and the associated technology transfer. Purchasing large quantities of a technology for use in several countries, for example, could reduce costs; while implementing a small number of technologies on a larger scale in a country may lead to more technology transfer than implementing many technologies on a limited scale.[80]

142. The technology pathway for adaptation is different from that for mitigation. A general principle to consider is how to enhance the R&D, diffusion and scaling up of good-fit adaptation technologies. The differences between technologies for adaptation and for mitigation in terms of the characteristics of environments enabling their use, and the circumstances in which they are used, need to be made clear.

143. Practical adaptation technologies are often intermediate, low capital, labour intensive and culturally relevant, and they frequently contribute to low-carbon growth and development. While the contribution of these technologies and practices to the gross domestic product might be relatively small, they frequently employ a large percentage of the economically active population. The research on and

[77] FCCC/SB/2009/2, paragraph 70.
[78] FCCC/SB/2009/2, paragraph 69.
[79] FCCC/SB/2009/2, paragraph 84.
[80] FCCC/SB/2009/2, paragraph 109.

development, deployment, diffusion and scaling up of such technologies should receive the same attention as mitigation technologies do.[81]

Deployment

144. Mitigation policies induce technological innovation, but they tend to be short-term, incremental improvements. Technology policies can also stimulate innovation, but they are less effective at reducing emissions than mitigation policies. A combination of mitigation and technology policies is more effective than either type of policy in isolation. International diffusion of technology has a significant impact on the scale of the economic benefits of technological change.[82]

145. Technology development and transfer rely upon commercial activities. Most foreign technology is purchased by firms or households, and most of the technology transferred is supplied by foreign firms. Thus, technology transfer requires an enabling policy environment, including stable macroeconomic conditions, a competitive tax regime, low tariffs on the imported technology and regulations suited to the new technology. In addition, technology transfer requires the human and institutional capacities to select and adopt the new technology and the associated knowledge.[83]

146. Technology development and transfer will increase the potential for, and reduce the cost of, mitigation over time. Policies and incentives for mitigation are necessary, but may not be sufficient to create incentives for technological innovation. Accelerating technological innovation will also require increased funding for R&D and demonstration, and policies to promote near-commercial technologies. Owing to the investment risks involved and the public good nature of research, technological innovation depends on public funding and other policies. The participation of developing countries in R&D and demonstration, which are currently concentrated in a few industrialized countries, needs to be enhanced.[84]

4. Challenges and remaining gaps

Research and development

147. Cooperation is needed at all stages of the technology development cycle. In this context, the current best-available technologies are not being diffused to the extent possible. This could be addressed through the targeted diffusion of these technologies and the invention of new technologies. Parties also mentioned the acceleration of innovation and development of technologies, cost reduction and the avoidance of duplication of efforts on R&D as being among the benefits of international cooperation.

148. Several R&D-related needs were identified at the national level, including the need for governmental support to enhance local capacity for R&D, the provision of funding for institutional development, the provision of grants to public and private entities through R&D projects, the establishment of suitable research platforms, the development of appropriate information channels, and the promotion of cooperation among national R&D agencies, industrial and private-sector research centres, universities, and non-governmental and other research entities.

149. Parties suggested that any new initiatives should build upon and complement existing cooperative efforts. To realize the potential of technology development, deployment and cooperation, it is necessary to identify and focus on key technologies. Areas for further cooperation include: early warning systems and other observation tools, technologies for irrigation and flood and drought control

[81] FCCC/SBI/2009/MISC.4.
[82] FCCC/SB/2009/2, paragraph 83.
[83] FCCC/SB/2009/2, paragraph 107.
[84] FCCC/TP/2008/7, paragraph 24.

(adaptation); and CCS, solar power, biofuels, system integration of renewables, and energy efficiency in buildings, transportation and industry (mitigation).[85]

150. There is also a need to enhance the capacity of developing countries to develop and expand endogenous technologies. Regional centres set up to address technologies on the basis of the region's resources could help to improve capacity, practices and processes, as well as the technologies themselves. Furthermore, test platforms for specific technologies can help to adapt equipment, practices and technologies for their operation in developing countries, as well as contribute to their continuous improvement and the creation of new endogenous technologies.

151. At the international level, some Parties highlighted the need to increase access to the existing R&D facilities in developed countries in order to build local capacity. Some Parties noted in their TNAs that developing countries need to receive further international support in order to improve their national systems of innovation, and to stimulate the creation of intermediaries in order to facilitate technology development and transfer. At the level of subregional, regional and international cooperation, some Parties recognized the need to strengthen institutional, financial and information frameworks to establish efficient and viable research platforms, especially in the scientific research domain.

Deployment

152. The limited market for mitigation and adaptation technologies in developing countries is a major barrier to the transfer of these technologies. In some cases, particularly with VC and private-equity finance, there is also a lack of bankable projects: the capital raised is consistently greater than the number of projects available for investment.[86]

153. The renewable energy supply sector receives a great deal of attention and is a growing commercial market, as is reflected by the large number of renewable energy supply projects carried out under the CDM. However, renewable energy supply faces large gaps in coverage, preventing greater penetration of all but a few of the more common, developed technologies, such as onshore wind, hydropower and biomass cofiring. As is the case for non-renewable energy supply technologies, the current levels of financing for the deployment of renewable-energy technologies are considerably lower than what is required. There are also unique and technology-specific gaps and barriers that need to be addressed, particularly in developing countries.[87]

154. Many non-renewable energy supply technologies are in the demonstration phase, which means that they still need to be scaled up and face cost-related and economic barriers. Many international technology programmes address energy supply technologies and the coverage is fairly comprehensive. In many cases, however, financing remains modest in scale and needs to be increased to bring the technology towards deployment.[88]

155. The general barriers to research on, and the development and deployment of, ESTs are:

(a) Lack of general knowledge and awareness of ESTs on the part of the investors;

(b) The high transaction costs of risk assessments: unfamiliarity with the technology makes it costly to carry out a detailed risk assessment if the appropriate methodologies are not readily available and need to be developed;

[85] FCCC/SB/2009/2.
[86] FCCC/SB/2009/2, paragraph 147.
[87] FCCC/SB/2008/INF.7, paragraph 39.
[88] FCCC/SB/2008/INF.7, paragraph 40.

(c) Lack of hard facts on risks and returns: risk assessments require detailed factual, empirical data which might not be available. There is a lack of information on successful, commercially financed technology development and transfer;

(d) Limited financial infrastructure: underdeveloped financial institutions, especially for more complex structuring;

(e) Volatile market conditions, in particular the volatility of prices of, for example, biofuels;

(f) Ethical considerations: reputational risk because of negative public reaction to, for example, nuclear energy, biofuels or CCS;

(g) Ineffective policies and regulations, which are neither favourable or disadvantageous to ESTs;

(h) Internal financing for energy efficiency: competition with other options and lack of awareness and information.

5. Key findings

156. A wide range of tools to promote collaboration are currently employed, including: (a) grants for R&D; (b) institutions such as centres of excellence; (c) technology innovation centres; (d) memoranda of understanding between governments; (e) major international programmes to advance technology development; (f) research projects and programmes within and between tertiary-education institutions; and (g) collaborative R&D projects undertaken by private-sector actors or partnerships.

157. At the national level, Parties are investing in national research organizations for R&D in relation to ESTs, creating national partnerships with the private sector and also establishing research funds.

158. A wide range of existing bilateral collaborative R&D initiatives have been established across many technologies for mitigation and adaptation. Bilateral activities are perhaps the dominant form of collaborative activity in R&D. Regional collaborative R&D initiatives often have strong links with national programmes and research institutions and play an important role in a wide range of technological fields relevant to mitigation and adaptation to climate change.

159. Multilateral organizations have become active in facilitating collaborative R&D activities. However, information on collaborative R&D in relation to technologies for adaptation is largely unavailable.

160. Parties have introduced strategies and road maps as a means of enhancing the deployment of technologies, and have established specific funds for the promotion of ESTs. Technology innovation centres and networks of centres of excellence can make a significant contribution to the development and deployment of technologies and can build endogenous technological capacity within developed and developing countries.

161. Multilateral organizations have provided financial support for various mitigation technologies in developing countries in a variety of sectors.

162. The objective of enhancing the deployment and diffusion of technologies is to develop a critical path that identifies necessary partnerships, collaborative activities, and the financing required over the long term in order to advance a particular technology through to the deployment and diffusion phases. Technology road maps and action plans can be used to achieve this objective.

163. Once climate-friendly technologies have successfully moved from the laboratory to the market, targeted policy measures such as regulations and direct financial incentives can encourage the use of these technologies and result in tangible reductions in energy consumption and GHG emissions.

164. It is important to strengthen existing mechanisms and processes for international cooperation, as well as to establish new arrangements to fill any gaps.

E. Adequacy and timeliness of the financial support provided, within the context of Article 4, paragraphs 1(c) and 5, of the Convention, for the purposes of development and transfer of technologies, the related activities and their results

165. This area of focus covers the adequacy and timeliness of the financial support provided, within the context of Article 4, paragraphs 1(c) and 5, of the Convention, for the purposes of development and transfer of technologies. It also addresses the related activities and their results at the national and international levels.

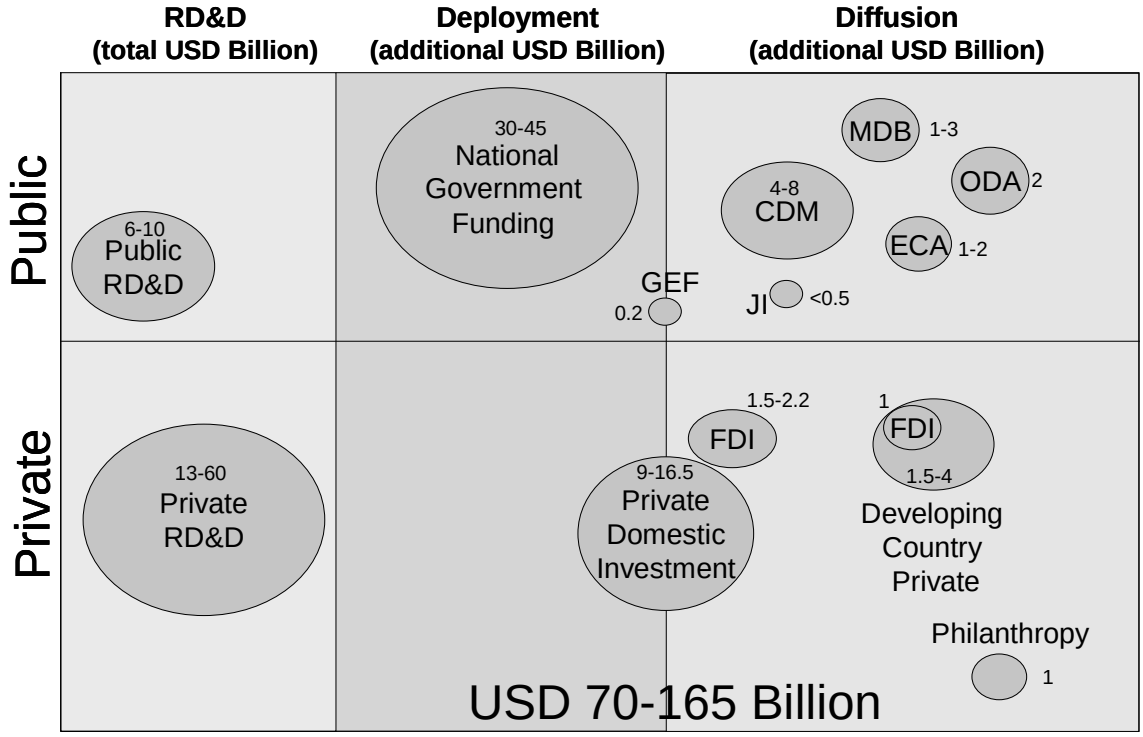
1. Financial support provided

166. In 2009, the EGTT undertook a thorough assessment of the financial resources and vehicles for technology development and transfer, as part of its report on financing options.[89] Its assessment of financial flows for technology development and transfer included all financial flows, both those under the Convention (support provided in the context of Article 11 of the Convention) and those that flow outside of the framework of the Convention (such as domestic and foreign private financial flows).

167. As of 2009, the financing available for research, development, deployment, diffusion and transfer in relation to mitigation technologies was estimated at between USD 70 and 165 billion per year. A summary of the data on financial resources at each stage of the technology innovation cycle, and according to whether the finance is public or private, is presented in figure 2 below.

[89] FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.

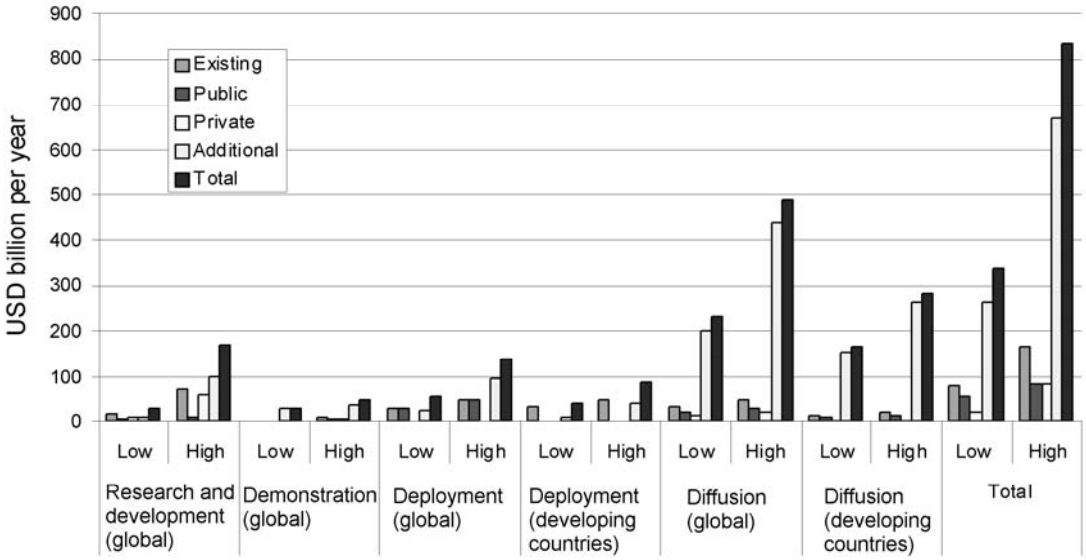
Figure 2. Estimates of current financing for mitigation technologies



Source: FCCC/SB/2009/2/Summary, figure 1.
Abbreviations: CDM = clean development mechanism, ECA = export credit agency, FDI = foreign direct investment, GEF = Global Environment Facility, JI = joint implementation, MDB = multilateral development bank, ODA = official development assistance, RD&D = research, development and deployment.

168. The gap between the current level of available finance and the financing required to stabilize the concentration of GHGs in the atmosphere at around 500 parts per million by volume of carbon dioxide equivalent has also been assessed by the UNFCCC and is illustrated in figure 3 below.

Figure 3. Estimates of annual financing needs for mitigation technologies up to 2030, by source and stage of technological maturity



Source: FCCC/SB/2009/2/Summary, figure 2.

169. According to the EGTT, most of the cost of developing and transferring technologies for adaptation is likely to be included in the cost of implementing adaptation projects in developing countries. Future spending needs for adaptation are estimated at between tens and hundreds of billions of USD per year.

170. The EGTT estimates that the current financial support for technology transfer is likely to amount to less than USD 2 billion per year.

171. The information compiled below attempts to distinguish between support provided under the Convention and other sources of finance that are relevant for accelerating technology development and transfer at each stage of the technology innovation cycle. However, there is a recognized need within the negotiations under the AWG-LCA for a more systematic approach under the Convention for recording financial support, including improved arrangements for the measurement, reporting and verification of such support.

Financial flows in, and support provided for, the R&D stage

172. According to data collected by the EGTT,[90] public financing for R&D totals approximately USD 6–10 billion per annum. Activity is concentrated in a relatively small number of countries, mostly in OECD countries (85 per cent of the total spending on R&D in over 90 countries during 2002, almost USD 760 billion, is by members of OECD). R&D activity is spreading internationally and spending on R&D in some developing countries, especially China, is rising more rapidly than in developed countries.

173. Annex II Parties have reported, in their national communications, on the provision of financial support for R&D almost exclusively on a bilateral basis. The focus has been on energy sector based research, which remains a high priority on the research agendas of Parties. The main areas subject to support include renewable energy sources, cleaner and more efficient energy conversion and the use of relevant technologies, security and sustainability of supply, and technologies within the transport sector.

[90] FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.

Research targeted at reducing GHG emissions and carbon sequestration is also being carried out in the agriculture and forestry sectors. As some Parties noted, the entry into force of the Kyoto Protocol resulted in expanded R&D in relation to mitigation.[91]

174. The amount of financial support for R&D provided to developing country Parties in the context of Article 11 of the Convention is unknown. However, the EGTT has previously noted that "although R&D is becoming more international, there is no international funding mechanism and there is limited coordination for such activities" and that "only about 10–20 per cent of financing resources are used for the development and transfer of technologies to developing countries".[92]

Financial flows in, and support provided for, the deployment and diffusion stage

175. According to the EGTT,[93] financial flows and support for technology deployment and diffusion are derived from several different financial resources and vehicles, including ODA, foreign direct investment, foreign portfolio equity investment and VC, commercial loans, commercial sales, philanthropic sources and export credit agencies. Most of these financial flows support private-sector technology development and transfer.

176. The financial support provided to developing country Parties for the deployment and diffusion of mitigation technologies both under and outside of the Convention is presented in table 3 below.

Table 3. Estimates of current financial support provided to developing country Parties for the deployment and diffusion of technologies for mitigation, by source
(billions of United States dollars per year)

Stage of technological maturity	Source of financing	Estimated annual investment
DEVELOPING COUNTRIES		
Sources under the Convention		
Deployment and diffusion	The GEF	0.19
	The CDM	4–8
Sources outside of the Convention		
Diffusion and commercial	Export credit agencies	<1
Deployment and diffusion and commercial	Bilateral ODA Multilateral ODA	2 1–3
Deployment and diffusion	Philanthropic private sources	1
Deployment, diffusion and commercially mature	Private investment including FDI of USD 1 billion	1.5–4

Source: Adapted from table 5 contained in document FCCC/SB/2009/2.
Abbreviations: CDM = clean development mechanism, FDI = foreign direct investment, GEF = Global Environment Facility, ODA = official development assistance.

177. Financial flows for adaptation projects under the Convention, plus some dedicated bilateral and private resources, currently amount to between USD 0.89 and USD 1.1 billion per year. A small fraction of this amount would be used for technology development and transfer.

[91] FCCC/SBI/2007/INF.6/Add.2, paragraph 66.
[92] FCCC/SB/2009/2/Summary, paragraph 9 (e) and (f).
[93] FCCC/SB/2009/2, paragraph 110, and FCCC/SB/2009/2/Summary.

178. The GEF has responded to the request of the COP, in its decision 4/CP.7, paragraph 3, by providing financial support to the technology transfer framework through both the GEF Trust Fund in the climate change focal area and the Special Climate Change Fund.

179. At COP 14, the establishment of the Poznan strategic programme on technology transfer was agreed upon in order to further enhance the support provided under the Convention to developing country Parties for technology transfer. The programme consists of three funding windows: (a) TNAs; (b) technology transfer pilot projects; and (c) dissemination of technologies and practices. In keeping with decision 2/CP.14, paragraph 2 (c), whereby the COP requested the GEF to consider the long-term implementation of the Poznan strategic programme on technology transfer, the GEF Secretariat has identified technology transfer as a long-term priority objective of the GEF in the climate change focal area.[94]

180. As shown in table 4 below, since 2000, the GEF has allocated USD 2.2 billion to climate change technologies (during its 18 years of existence, it has allocated USD 2.5 billion to supporting more than 30 climate-friendly technologies in more than 50 developing countries, generating an estimated USD 15 billion in co-financing, mostly from multilateral development banks).

Table 4. Total annual investment in and financial flows for climate change technologies through the financial mechanism under the Convention
(millions of United States dollars per year)

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Latin America and the Caribbean	33.9	15.4	10.4	32.6	72	31	93.3	25.7	52	104.9	**471.1**
Asia and the Pacific	23.6	121	53.5	24.2	56.3	37.2	111.8	143.2	110.6	125.3	**806.7**
Africa and the Middle East	38.4	28.3	45.7	45.8	18.8	23	1.1	11.3	80.2	45.3	**338**
Central and Eastern Europe	23	18.3	26	59.8	9.9	32.6	65.3	37.5	48.5	29.7	**350.5**
Global and multi-country	16.4	7.2	3	79	0.9	16.4	31.1	7.1	0	69.4	**230.4**
Total	**135**	**190.3**	**138.6**	**241.4**	**157.9**	**140.3**	**302.6**	**224.8**	**291.2**	**374.7**	**2196.8**

Activities of partner institutions and other initiatives

181. The World Bank, as an implementing partner of the GEF, has managed nearly USD 1.6 billion or 64 per cent of the funding provided by the GEF in the climate change focal area. The World Bank's initiatives in relation to energy efficiency and renewable energy have committed total funding of USD 1.4 billion, or 40 per cent of the total commitments in the energy sector, with funding by the GEF making up USD 128 million of this total.[95]

182. A number of different carbon funds are hosted by the World Bank to support CDM projects. During 2007, nearly 10 per cent of the World Bank's clean energy portfolio (accounting for USD 140 million) was made up of carbon finance operations. The World Bank is placing renewed emphasis on climate change and has established a portfolio of strategic Climate Investment Funds.[96]

[94] FCCC/CP/2009/9, paragraph 45.
[95] GEF. 2008a. pp.48–53.
[96] Idem.

There are two distinct funds: the Clean Technology Fund, to promote increased financing for demonstration, deployment and transfer of low-carbon programmes and projects, which includes programmes in the power sector, the transport sector and energy efficiency; and the Strategic Climate Fund, which provides financing for the piloting of new approaches to technology development and the support of targeted programmes.[97]

183. Other multilateral development banks have established specialized funding instruments to address climate change and to support, among other things, the transfer of ESTs. The Asian Development Bank is supporting clean-energy projects through the Asia-Pacific Carbon Fund, and has announced the establishment of a new Climate Change Fund. The European Bank for Reconstruction and Development is supporting low-carbon projects through both the Sustainable Energy Initiative and the Multilateral Carbon Credit Fund. The Inter-American Development Bank is using its own capital to support both sustainable infrastructure projects through its Infrastructure Fund and sustainable energy projects through its Sustainable Energy and Climate Change Initiative. All of these initiatives include elements of technology development and transfer.[98]

184. UNEP has established the Rural Energy Enterprise Development initiative, which has funded more than 50 new clean-energy enterprises in developing countries, the Seed Capital Assistance Facility and the Sustainable Energy Finance (SEF) Initiative, which has spawned a network of public finance institutions called the SEF Alliance, as well as innovative financing initiatives aimed at leveraging private-sector investment.

185. All Annex II Parties provided information on financial support provided and practicable steps to promote, facilitate and finance the transfer of, or access to, ESTs and know-how to other Parties, particularly developing country Parties. They also provided examples of technology development and transfer programmes and projects, eleven Parties providing examples in tabular format and the other Parties providing this information in textual format. The majority of these programmes and projects were in the energy sector, particularly in the areas of improving energy efficiency and using renewable energy sources.[99]

186. There is an increased interest in technology development and transfer in relation to adapting to the adverse effects of climate change in developing countries. Almost all Parties referred to bilateral projects and programmes intended to assist developing countries in adapting to the adverse effects of climate change. Most of these projects and programmes focus on soft technology activities in general and capacity-building in particular.[100]

187. Table 5 below presents a summary of the total annual bilateral financial contributions by sector, as reported by Annex II Parties in their third and fourth national communications. However, since many Parties reported contributions for different years and not specifically for the development and transfer of technology, care should be taken when interpreting these figures.

[97] UNIDO and UNDESA. 2010. p.20.
[98] GEF. 2008a. pp.48–53.
[99] FCCC/SBI/2007/INF.6/Add.2.
[100] FCCC/SBI/2007/INF.6/Add.2, paragraph 50.

Table 5. Bilateral financial contributions by sector, 1997–2003
(millions of United States dollars per year)

		As reported in the third national communication				As reported in the fourth national communication			
		1998	1999	2000	Total 1998–2000	2001	2002	2003	Total 2001–2003
Mitigation	Energy	2 323.6	1 888.6	1 590.5	**5 802.7**	14 666.7	1 041.2	2 125.0	**17 832.8**
	Transport	1 699.3	703.1	855.4	**2 215.9**	39296.2	378.0	1 501.9	**41 176.1**
	Forestry	437.5	309.3	311.1	**1 057.9**	361.3	305.6	562.0	**1 228.9**
	Agriculture	563.4	179.9	56.1	**799.4**	7 458.1	22.1	31.9	**7 512.1**
	Waste	143.7	72.7	7.0	**223.4**	56.9	31.5	46.4	**134.8**
	Industry	499.8	395.3	55.0	**950.1**	71 798.2	30.2	57.2	**71 885.6**
	Total	**5 667.4**	**3 548.9**	**2 875.2**	**12 091.4**	**133 637.5**	**1 808.5**	**4 324.4**	**139 770.4**
Adaptation	Capacity-building	873.1	2 608.3	996.4	**4 477.7**	52.4	90.0	99.7	**242.1**
	Coastal zone management	171.4	513.0	29.2	**713.7**	9.5	14.2	7.5	**31.2**
	Other vulnerability assessment	122.5	86.9	27.4	**236.8**	23.4	16.2	29.2	**71.3**
	Total	**1 167.0**	**3 208.2**	**1 053.1**	**5 428.2**	**85.3**	**120.4**	**136.4**	**344.6**
	Grand total	**6 834.3**	**6 757.1**	**3 928.2**	**17 519.7**	**133 722.8**	**1 928.9**	**4 460.8**	**140 115.0**

Note: In addition to data reported by Parties under "Other vulnerability assessment", the row for this category includes data provided by some Parties, such as Belgium, the Netherlands and Switzerland, in categories that are different from those specified in the UNFCCC reporting guidelines.

Source: FCCC/SBI/2007/INF.6/Add.2, table 5.

2. Financial support needed

188. Many analysts have concluded that the current scale of energy-related R&D is inadequate to address the challenge of climate change, and they propose that efforts be stepped up substantially.

189. In terms of additional capital required, IEA, in its publication *Energy Technology Perspectives 2008*,[101] reports a need for investment in the technology diffusion phase of up to USD 1,100 billion annually, as an average over the years 2010–2050. Furthermore, IEA estimates that USD 100–200 billion per year is required globally to cover the early costs of deployment, 60 per cent of which would be required in developing countries.

190. According to the report by the EGTT on financing options,[102] the additional incremental financing needs for climate change mitigation technologies beyond current funding levels span a range of USD 262–670 billion per year. Table 6 below shows the overall additional incremental costs for each stage of the technology cycle.

[101] IEA. 2008. *Energy Technology Perspectives 2008.* Available at <http://www.iea.org/techno/etp/index.asp>.
[102] FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.

Table 6. Overall additional incremental costs for development, deployment and diffusion of mitigation technologies

(billions of United States dollars per year)

	R&D (total spending)	Demonstration (total spending)	Deployment (additional cost of climate technologies)		Diffusion (additional cost of climate technologies)		Total
	Global	Global	Global	Developing countries	Global	Developing countries	Global
Current total	15.8–70	NA	30–45	NA	31.5–49	11.3–18.8	77.3–164
Additional financing needed	50[a] 20–100[b] 10[c]	27–36[d]	57–94[e] 25–35[f]	10–38.5[g]	250–440[h] 200–210[i]	150–264[h] 82–180[g]	262–670

Abbreviations: NA = not available, R&D = research and development.
Note: The "Current Total" row is taken from table 4 of this document.
[a] Stern N. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press. p.371. Public finance only.
[b] Doornbosch R, Gielen D and Koutstaal P. 2008. *Mobilising Investments in Low-emission Energy Technologies on the Scale Needed to Reduce the Risks of Climate Change*. SG.SD/RT(2008)1. Paris: OECD. p.5.
[c] UNFCCC. 2007. *Investment and Financial Flows to Address Climate Change*. Bonn: UNFCCC. p.7. Public finance only.
[d] Calculated from demonstration costs estimated in: International Energy Agency. 2008. *Energy Technology Perspectives 2008*. Paris: IEA. Chapter 3.
[e] UNFCCC, *Investment and Financial Flows to Address Climate Change*, p.90.
[f] UNFCCC, *Investment and Financial Flows to Address Climate Change*, p.6.
[g] The level of investment required in developing countries is calculated using the same investment share as estimated by the secretariat, which is 40.9 per cent in developing countries and 59.1 per cent in developed countries (UNFCCC, *Investment and Financial Flows to Address Climate Change*, p.214, annex V, table 4).
[h] McKinsey. 2009. *Pathways to a Low-carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve*. Available at <http://www.mckinsey.com/clientservice/ccsi/pathways_low_carbon_economy.asp>. p.8 and p.17.
[i] UNFCCC, *Investment and Financial Flows to Address Climate Change*, p.92.

Source: FCCC/SB/2009/2, table 7.

191. In 2008, the secretariat produced an update of its assessment of the financial resources needed for adaptation, and suggested amounts in the order of tens of billions, possibly hundreds of billions, of USD per year.[103]

192. In terms of gaps in the financing for R&D, IEA elaborated an analysis of the gaps in the funding for global research, development and demonstration (RD&D) activities for several technologies. This analysis included, for each technology, the estimated current level of public spending on RD&D, future RD&D priorities, and an assessment of the gap between the current level of ambition in terms of technology development and the level that will be needed to meet climate change related goals by 2050. The results are shown in table 7 below.

[103] FCCC/TP/2008/7. See also Flåm K and Skjærseth J. 2009. Does adequate financing exist for adaptation in developing countries? *Climate Policy*. 9(1): pp.109–114.

Table 7. Gaps in the funding for research and development identified by the Major Economies Forum on Energy and Climate as assessed by the International Energy Agency

	RDD&D needs to achieve BLUE Map 2050	RD&D needs to achieve BLUE Map 2050	Annual RD&D needs to achieve BLUE Map 2050	Current annual public RD&D spending	Estimated annual RD&D spending gap
	(USD Billion)[a]	(USD Billion)[b]	(USD Million)[c]	(USD Million)[d]	(USD Million)[e]
Advanced vehicles (includes electric vehicles + fuel cell vehicles; EE in transport)	7,500 - 9,100	830 - 1,660	16,600 - 33,200	1,856	14,744 - 31,344
Bio-energy (biomass combustion + biofuels)	210 - 250	23 – 46	460 - 920	738	-278 - (+182)
CCS (power generation, industry, fuel transformation)	2,500 - 3,000	275 – 550	5,500 - 11,000	532	4,968 - 10,468
Energy efficiency (industry)	2,000 - 2,500	225 – 450	4,500 - 9,000	524	3,976 - 8,476
Higher efficiency coal (IGCC + USCSC)	700 - 800	75 – 150	1,500 - 3,000	841	659 - 2,159
Smart grids	2,550 - 3,000	278 – 555	5,550 - 11,100	522	5,038 - 10,578
Solar (PV + CSP + heating)	750 - 890	82 – 164	1,640 - 3,280	680	960 - 2,600
Wind energy (onshore and offshore)	600 - 700	65 – 130	1,300 - 2,600	238	1,062 - 2,362
Nuclear energy	650 - 750	70 – 140	1,400 - 2800	4,922	-3,522 - (-2,122)
Total across technologies	**17,460 - 20,990**	**1923 – 3845**	**38,460 - 76,900**	**10,853**	**27,607 - 66,047**

[a] RDD&D values taken from ETP 2008 BLUE Map scenario for 2050.
[b] RD&D values derived using 10% - 20% of average RDD&D value (column 1) for Blue Map 2050 scenarios.
[c] Derived from RD&D values (column 2) and assuming 80% attributed to IEA countries, the European commission, Brazil, Russia, China and India, and dividing by 40 years.
[d] IEA 2007 data with the following exceptions: Australia (2009-2010 estimated), Canada (2009 estimated), France (direct submission, 2007 revised), Germany (2009 estimated), USA (2009 estimated). The following non-member countries spendings have been added from direct information source: Russia (2009 estimate), Brazil (year?, bio energy), China and India (year?, bio energy, solar energy, wind). When necessary, spending has been calculated using in 2008 exchange rates.
[e] The difference between columns 3 and 4; it is assumed that at least 50% of this comes from public sources.

Source: International Energy Agency. 2009. *Global Gaps in Clean Energy Research, Development, and Demonstration.* Prepared in support of the Major Economies Forum (MEF) Global Partnership by the International Energy Agency. Available at <http://www.iea.org/papers/2009/global_gaps.pdf>.

Abbreviations: CCS = carbon dioxide capture and storage, CSP = concentrated solar power, EE = energy efficiency, IGCC = integrated gasified combined cycle, PV = photovoltaic, RD&D = research, development and demonstration, RDD&D = research, development, demonstration and deployment, USCSC = coal ultra-supercritical steam, USD = United States dollar.

3. Good practices and lessons learned

193. Despite difficulties in estimating the current level of private-sector financing for technology development and transfer, available evidence suggests that it is currently around 60 per cent of the total financing available. In order to increase the proportion of private-sector financing, more sophisticated policies and investment programmes will be required to attract the private sector.

194. According to the GEF, improving and expanding support for conducting TNAs, and preparing technology road maps and national action plans, will help form a strong foundation for a strategic technology development and transfer programme. These activities can be strengthened in order to identify and prioritize national activities for technology development and transfer to attract financial investment.[104]

195. In terms of new financing options, the GEF has suggested exploring the option of public and private-sector VC funds playing a growing role in funding the transfer of ESTs to developing countries.

196. Furthermore, carbon finance could also play an increasingly important role in financing technology development and transfer, and the benefits and challenges of this instrument should be explored to scale up the level of investment in ESTs.

197. Capacity-building for financing technology development and transfer is another area which should be supported. According to the GEF, while many institutions and organizations proclaim to be leading efforts to develop and transfer technology, the investment in properly trained and experienced human capital is inadequate. Initiatives aimed at building project financing skills in developing countries, including in government institutions, can increase the steady flow of bankable technology projects, especially when combined with improved access to private capital markets through vehicles. Demand is growing for training and capacity-building initiatives that are focused on technology programmes and policies, in addition to the traditional efforts that focus on technology projects.

4. Remaining gaps and challenges

198. A major challenge exists in estimating the support provided by Annex II Parties to developing country Parties. A systematic and standardized accounting and recording system is needed. Furthermore, greater attention needs to be paid to improving data collection and the estimation of private-sector and domestic financing for technology development and transfer.

199. The GEF has identified four gaps in the support provided for the transfer of ESTs to developing countries to date, namely:

(a) The weak link between project development by the GEF, TNAs and national communications: to date, about 69 TNAs are available on the UNFCCC website. Drawing from these TNAs, the secretariat has been able to collate a TNA project database with project proposals requiring financing in excess of USD 10 billion. However, only a handful of countries have developed detailed project concepts and proposals based on their TNAs which are ready to be financed. The provision of further support to developing country Parties is needed to address this gap;

(b) A lack of adequate reporting and knowledge management in relation to technology development and transfer activities. According to the GEF, there has been little reporting by the GEF on its activities in the area of technology development and transfer, and there have been no systematic efforts to draw on and disseminate the experiences

[104] GEF. 2008a. p.18.

and lessons learned. There has been no comprehensive, in-depth analysis of the portfolio of the GEF from the perspective of technology development and transfer.

(c) An uneven engagement with the private sector. The GEF Council adopted a strategy in June 2006 with guidelines aimed at enhancing its engagement with the private sector, and a specific public–private partnership initiative was approved by the Council in June 2007. However, engagement by the GEF with large multinationals, the private financial community and the capital market continues to be underutilized.

(d) The limited synergy with the carbon market. As an operating entity of the financial mechanism under the Convention, the GEF has had limited interaction and synergy with the market-based flexibility mechanisms such as the CDM. Although the mandate and the modality of the GEF and carbon finance are different, there is tremendous potential for synergy between the two mechanisms that should be further explored, potentially in the context of a post-2012 international climate change agreement.[105]

200. With regard to the estimates of financing, the biggest gap is in private financing for deployment of technologies. Specific policies and measures are needed to tackle this issue. The focus should be on innovative financing tools that reduce the risk of investment within the context of national climate change strategies and nationally appropriate mitigation actions. In parallel, there is a need for more public financing mechanisms, particularly early stage VC financing, and reforms to enabling environments which can support and mobilize private-sector investment.[106]

201. The second important gap relates to the development and transfer of technologies for adaptation. Much greater emphasis needs to be placed on this dimension of climate change. Basic information on the financial needs for climate change adaptation technologies is not available. While several assessments of the financial resources needed for adaptation have been carried out, a specific assessment of the needs related to the development and transfer of technologies for adaptation should also be conducted.

202. The EGTT, in its 2009 report on financing options,[107] identified some issues with regard to gaps in the existing financial resources for the development, deployment, diffusion and transfer of ESTs, including that:

(a) Financing for R&D relies heavily on businesses and governments in a relatively small number of countries;

(b) While R&D is becoming more international, there is no international funding mechanism and limited coordination between countries;

(c) The existing mechanisms under the Convention and its Kyoto Protocol provide very limited support for technologies at the demonstration and deployment stages;

(d) The existing mechanisms under the Convention and its Kyoto Protocol support about half of the technologies that developing countries need and lack coordination in terms of the technologies that they support;

(e) No explicit mechanism or financial resources are available for technology transfer.

[105] GEF. 2008a. p.15.
[106] FCCC/SB/2009/2.
[107] FCCC/SB/2009/2 and FCCC/SB/2009/2/Summary.

203. There is also a need to increase the visibility of, and encourage cooperation on, the development and transfer of technologies among international and regional financial institutions. Enhanced coordination is needed across these various participants, and the UNFCCC may have a key role to play in ensuring a more coherent and strategic alignment of existing and future efforts.[108]

204. The Technology Mechanism proposed in the work under the AGW-LCA could play a significant role with regard to the adequacy and timeliness of the provision of support, through the provision of clear guidance on activities and/or outcomes eligible for support, and by building stronger links with the financial mechanism under the Convention and its operating entities.

5. Key findings

205. Spending on R&D is concentrated mostly in the OECD countries; however, R&D activity is also increasing in some large non-Annex I Parties. While an estimate of the support provided by Annex II Parties to non-Annex I Parties for R&D is not available, evidence suggests that little support is currently available.

206. There is an increasing number of available funds provided by multilateral organizations and through bilateral channels that include elements of technology development and transfer. These funds focus mainly on mitigation measures and technologies.

207. The current support provided is mainly for mitigation through the energy sector (renewable energy and energy efficiency); however, the current scale of financing for technology for mitigation remains inadequate to address the challenge of climate change.

208. There has been some increase in the funds available for adaptation; however, there is still a need to increase investment in technologies for adaptation. A reliable estimate of the funding needs is currently unavailable.

209. Annex II countries have provided financial incentives to the private sector to promote technology development and transfer. But there is still a need to further engage the private sector in technology development and transfer, particularly in developing countries.

210. Carbon finance has played an important role in technology development and transfer, through such mechanisms as the CDM.

211. There is still a gap in the funding for technology development and transfer initiatives identified in TNAs.

212. There is still a lack of capacity for the funding of technology development and transfer, where few organizations have the human skills required to ensure that technology development and transfer remains a valuable component of projects and programmes. Ensuring the involvement of the private sector in technology development and transfer would improve the overall capacity to deliver projects and programmes. Programmes aimed at supporting developing country Parties in the preparation for financing of high-quality technology transfer projects should be expanded, and there is a significant opportunity for similar programmes that provide further support for the development of programmes and policies for financing.

[108] GEF. 2008a. p.20.

V. Using performance indicators to monitor and evaluate the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention

213. The analyses in chapter IV above concentrated on the steps taken by Parties and other relevant organizations in the process of the development and transfer of technologies in five areas of focus. This chapter uses the set of 40 performance indicators developed by the EGTT[109] as an additional tool for the review of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention. The information and data required for using these indicators is provided in the report to the SBSTA, at its thirty-second session, on this matter.[110]

214. The following results are based on a preliminary analysis of the data and information compiled and synthesized for using the 40 performance indicators as reported to the SBSTA. This chapter presents the analysis and findings in relation to each theme of the technology transfer framework: (a) technology needs and needs assessments; (b) technology information; (c) enabling environments; (d) capacity-building; and (e) mechanisms for technology transfer. Consistent with the original mandate for the work of the EGTT on performance indicators, it also presents analysis and findings related to the indicators of financial flows.

1. Technology needs and needs assessments

Analysis of the effectiveness of the implementation of this key theme

215. According to the report by the GEF on the elaboration of a strategic programme to scale up the level of investment in the transfer of ESTs,[111] only a handful of countries have developed project concepts and proposals based on their TNAs, and hardly any of those proposals have been submitted to the GEF for funding. There are many reasons behind this weak link between TNAs and project development by the GEF. First, enabling activities such as national communications are primarily designed to assist countries in fulfilling their requirements under the Convention – they seldom lead to the development of projects. Further, the guidelines for preparing TNAs have not, in the past, covered the detailed project development phase, although improvements in this regard have been made in the most recent version of the UNDP handbook. Second, in many countries, the government agencies responsible for enabling activities are different from, and often not well coordinated with, those that develop climate change project proposals for funding by the GEF or other sources. Third, the quality of TNAs varies substantially in terms of analytical rigour, with little effort often being devoted to indentifying the cost-effectiveness and market potential of technologies, barriers that prevent the market potential from being realized, and the means of overcoming these barriers. Finally, in the first round of preparation of TNAs, technical support and guidelines were provided far too late in the implementation process to be effective.

2. Technology information

Analysis of the effectiveness of the implementation of this key theme

216. The implementation by Parties and relevant organizations of the technology information component of the technology transfer framework has been moderately effective, although there is significant potential for enhanced implementation.

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[109] FCCC/SB/2009/4.
[110] FCCC/SBSTA/2010/INF.3.
[111] GEF. 2008a.

217. Several Parties included information about technology development and transfer activities in their national communications. Furthermore, TT:CLEAR provides relevant information, and has a high annual number of visitors. However, its ability to provide a coordination mechanism and harness other technology information centres has been hampered by a lack of resources, and could be significantly strengthened. Furthermore, there are opportunities to use TT:CLEAR as a powerful networking tool, including with practical resources that could support technology development and transfer activities, including: TNAs, technology road maps and technology action plans; tools and resources for financing projects, programmes and policies; patent data and other facilities for searching technology databases, including performance data on best-practice technologies; and information on best-practice policies and measures to support technology development and transfer.

218. The information component of the technology transfer framework has partially reached its objective to establish an efficient information system in support of technology development and transfer and to improve the generation, flow and quality of, and access to, technical, economic, environmental and regulatory information relating to the development and transfer of ESTs under the Convention, especially through TT:CLEAR.

3. Enabling environments

Analysis of the effectiveness of the implementation of this key theme

219. Several activities, studies, projects and programmes regarding enabling environments and developing and implementing regulations that promote the use and transfer of, and access to, ESTs have been implemented. However, even if all of these activities, projects and programmes contributed to improving the effectiveness of the transfer of ESTs by identifying and analysing ways of facilitating this transfer, several barriers at each stage of the process have not been removed and still limit the effectiveness of the transfer of technologies. These barriers include the lack of regulatory and legislative frameworks, the lack of tax benefits and incentives to encourage imports and exports of ESTs, as well as perverse subsidies that support high-emission technologies, and a lack of progress in the use of public procurement to support the transfer of ESTs.

4. Capacity-building

Analysis of the effectiveness of the implementation of this key theme

220. Parties identified, in their TNAs, the need for capacity-building in relation to the development and transfer of ESTs, including the need to build up individual and institutional capacities, and public awareness. Allocation of financial resources to capacity-building in the development and transfer of ESTs and the annual number of experts benefiting from this allocation cannot be identified. This allocation is not separate from that committed for other capacity-building or for other policies and measures, and Parties do not gather data on the annual number of participants in training programmes on EST-related activities.

221. Even though scientific and technical skills, capabilities and institutions in developing country Parties have been strengthened and developed, Parties still identified some needs for capacity-building. Therefore, there might be a need to increase and monitor the financial support provided for capacity-building activities focused on the development and transfer of ESTs.

5. Mechanisms for technology transfer

Analysis of the effectiveness of the implementation of this key theme

222. Parties do not systematically report on:

(a) Innovative public–private financing mechanisms and instruments at the national level;

(b) Matters that pertain to the relationship between the Convention and other MEAs;

(c) The development of endogenous technologies;

(d) Joint or collaborative R&D.

223. Nonetheless, there is some indication of the existence at the regional level of innovative public–private financing mechanisms and instruments. Furthermore, a JLG between the secretariats of CBD, the UNFCCC and UNCCD is active. These mechanisms facilitate the support of financial, institutional and methodological activities.

6. Analysis of financial flows

224. It can be concluded that there is a need for a systematic approach to the measurement, reporting and verification of financial flows for the development, deployment, diffusion and transfer of technologies for mitigation and adaptation. The report by the EGTT on financing options[112] and the secretariat's report on investment and financial flows[113] have made significant advances in this direction. However, specific information on support as it relates to the provisions of the Convention is inadequate. This is partly because there is no agreed list of technologies for mitigation and adaptation and no agreed definition of the costs that should be financed. The available data relating to private-sector R&D, deployment, diffusion and transfer of technology are also very limited. The quality of the available information with regard to renewable-energy technologies is much higher than with regard to other types of technology. In almost all areas, more and better information is available in relation to mitigation technologies than to technologies for adaptation.

225. Despite the nature of the information, the broad patterns are clear:

(a) The financial resources for technologies for mitigation and adaptation make up only a small share (probably less than 3.5 per cent) of the resources devoted globally to all technology development and transfer;

(b) Most of the financial resources (probably over 60 per cent) for the development and transfer of climate technologies are provided by businesses, and most of the remaining resources (about 35 per cent of the total) are provided by national governments;

(c) Most of the public-sector resources (about 95 per cent) are provided directly by national governments, and the remainder is provided through multilateral sources, including the Convention;

(d) Technology development is concentrated (about 90 per cent) in a few countries or regions, namely the United States, the EU, Japan and China;

(e) Although R&D is becoming more international, there is no international funding and limited coordination of such activities;

[112] FCCC/SB/2009/2.
[113] FCCC/TP/2008/7.

(f) Only about 10–20 per cent of the financial resources available are used for development and transfer of technologies to developing countries.

226. The existing mechanisms under the Convention and its Kyoto Protocol:

(a) Make up a small share (probably less than 5 per cent) of the total financial resources available for the development and transfer of climate technologies;

(b) Provide very limited support for technologies at the 'valley-of-death' demonstration and deployment stages;

(c) Provide support for about half of the technologies that developing country Parties need;

(d) Lack effective coordination in terms of the technologies that they support;

(e) Do not explicitly provide resources for technology development and transfer, but do contribute to technology development and transfer in other ways.

VI. Findings and conclusions

227. Overall, the review and assessment of the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention has shown that, since the implementation of the technology transfer framework, some significant strides forward have been taken in the implementation of Article 4, paragraphs 1(c) and 5, thus rendering the technology transfer framework effective. Since 2002, many Parties have undertaken a variety of actions in the process of the development, demonstration, deployment and diffusion of ESTs. Furthermore, Parties have taken steps to promote the transfer of technologies to developing country Parties, through regulatory and legislative frameworks, the promotion of public and private partnerships, the creation of partnerships to improve intergovernmental processes, increases in collaborative R&D, as well as by increasing financial flows and the support provided to key technologies and developing country Parties.

228. With regard to the first area of focus of the review, several countries reported actions that have promoted and supported institutional systems and regulatory and legislative frameworks, as well as measures to address legislative and institutional barriers to technology transfer. At the international level, bilateral and multilateral agencies have undertaken activities that have helped to promote and support institutional, regulatory and legislative frameworks. However, there is an indication that the past and current support provided was and still is inadequate given the needs identified by developing countries. There is also an indication that national institutional systems and regulatory and legislative frameworks are frequently fragmented in developing countries and support to enhance enabling environments is still needed in many developing countries.

229. With regard to the second area of focus of the review, it has been noted that several Parties have taken actions to promote public–private partnerships in the area of the development and transfer of ESTs. In Annex I countries, the role of the private sector has indeed become more prominent since 2002 in enhancing the transfer of technologies to developing country Parties. At the international level, the EGTT has played a valuable role in bringing together national- and international-level expertise on issues regarding the development and transfer of ESTs. Its contributions to the negotiations on technology development and transfer have been widely acknowledged, and it has been at the forefront in strengthening the engagement of the private sector. Several multilateral organizations have introduced ways of promoting public and private involvement in technology transfer, including the creation of partnerships with private-sector organizations and enterprises. However, the private sector needs to be further engaged, particularly in the implementation of the outcomes of negotiations under the Convention related to technology development and transfer.

230. With regard to the third area of focus of the review, the UNFCCC has provided a good forum in which to initiate intergovernmental processes, especially since the implementation of the technology transfer framework. Collaborative work with the other conventions is also imperative to ensure the development and transfer of technologies for adaptation. The creation and maintenance of partnerships play a key role in enhancing cooperation with relevant intergovernmental processes. As such, workshops provide a valuable backdrop for the promotion of mechanisms and processes for the enhancement of intergovernmental processes, especially given the increase in interest from key international organizations, which should lead to enhanced cooperation.

231. With regard to the fourth area of focus of the review, Parties are investing in national research organizations in order to enhance R&D, creating national partnerships with the private sector and establishing research funds, which include collaborative arrangements and, in some cases, support for developing country Parties on R&D. In addition to extensive portfolios of bilateral programmes across many technologies for mitigation and adaptation, international technology road maps and action plans provide a means of enhancing the deployment of technologies, particularly in developing countries. At the international level, several multilateral organizations are taking steps to promote collaborative R&D by providing financial support for various mitigation technologies in developing countries in a variety of sectors, while technology innovation centres and networks of centres of excellence have also contributed to the development and deployment of new and existing technologies. Nonetheless, limited support is being provided for collaborative R&D under the Convention, and this should be an area of focus for future arrangements.

232. With regard to the fifth area of focus of the review, while there has been a significant increase in the financial support provided for the development and transfer of technologies, the level of support is still far from adequate when considered in the light of the estimates of additional incremental financing needs in developing countries. While public financing will continue to be crucial, there is a need for policies and measures that can leverage greater private-sector investment in technologies for mitigation and adaptation.

233. The increased interest of donors and multilateral organizations in providing funds for mitigation technologies has led to an increase in the total amount of funds available. However, there is a crucial need to expand the use of public financing mechanisms and innovative instruments, including public-sector VC funds, to support the transfer of ESTs to developing countries. The CDM has also played an important role in increasing funding for technology development and transfer. Challenges remain in terms of the establishment of robust accounting systems for financial support and flows, and information on and support for technologies for adaptation must become a priority.

234. With regard to the 40 performance indicators developed by the EGTT, data have been collected for the majority of the indicators in relation to each key theme of the technology transfer framework. Significant data gaps remain, however, most notably in relation to the enabling environments, capacity building, and mechanisms for technology transfer themes, and with regard to financial flows. Regarding the performance indicators for non-Annex I countries, accessing the required data has posed significant challenges.

235. However, the indicators developed by the EGTT are often too detailed, and, while they can be useful for monitoring the implementation of the themes of the technology transfer framework, they present challenges when being used to derive meaningful insights into the effectiveness of the implementation of Article 4, paragraphs 1(c) and 5, of the Convention. There will be a need to undertake further work on the development of indicators to support the implementation of a post-2012 international climate change agreement, which is aligned with the efforts to establish a system for measurement, reporting and verification, as defined in decision 1/CP.13, the Bali Action Plan.

Annex

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