UNFCCC workshop on technology needs assessments

Background Paper II

Enhancing Implementation of TNA Results

I. Objective of the paper

1. The objective of this background paper is to explore possible actions to enhance the implementation of technologies for mitigation and adaptation as prioritized through Technology Needs Assessments (TNAs) in the form of projects, programmes and policies.

II. Scope and approach of the paper

2. A key output of a TNA is a range of technologies which have been prioritised for their contribution to the country's sustainable development and climate change mitigation and adaptation. As a next step, a country can formulate actions for a successful development and transfer of these technologies, which can take place at the levels of technology projects, programmes and policy measures.

3. However, the process of technology development and transfer is complex and each country has specific national institutional structures and social networks of actors who operate under their respective policies and regulations. It also acknowledges that technologies may be in different stages of development and that this requires different actions.

4. In order to learn from earlier conducted TNAs how technology projects, programmes and policies have been formulated, the documents used for this paper include:

a. Case studies from 68 completed TNAs,

b. Report on the workshop on best practices in conducting technology needs assessments (FCCC/SBSTA/2007/11),

c. Technical paper on best practices in technology needs assessment (FCCC/TP/2007/3),

d. Synthesis report on technology needs identified by Parties not included in Annex I to the Convention (FCCC/SBSTA/2006/INF.1)

e. Second synthesis report on technology needs identified by Parties not included in Annex I to the Convention (FCCC/SBSTA/2009/INF.1)

f. The secretariat's background paper on good practice for TNAs prepared for the UNFCCC workshop on sharing good practices with conducting TNAs,

g. The United Nations Environment Programme (UNEP) report on assistance to fourteen countries within the framework of the global environment facility (GEF) expedited financing for (interim) measures for capacity building in priority areas, and;

h. The United Nations Development Programme (UNDP) report on experiences and lessons learned from TNAs.

5. Another input to the paper is the updated *Handbook for Conducting Technology Needs Assessment for Climate Change* (TNA Handbook) which is used for new rounds of

TNAs.[1] Next to identifying priority technologies, the updated TNA Handbook offers guidance on identifying measures for acceleration of technologies through demonstration projects, sector programmes and national strategies for acceleration of technology innovation.

6. Finally, a number of experts have been interviewed in the countries for which TNAs have been prepared. These interviews focussed on technology implementation results and first lessons learned.

7. The paper is built up as follows:

(a) Discussion of projects, sectoral plans or programmes, strategic actions and policy measures identified in TNA reports,

(b) Measures for successful implementation of TNA results at technology (project) level,

(c) Enhancing TNA result implementation at sector and national level,

(d) Collaboration between public and private sector stakeholders in implementing TNA results, and

(e) Financial resources to finance implementation of the TNA results (role of the GEF, international organisations, development banks).

III. Discussion of projects, sectoral plans or programmes, strategic actions and policy measures identified in TNA reports

A. Introduction

8. The UNFCCC secretariat's synthesis report has indicated that about 70% of Parties which conducted TNA reports identified in their TNAs next steps for accelerating prioritised technologies.[2] Examples of such steps are: enhancing access to information and raising awareness of environmentally sustainable technologies, and labels and standards for energy efficiency measures in the buildings and residential sectors.

9. Some 35% of Parties developed in their TNAs concrete ideas, proposals and/or concepts for projects and/or programs in different sectors. However, the report has also shown that very few TNAs contained comprehensive implementation plans with extensive coverage of technology transfer issues.

10. The conclusions of the two workshops organized by the secretariat on options for innovative financing of technology transfer (held in Montreal, Canada, in 2004 and Bonn, Germany, in 2005) underlined an increasing engagement of the private sector in the implementation of TNA findings. The lessons learned included:

(a) Finance for technology development and transfer is generally available,

(b) Some projects are not at all suitable for private sector financing,

[1] < http://unfccc.int/ttclear/pdf/TNA%20HANDBOOK%20EN%2020101115.pdf>

[2] Second synthesis report on technology needs identified by Parties not included in Annex I to the Convention. Note by the secretariat, FCCC/SBSTA/2009/INF.1 <http://unfccc.int/resource/docs/2009/sbsta/eng/inf01.pdf>

(c) Many projects could, however, access financing with the right guidance and structuring,

(d) There is a shortage of good financing/project proposals that meet the standards and criteria of private sector financing communities, and

(e) An early stage filter mechanism during the TNA process would be beneficial to sort projects into broad financing groups: private sector; private and public sectors, and public sector.

11. The secretariat's synthesis report has also identified the following key actions identified in TNAs for development of an implementation strategy:

(a) Identifying barriers to and constraints on technology transfer and analyzing them,

(b) Identifying the widest possible group of stakeholders who have a role to play in technology transfer, from source of technology to end user, and involve them in the consultation process, and

(c) Agreeing on actions to be undertaken to remove the barriers identified and possibly assigning the role of dealing with barrier removal to responsible institutions.

12. Box 1 gives an overview of good practices identified from TNA reports by the secretariat's synthesis report.

Box 1. Good practices in implementing the findings of technology needs assessments

- Develop an effective and integrated implementation plan with activities, time frames, milestones and responsibilities in order to address the findings and recommendations from the TNA,
- Develop a comprehensive list of potential donors,
- Draw on synergies with relevant on-going programmes,
- Set up a mechanism to engage stakeholders during the implementation phase,
- Revise the plan to accommodate changes in national development policy and the funding priorities of donors.

13. The form that the implementation of prioritised technologies for mitigation and adaptation takes depends on the technology, the promoters and the beneficiaries in question. It may be in the form of project proposals or simply a set of actions for soft technologies such as the transfer of research findings or practices for adaptation.

14. Although no single 'recipe' exists for technology implementation plans and strategies, it is a good practice to prepare an implementation plan that accommodates all technologies prioritised while paying due attention to the specific nature of each one. An example of this approach is shown in Figure 1, which provides a simple flow chart for preparing and implementing technology transfer plans.[3]

[3] Climate Technology Initiative (CTI), 2001, Methods for Climate Change Technology Transfer Needs Assessments and Implementing Activities: Experiences of Developing and Transition Countries <http://www.climatetech.net/pdf/Ccmethod.pdf>

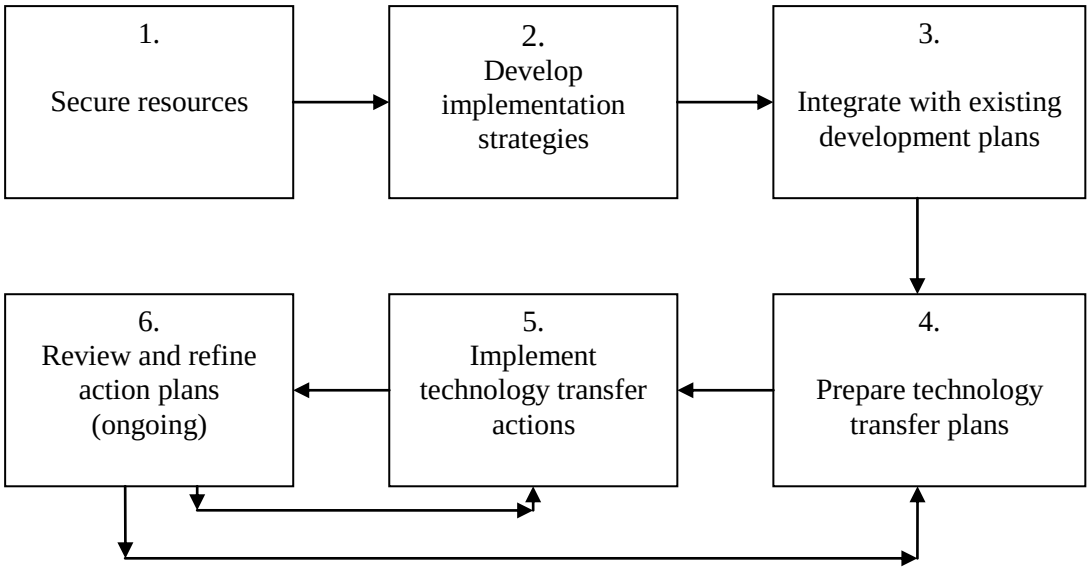

Figure 1. Flow chart for preparing and implementing technology transfer plans (reproduced from CTI, 2001)

15. The sections below discuss in further detail how TNAs have thus far resulted in project proposals, sector level programmes and input to national technology innovation strategies in the countries based on prioritised technologies.

B. Projects identified in TNA reports

16. The secretariat's second synthesis report concluded, based on a preliminary analysis, that in the 68 TNA reports analysed, Parties have identified 264 project proposals with potential financing needs totalling over US$11 billion.[4] An overview of how project proposals have been divided across different sectors and subsectors is shown in Table 1.

[4] Second synthesis report on technology needs identified by Parties not included in Annex I to the Convention. Note by the secretariat, FCCC/SBSTA/2009/INF.1 http://unfccc.int/resource/docs/2009/sbsta/eng/inf01.pdf

No	Acronym	Country	Sectors and subsectors																		
			Energy			Industry			Transport			Agriculture & forestry										
			Buildings & residential	Energy generation	Energy transmission	Industrial energy-efficient	Cement production	Miscellanous industries	Vehicles	Infrastructure	Public transport	Agriculture	Forestry	Livestock	Waste management	Coastal zones	Water	Health	Systematic observation	Information and awareness	Capacity-building
1	ALB	Albania	●				●	●			●	●	●	●	●		●	●	●		
2	ATG	Antigua and Barbuda	●	●												●			●		
3	ARM	Armenia	●	●									●	●							
4	AZE	Azerbaijan	●	●	●			●		●			●	●	●		●	●			
5	CPV	Cape Verde		●								●	●	●	●	●				●	●
6	CHN	China		●		●															
7	CIV	Côte d'Ivoire	●	●											●						
8	HRV	Croatia	●	●		●		●											●		●
9	COD	Democratic Republic of the Congo	●	●		●	●	●				●	●	●	●				●	●	●
10	DMA	Dominica		●															●	●	●
11	ECU	Ecuador		●		●			●			●	●		●				●	●	●
12	ETH	Ethiopia	●	●		●	●		●			●	●	●	●						
13	GEO	Georgia	●	●			●		●										●		
14	HTI	Haiti				●							●		●						●
15	LBN	Lebanon	●	●		●			●						●						
16	MRT	Mauritania	●									●				●				●	
17	NER	Niger	●	●	●			●													
18	MDA	Republic of Moldova				●							●		●						
19	WSM	Samoa										●		●		●			●	●	●
20	TJK	Tajikistan	●	●			●	●	●	●		●	●	●			●	●	●		
21	MKD	the former Yugoslav Republic of Macedonia	●	●		●															
22	TKM	Turkmenistan		●																	
23	UZB	Uzbekistan	●	●	●	●	●	●					●								
24	VNM	Viet Nam	●	●		●						●	●			●					

Table 1. Categorization of the projects proposals submitted by Parties in their TNAs, source: UNFCCC, Second synthesis report

17. The table shows that most projects are in the field of energy generation and energy saving through measures in buildings and residential dwellings. Other 'popular' categories are energy efficiency measures in industrial sectors, forestry, and waste management.

18. Most technology projects for adaptation have been proposed for systematic observation systems, climate change impact information and awareness building campaigns and capacity building measures.

19. As in the early TNA rounds no template was available for project concepts or ideas, countries used own templates. Common elements used in the project plans were: project name, location, link to national priorities, project rationale, timing of preparation and implementation, expected outcomes in terms of economic, development and environmental benefits, planned activities, and budget. Annex 1 shows an example of a project plan included in a TNA report.

20. Moreover, some project information was not disclosed for commercial confidentiality reasons or because projects are simply too early in the development stage to already provide detailed financial information. Consequently, the majority of TNA reports consist of project concepts or ideas rather than full proposals.

C. Programmes for technology acceleration within sectors or specific areas identified in TNAs

21. In Viet Nam, the TNA was concluded with the formulation of sector plans with the following information: technologies prioritized for the sector, purpose of the technologies within the sector and forecast locations to use them, preliminary estimate of the GHG emission reduction or vulnerability reduction impacts of considered technologies up to the year 2010, as well as an inventory of who would be the stakeholders to take part in this sector program.[5]

22. Also Dominica identified next steps for accelerating prioritised technologies in individual sectors, while the Republic of Moldova described future strategies for the energy sector. In the field of adaptation, Turkmenistan formulated a climate observation system program.

23. Ghana, in its TNA, identified actions to remove barriers to the transfer of prioritised technologies, in particular for the sectors Energy and Waste. These actions include national actions, such as national programmes and policies, and actions expected from the internal community. In addition, the Ghana TNA specified institutional, human, and systemic capacity needs for technology transfer.

24. The Islamic Republic of Iran described draft programs and policies to encourage technology transfer. Another example of country which has formulated a cross-technology plan at the level of sectors is Sri Lanka. The Sri Lankan TNA also identifies sectors that require priority consideration by the government for policy development and future projects.

D. Strategic actions recommended in conducted TNAs

25. The TNA reports do not show a structured approach applied for formulating country level strategies for technology development and transfer. Burundi, Democratic Republic of Congo, Madagascar and Mauritius identified technology implementation plans, which could potentially be integrated in a national strategy for technologies for mitigation and adaptation. In the case of China, projects have been proposed as part of national or departmental development plans.

26. Countries also considered implementation aspects for prioritised technologies such as need to overcome barriers or removing system inefficiencies. However, a clear assessment of what this would imply for an overall strategy for technology acceleration at the national level has been mostly lacking.

27. Moreover, although the aspect of whether a technology is in the RD&D phase, deployment or diffusion phase has been taken into account by countries when formulating individual projects, this has generally not resulted in national strategies in TNAs for different technology development stages.

28. The above conclusions are supported by the UNDP report on "*Experiences and lessons learned from technology needs assessments (TNAs)*", which states that the TNAs prepared generally gave little attention "*to the non-technological options needed to create an environment conducive to the adoption of hard technologies*."[6]

29. An example of how TNA results are linked to strategy making at the national level is that of Thailand. According to an expert interviewed, the TNA report of Thailand will be used to: (1) build capacity for climate change adaptation, (2) promote greenhouse gas mitigation, (3) support research and development on technologies for adaptation and

[5] http://unfccc.int/ttclear/pdf/TNA/Viet%20Nam/Vietnam_Final%20Report_Phase%20II.pdf, p.63.
[6] UNDP, 2008. Experiences and lessons learned from technology needs assessments (TNAs), Report to the Global Environment Facility (GEF), 31 May 2008.

mitigation, (4) raise awareness and enhance public participation in mitigation and adaptation actions, (5) build institutional capacities and coordinate for mitigation and adaptation, and (6) seek international cooperation in climate change mitigation. These elements have been incorporated in "*National Strategy on Climate Change Management 2008-2012*" for Thailand.[7]

30. The importance for lifting the focus of attention from the project to the level of national strategy is clearly illustrated by the response of one of the experts interviewed for this paper: "*In developing countries projects often fail because stakeholders are not in the position to solve problems related to technology implementation, even though they understand the problems well. Problems are subsequently distributed among many departments and functionalities. Resources must therefore be devoted towards coordinating efforts and linkages. One way this could be achieved is to adopt a top-down approach, where planning will move from the more general to the specific level. In addition, it would be good to set up a cross sectoral TNA action planning team for the specific projects. This would help stakeholders to see the impact of their actions on other sectors*."

E. Policy measures for country-driven policy actions

31. Specific examples of policies identified in TNAs for acceleration of priority technologies are the implementation of labels and standards for improving energy efficiency measures in the buildings and residential dwellings sector.

32. Nonetheless, the UNDP TNA evaluation report concludes that identified policy actions in TNA report need further development "*to ensure more comprehensive TNAs addressing the policy aspects of technology transfer and adoption under the Convention. Linkages of TNA with key policy process should be strengthened in future TNA analysis*."[8]

33. Finally, the UNDP evaluation report concludes "*[t]hat TNAs should be conducted with a clear understanding of the policy process these assessments may feed into. The information generated by TNAs, if generated through a policy-driven approach, can provide critical inputs to national efforts to address climate change*."[9]

F. Inventory of the status of project proposals reported in TNAs.

34. The Conference of Parties (COP) requested the secretariat to provide regular updates on progress with implementation of TNA results, including success stories for consideration by the SBSTA at its subsequent sessions.[10] In response to this the secretariat has prepared an inventory of the status of project proposals reported in TNAs. For this a project progress fact sheet has been developed with a basic set of questions on project data (name, location), status of implementation, identified barriers to the successful implementation, the financial coverage of the project, and basic data on the financiers.

35. As the result of this initiative the secretariat received replies from twelve Parties highlighting progress of their project proposals of which **some five** were developed from their TNAs results.

36. Some Parties financed their technology projects through the GEF. One Party reported a project with environmental impacts (production of electricity from renewable energy sources) and social impacts on local communities (job creation, development of tourism). One Party used an international cooperation bank and a private financing cooperation to finance an upgrade of their thermal power plant and a methane capture project.

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[7] http://www.gistda.or.th/gistda_n/index.php/dl-presentation/doc_download/330-national-strategy-in-climate-change-management-modeling-and-data-application
[8] Ibid, pp.7-8.
[9] Ibid, p.8.
[10] Decision 3/CP.13, Annex I, paragraph 8 (g).

37. To finance implementation of technology projects, one Party addressed the barrier of a lack of large scale financing resources by focusing on a series of smaller projects in particular sub-sectors. Public funding for smaller size projects was available and hence several projects below US$ 1 million were developed in transport and industrial sectors. Proposals were prepared in the sectors of environmentally friendly urban transport (fuelled by bio-ethanol), and energy efficiency measures in industry. The financing provided by the national government covered also capacity building for project operators.

38. By tackling the barriers of implementation of TNA results several Parties have demonstrated that the TNA process, next to identification of priority sectors and technologies, has also resulted in the implementation of projects. This has shown a possible way how future TNA can be done. The lessons learned from these countries' successful implementation of projects is being fed back to the UNFCCC and incorporated into workshops and training materials that will assist to shape future TNA and future projects.

39. One Party implemented the project "*Capacity building for climate technology transfer and clean development mechanism (CDM)*." The project was designed to create a national climate technology transfer centre as a direct response to the country's needs in technology transfer. It had the following objectives: improve decision making procedures, support establishment of operational national system for coordination of public-private partnership, and contribute to the uptake of environmentally sustainable technologies in different economic sectors. The project supported the creation of national capacities for technology transfer and CDM.

G. Conclusions

40. The TNA reports completed thus far have resulted in several portfolios of potential technology projects. These project descriptions or proposals generally include information about project purpose, implementation plan, involved stakeholders, costs, timeline, *etc*.

41. However, when analysing across the TNA reports it becomes clear that a structured approach with identifying development priorities as a starting point and a national strategy for technology acceleration as an integral part of national climate policy is often lacking.

42. The resulting picture from TNA reports is therefore diverse with some countries limiting a TNA to technology projects only, whereas others also identify programmatic actions and extent TNAs to sector plans or even national action.

IV. Enhancing implementation of TNA results at technology (project) level

A. Introduction

43. This chapter and the next discuss how countries can enhance the implementation of technologies identified in a TNA as technology projects and at the level of sectors and national strategies. This discussion is based on good practice with completed TNAs, as discussed in the former chapter, and literature sources on technology development and transfer.

44. Both chapters emphasise that measures for acceleration of technology development and transfer depend on a number of aspects, such as:

- The existing enabling environment in the country concerned, including barriers and opportunities, and country-specific institutional structures and national networks.

- The scale of technology implementation, i.e. whether the technology is applied at the household or community level (small scale) or at a larger scale.
- The technology's development stage, i.e. whether the technology is still in an RD&D phase, or in a process of deployment in the market or ready for diffusion at a scale of commercial application (see for an illustration Figure 2).

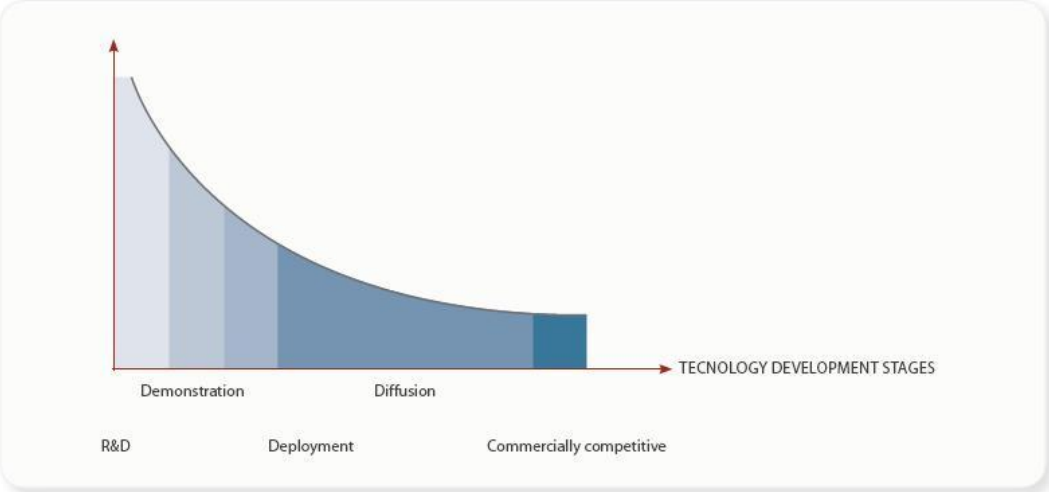

Figure 2. Learning curve for technology innovation[11]

The figure illustrates how a technology generally develops along a learning curve with relatively high costs during the initial development stages (RD&D) and relatively low costs during the stage of commercial application (diffusion).

45. As explained above, the process of technology development and transfer is complex with complexities depending on the country context. However, some general observations can be made and an example of this is the so-called "Valley of Death" concept (Figure 3), as developed by the World Bank. It explains how public development efforts play a key role during the initial technology development stage with a more important role for the private sector during its commercial application.

46. A crucial phase is in between of these two stages, which is called the "Valley of Death." Here, public development efforts should be replaced with private development efforts, but this can be hampered due to risk, unfamiliarity with the technology, inefficient enabling environment, *etc*. In other words, if decreasing public sector support is not replaced with private development efforts, then the technology development could be stopped here.

[11] Expert Group on Technology Transfer (EGTT), 2009, *Advance report on recommendations on future financing options for enhancing the development, deployment, diffusion and transfer of technologies under the Convention*, FCCC/SB/2009/INF.2.

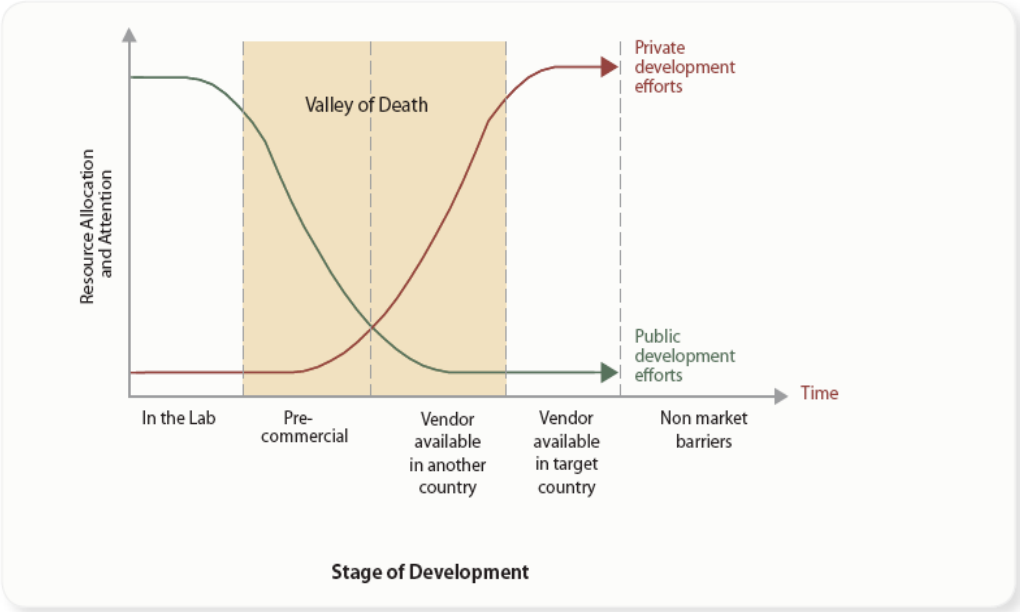

Figure 3.Valley of Death concept illustrated[12]

B. Acceleration of long term, pre-commercial technology implementation

47. A TNA could prioritise technologies for a country which are only available as a promising prototype (*e.g.*, 5-15 years to market) or in a demonstration phase (up to 5 years to full marketing). For these technologies the focus is mainly on RD&D-related measures.

48. The technology developers may or may not be in the country concerned, but activities to foster roll out of the technology could be carried out in-country. Such activities can be identified by characterising the enabling environment in the country for technology RD&D (*e.g.*, who are the main stakeholders, what are the networks involved, what are the policies and regulations surrounding this stage) and exploring how it could be improved. In this respect, a country can seek collaboration with other countries on RD&D activities, *e.g.*, through South-South or North-South co-operation.

49. For example, incentives and support structures may need to be put in place to allow technology developers access to additional funding to support the pre-commercialisation phase. This may help them to identify low-cost routes for supply chains and manufacturing or even subsidise the technology until economies of scale come into play. It may also support developers in maintaining diversity in the technology design in order to develop robust technology alternatives.

C. Accelerating prioritised technologies in the process of deployment in the market

50. During the process of deployment in the market, transfer of technologies will be enacted mainly through private developers (see Figure 3). Therefore, at this stage, it is important to facilitate the involvement of investors and technology users, *e.g.*, through networks and other national, regional and local institutions. This can support development of technology information dissemination strategies and awareness raising campaigns. The stakeholder groups involved in the TNA process together with their wider groups can form a starting point for such networks.

[12] Handbook for Conducting Technology Needs Assessment for Climate Change, Annex 12, http://unfccc.int/ttclear/jsp/TNAHandbook.jsp

51. One of the benefits of such networks and the dissemination of information on a technology is that it helps to increase decision makers' familiarity with new technologies. For example, when decision makers can see a technology operating successfully under country conditions or an equivalent context, it will be easier for them to adopt the technology for further deployment.

52. The networks can also identify training requirements for operation and maintenance of the technology, and set out training program requirements for national or international funding. Moreover, the networks can determine whether a technology needs to be modified to be robust under country conditions (*e.g.*, under different climatic circumstances) and how this can be arranged.

53. A technology could be deployed in the country in different ways, such as, for example, through the import and installation of a fully functioning turnkey technology, by adapting existing in-country technologies, or constructing a technology by in-country manufacturers and suppliers through agreements on intellectual property rights. The latter aspect could have different implications across technologies thereby affecting the particular business model used.[13]

54. In the deployment process it also has to be decided what financing model to use for implementation of the technology. For example, a technology can be further developed in a joint venture, manufactured and operated under license, or leased. The choice of the financing model could depend on such factors as consumers' ability to pay for technology services and the commercial presence of entities able to deploy the technologies.

55. This also requires awareness on the utilization of capital markets. For example, some priority technologies may not conform to current investment criteria yet and for these alternative financing arrangements may be needed, such as: micro-finance, grant or incremental funding.[14]

D. Acceleration of prioritized technologies in the process of market diffusion

56. For acceleration of diffusion of a prioritized technology in the country it is important in a TNA to describe the market or system for the technology, including the market actors with their specific norms, rules and firm-to-firm interactions, as well as decision making requirements for adoption.[15]

57. Stakeholders in a TNA could describe the relevant business environment for the technology to be diffused, *e.g.*, relevant legislation, procedures, contract enforcement, business regulation, finance policy, trade standards, consumer trends, market actors, and supporting services, market information, *etc*.[16]

58. Based on the resulting map for technology diffusion, barriers, bottlenecks and inefficiencies (*e.g.*, in current regulations and policies) can be identified, as well as missing elements (*e.g.*, regulation and enforcement). This also provides insight into what measures are needed to improve the enabling environment for technology diffusion.

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[13] Tomlinson, S., P. Zorlu, and C. Langley, 2008, *Innovation and Technology Transfer: Framework for a Global Climate Deal*, E3G report with Chatham House, http://www.e3g.org/images/uploads/E3G_Innovation_and_Technology_Transfer_Full_Report.pdf

[14] See also "Guidebook for investors on preparing technology transfer projects for financing" by EGTT, 2008, and "Future Financing Options for Enhancing the Development, Deployment, Diffusion and Transfer of Technologies under the Convention" by EGTT, 2009.

[15] Rogers, E.M., 2003, *Diffusion of Innovations*, 5th ed., The Free Press, New York, NY, USA.

[16] Albu M. and A. Griffith, 2006, 'Mapping the market: participatory market chain development in practice', *Small Enterprise Development*, Vol.17, No.2, pp. 12-22.

59. Similar to the process of technology deployment, in the process of identifying appropriate models for technology and finance transfer, as well as in improving the enabling environment for technology diffusion an important role is to be played by networks of stakeholders.

E. Conclusions

60. This chapter has discussed measures for consideration in a TNA for successful implementation of prioritised technologies. In general, these measures relate to creating an enabling environment for acceleration of technology development and transfer and the required capacity development for that.

61. A first observation from the chapter is the recognition of the role of stakeholder networks around a technology so that they can actively take part in a technology programme, possibly at the level of a sector or even beyond that.

62. Second, successful technology implementation requires insight into the market, system or broader environment within which the implementation is to take place. This provides insight in barriers, inefficiencies or other bottlenecks and helps identify measures to resolve these.

63. Third, it has been shown that measures for technology acceleration depend on the development stage of the technology and the circumstances for technology development and transfer, *e.g.*, whether the technology is rolled out in the market as a commodity or part of a large scale infrastructure project.

V. Enhancing TNA result implementation at sector and national level

64. Sector and national level actions for technology development and transfer have a more strategic dimension than the project level measures discussed above. Nevertheless, also at the level of sectors and national strategies it is important to distinguish the different possible technology development stages, as acceleration of, *e.g.*, technology RD&D requires different strategic actions than acceleration of technology diffusion.

65. In a TNA, sector and national level strategies can be formulated by analysing what role the prioritised technologies can play in achieving long term development goals. For example, if a sector target is to increase the share of renewable energy technologies to 25%, then concentrated solar power technology can contribute to that by 10%-points.

66. This provides insight into the number of units to be invested in and related costs. In addition, similar to the characterisation of enabling environment for technology projects in the former chapter, measures can be identified for an enabling environment for technology application at this scale. These measures form elements for a strategy. They can be characterised in terms of responsibilities, timing, costs, *etc*., for the formulation of an action plan for implementation of the strategy (see Table 2 for an example).

67. Technology acceleration strategies therefore would not only give insight into measures for technology development and transfer, but also into how this would support achieving sectoral and country level development targets. It would will also contribute to capacity development for successful technology development and transfer in the country.

Sector: Agriculture

Specific Technology and category: Crop rotation system – small and large scale – short term

Innovation stage: Deployment – Diffusion

Measure (grouped under core elements)	**Priority**	**Why is it important?**	**Who should do it?**	**How should they do it?**	**Time scale**	**Monitoring, reporting and verification for measure**	**Estimated costs**
Formation of networks							
Identification of existing networks	1						
Creation of hubs	2						
Policies and measures							
Demand driven innovation policies	1						
Other core elements as listed e.g. skills training etc.							
Measure 1 *etc.*	3						

The Table shows how the characterization of the measures for accelerating prioritized technologies takes place. The table groups the prioritized measures, for one technology in one (sub)sector and innovation stage, vertically under the core elements of a strategy. Then, horizontally, the priority of the activity and the characterization of these measures under the headings for an implementation action plan are placed. These can be aggregated up as required to form a national action plan.

Table 2. Prioritisation and characterisation of technology acceleration measures for a strategy[17]

VI. Role of public and private sector stakeholders in implementing TNA results

A. Role of public sector stakeholders

68. Public sector stakeholders could facilitate the implementing the TNA results by providing enabling environments, encouraging coordination among different stakeholders within governmental departments, the private sector and the financial sector, and establishing steering committees composed of cross-sectoral government representatives and a pool of experts (as well as the criteria for selecting them).

69. Governments could support successful implementation of TNA project ideas by establishment of strategic partnerships between public and private sector stakeholders, work with external experts, organize training and workshops, work with universities and RD&D centres on innovative technologies and establish a knowledge database of external experts for internal capacity-building (such as train the trainers).

70. As explained in chapter IV, public sector developers play a dominant role during a technology's RD&D phase. During this stage, public sector institutes might need to arrange for technology developers within the country or undertake activities to foster roll-out of the technology. This could include incentives and support structures to allow technology developers access to additional funding to support the pre-commercialisation phase with regard to identifying low-cost routes. At this stage, the government could support implementation of demonstration projects.

[17] Updated TNA Handbook, Chapter 6., p.85, see footnote 1.

71. The role of public sector developers becomes smaller during the subsequent development stages of technology deployment and diffusion when private sector developers become commercially involved in the technology development process (see below under B).

72. Public sector stakeholders play an important role in promoting policies and measures for addressing barriers to technology transfer as identified in TNAs. Good practices discussed in TNA reports include executive level government buy-in from the beginning, addressing cultural barriers and creation of working groups focusing on several sectors.

73. Governments, together with other stakeholders, play a key role in the strategy formulation process and will be responsible for taking the policy decision needed for implementation of the strategy. As a specific example, governments can coordinate the process of deriving capacity-building needs identified in TNAs, including those formulated as part of a national strategy for technology innovation.

B. Role of private sector stakeholders

74. The private sector plays a key role in the deployment and diffusion of prioritized technologies (see Figure 3). Not only do private sector entities involved in technology transfer processes need to take decisions on the type of transfer of a technology (*e.g.*, joint venture, domestic manufacture under license, leasing, *etc*.), the private sector also provides supporting services. The Private Financing Advisory Network (PFAN), which is a multilateral, public-private partnership initiated by CTI is an example of such a supporting service.

75. With respect to engagement of the private sector (incl. the financial community), one good practice identified in TNA reports is for the Party to initiate cooperation with the private sector at the beginning of the TNA process. Other good practices are to share best practices, identify risks and work with universities to address in their curricula the role of the private sector in technology transfer.

76. Project developers could prepare themselves well for this by mapping out the system or market in which the technology is to be rolled out, in terms of: how does the present environment enable roll out of this technology, who are the main actors involved in rolling out the technology, and what are the supporting services? Such a picture enables formulating a technology roll out plan with early contact with these parties.

VII. Financial resources to finance implementation of the TNA results (Role of the GEF, international organisations, development banks, private sector institutes)

A. Overview of potential financial resources and project/program development support

77. The target of the Climate Change Focal Area Strategy of the Fifth Replenishment of the **GEF Trust Fund** (GEF-5) is to avoid 500 million tonnes of CO_2-eq. emissions, with an expected budget of approximately US$ 1.4 billion (during 2010-2014), by supporting developing countries and economies in transition toward a low emission development path.[18]

78. The GEF also administers a special **Climate Change Fund** which provides finance mainly through technology programmes for building capacity for applying specific technologies in non-Annex I countries. As per 21 September 2010, 28 projects had been approved, which, together, correspond to a disbursement of fund of over US$ 97 million.

[18] http://www.thegef.org/gef/sites/thegef.org/files/publication/TechTransfer_2010.pdf

79. As part of the implementation of the *Poznan Strategic Program on Technology Transfer*, a GEF funding window was created to finance pilot projects that support the deployment, diffusion, and transfer of technologies that have been identified as national priorities through TNAs, National Communications, or other means. Fourteen proposals were selected out of 39 submissions, covering 16 countries supported by six GEF Agencies. Total GEF funding to support these pilot projects amounts to US$58 million. Co-financing for these projects totals more than US$195 million.[19]

80. Moreover, the GEF currently funds a 3-year **TNA project**, which is implemented by the UNEP through the UNEP Risoe Centre and which started in 2010 with the implementation of a new round of TNAs in 36 developing countries.[20] As part of the *Poznan Strategic Program on Technology Transfer*, US$ 9 million has been made available for TNAs. US$ 40 million is available for technology transfer pilot projects and US$ 1 million for dissemination of technologies and practices.

81. The current **Clean Development Mechanism (CDM)** project pipeline contains 6147 projects of which 3034 are registered by the CDM Executive Board (other projects are under validation). The registered projects are expected to generate 467 million CERs/year. Roughly one-third of all CDM projects, accounting for almost two-thirds of the annual emission reductions, involve technology transfer. Projects either scale-up the deployment of technology solutions already available in the host country or introduce technological solutions from other countries.

82. The members of the OECD's Development Assistance Committee (DAC) have provided US$ 3.8 billion in bilateral **Official Development Assistance (ODA)** in 2007 to help developing countries reduce their own GHG emissions (about 4% of total bilateral ODA in 2007). DAC data indicate that most support went into energy and transport sectors.

83. The World Bank Group has launched a series of carbon funds for achieving cost-effective GHG reductions while contributing to sustainable development. The **World Bank Investment Framework for Clean Energy and Development** aims to provide extensive support for mitigation and adaptation projects. The new financial instruments being considered are a Clean Energy Financing Vehicle, which would blend public and private sources of financing to promote mitigation technologies, and a Clean Energy Support Fund, which would provide subsidies in line with the extent of GHG emission reductions

84. The **UNDP Millennium Development Goal Carbon Facility** is a carbon-finance mechanism featuring GHG emission reduction projects which contribute directly to achieving the millennium development goals.

85. **UNEP's Finance Initiative (FI)** is a global partnership between UNEP and over 160 financial institutions and a range of partner organizations to develop and promote linkages between the environment, sustainability and financial performance. Focus areas included examination of different types of financial instruments/products and services that lead to climate change mitigation and adaptation, and renewable energy.

86. The **European Commission Global Energy Efficiency and Renewable Energy Fund** aims to blend capital of public and private investors to support small and medium-sized projects and enterprises. The fund recognizes that private investors need higher financial returns, whereas public investors value the economic, social and environmental benefits of renewable energy investments more than most private investors.

87. The **CTI Private Financing Advisory Network (PFAN)** can review the priority actions at a relatively early stage in their identification. Most individuals familiar with the

[19] http://www.thegef.org/gef/sites/thegef.org/files/publication/TechTransfer_2010.pdf
[20] See http://tech-action.org/

technical aspects of a project are not experts in project financing and this facility helps structure the projects being identified and assists in preparing supporting business plans.[21]

88. Private sector investment has been recognized as a key for the success of technology transfer activities. The level of foreign direct investment (FDI), commercial lending, and equity investment all increased greatly in recent years. For example, FDI flows to developing countries continued to grow in 2008, reaching a record level of US$ 630 billion. These are the dominant means by which the private sector can support technology-based investments in developing countries and economies in transition, often in the industry, energy supply and transportation sectors.

89. It is therefore critical to ensure that the necessary conditions are in place to encourage this flow and to ensure that all countries have access to it (main beneficiaries at present are Europe & Central Asia, East Asia and the Pacific and Latin America and Caribbean).

90. The UNFCCC secretariat developed, in close collaboration with the EGTT, the **Guidebook on Preparing Technology Transfer Projects for Financing** to support project developers in preparing project proposals that meet the standards of international finance providers. It is available in several languages: English, French, Spanish, and Chinese. A roll-out programme including training of trainers and regional training workshops is currently undertaken.

91. COP13 requested the UNFCCC Secretariat to coordinate the implementation of a regional training programme on project preparation with the participation of international organizations and initiatives. In response to this request, the secretariat in collaboration with the United Nations Industrial Development Organization (UNIDO) organised a **Training of Trainers workshop** on project preparing, which took place in Vienna, Austria, in September 2008 The training workshop was followed by three regional workshops on preparing technology transfer projects for financing, namely:

(a) African regional workshop on preparing technology transfer projects for financing was held in Gaborone, Botswana, from 2 to 4 September 2009, in collaboration with UNEP, and CTI,

(b) Latin American and Caribbean workshop on preparing technology transfer projects for financing was held in Belize City, Belize, from 5 to 7 May 2010, in collaboration with the GEF, IADB, UNEP and CTI,

(c) Asian and Pacific workshop on preparing technology transfer projects for financing was held in Singapore from 26 to 28 October 2010 in collaboration with the UNEP, ADB and CTI.

92. The objective of the training programme was to assist developing country Parties to assess, prioritize and update their technology needs, and to provide technical assistance to project developers in developing countries in transforming ideas resulting from TNAs into bankable project proposals that will meet the standards of international financial providers.

VIII. Key findings

93. From the 68 TNA reports it can be concluded that approximately 70% of the countries have identified next steps for supporting the implementation of prioritised technologies for mitigation and adaptation in their countries. In some 35% of the cases,

[21] http://www.cti-pfan.net/

countries have formulated concrete technology project proposals and sectoral actions or programmes.

94. However, from the TNA reports analysed it can also be concluded that large differences exist between countries in terms of how they formulate such projects and programmes. A structured approach for technology project preparation and programme formulation was often lacking in the TNAs analysed.

95. This paper has concluded that the implementation of priority technologies identified in a TNA can be enhanced by analysing, with stakeholders, what the enabling environment for a technology looks like: what are the barriers to technology development and transfer and what measures can be taken to address these? It has been argued that for this analysis, it is important to distinguish between the different development stages of a technology: RD&D, deployment and diffusion.

96. Taking a sectoral and/or national perspective of technology development and transfer enables a country and its stakeholders to develop a clearer picture of the potential role that a technology could play within a sector or nationally and what needs to be done to improve the market system or enabling environment for technologies within the sector or in the country in general.

97. In the process of technology development and transfer, public sector developers play a key role during the stages of RD&D, whereas private sector developers take over as the technologies develop towards commercial viability. During this process, it is important that the replacement of public support with private sector actions takes place smoothly, so that the technology can successfully proceed through the 'Valley of Death'.

98. Finally, the paper has shown that several international multilateral, public and private sector resources exist to support implementation of technologies prioritised in a TNA. This support contains both funding, training and assistance to project, programme and policy formulation.

Annex 1. Example of project plan for technology prioritized in TNA	
Concept project	Introduction of thermal insulation of households/public buildings which use fuel wood, LPG, electricity or kerosene as energy source to meet energy demand for space heating and air-conditioning.
Project objectives	The overall objective of the project is to increase security of supply for electricity and heat in the country by promoting the least cost demand side solution. Additional objectives are: - To enable various stakeholders to take decisions regarding potential thermal insulation projects. - Significant increase of security of supply by increasing energy efficiency. - Reduction of GHG emissions and reduction of emissions of acid rain causing agents.
Project background	The availability of energy supply is one of the key limitations to economic growth and outage reduction. In general, the current national power production satisfies less than 2/3 of consumption needs. The rest is imported abroad or covered through load shadings. The residential sector is the second largest consumer of energy sources in the country. Its importance is highlighted by the fact that it consumes large quantities of electricity, fuel wood and LPG. The resulting deforestation and the growing use of electrical appliances, and other related issues such as access and prices, can cause future problems. The existing building stock is responsible for more than 48 % of energy consumption. In the current household and public building stock, the largest energy demand comes from space heating. The majority of the household stock is poorly thermally insulated.
Project linkage to national priorities	The country's energy supporting body addresses climate change to a significant extent which complements a national strategy. Among other policies addressed is the introduction of district heating and CHP systems. The proposed project is therefore expected to contribute to the national energy strategy of the country.
Involved stakeholders	National agencies of energy and energy efficiency; the ministry of Energy; ministry of Environment; ministry of Finance; various environmental NGO's; various private installing companies of solar hot water heater systems.
Expected outputs	The main benefit of increased insulation of household buildings and public service buildings is that space heating demands can be met while using less energy commodities. Other benefits are: - National energy efficiency improved - Increased energy security of supply in general and electricity supply in particular - Reduced levels of GHG emissions - Job creation in service and household sectors - Estimated investments needs and cost-benefit analysis shows short term return of investments (approx. 3-5 years) - Increased levels of trained stakeholders - Increased self-sufficiency which limits the trade deficit through imports
Budget	The project requires 54.28 million US$.
Duration/Time	Sometimes the project is time limited and so, it is important to communicate this as a headline item from the onset.
Success Criteria	