CLIMATE TECHNOLOGY AND DEVELOPMENT PROJECT

The Technology Mechanism under the UNFCCC: Ways Forward

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Abstract

This paper highlights the main opportunities that the Technology Mechanism established under the United Nations Framework Convention on Climate Change (UNFCCC) may bring to the development and transfer of technologies and recommends ways forward for the success of the mechanism. Making use of the academic and institutional literature on innovation and technology cooperation, this paper reviews potentially effective international interventions in national innovation systems. This is crucial to understanding the type of activities that the Technology Mechanism could support and the importance of establishing a balanced governance for the mechanism to assure that those activities are supported and implemented.

The paper then applies what is learned from earlier programmes to the Technology Mechanism. First, the expected roles of the two institutions that form the Technology Mechanism, the Technology Executive Committee and the Climate Technology Centre and Network, are described – beyond what is formally agreed. In particular, the paper recommends the ample participation of technological, scientific and academic institutions in the Network to facilitate sharing of know-how and experiences as well as to strengthen indigenous technical capacities.

A number of additional activities are explored, such as the need to create enabling environments in both industrialised and developing countries, including appropriate regulatory frameworks and technical and institutional capacities necessary for the implementation of technologies at local level. The paper argues the relevance of cooperative research, development and demonstration (RD&D) programmes and activities and their benefits as part of the Technology Mechanism portfolio, including sharing of knowledge and experiences among countries. In addition, the paper recommends that the actors in the Technology Mechanism engage with the financial and business communities as well as with international donors to increase understanding, demonstrate the necessity and benefits of supporting technology R&D and demonstration activities in order to catalyse increased financial as well as political support.

Introduction

Different visions about how to accomplish the development and transfer of technologies have been deterring international agreement on the issue for a number of years. In 2010, however, as part of the Cancún Agreements, the Conference of the Parties to the UNFCCC decided to establish a Technology Mechanism to facilitate the implementation of actions for enhancing technology development and transfer to support mitigation and adaptation activities in developing countries, including research, development, demonstration, deployment, diffusion and transfer of technology, and based on nationally determined technology needs (UNFCCC 2010).

The Technology Mechanism opens an enormous opportunity to create tools that truly contribute to the development and transfer of technology in its broader sense and through national and regional actions. In this policy brief, we briefly review literature on international technology interventions and innovation systems with the aim of suggesting ways by which the Technology Mechanism can support activities within the areas of work defined in the Cancún Agreements.

Effective international technology interventions

The definition of the technology cycle as established in the Cancún Agreements is one way to understand the core activities involved in the technology development and transfer process (UNFCCC 2010). These activities include the research, development, demonstration, deployment and diffusion of technologies, as well as their transfer (Grubb 2008; Gallagher et al 2012). However, although these different "phases" in the technology cycle can be seen as distinctive activities, a purely linear interpretation of the innovation activities is too simplistic. In reality, innovation is much more "systemic"; it depends on linkages between different actors in a system, as well as a large number of contextual factors (see figure 1).

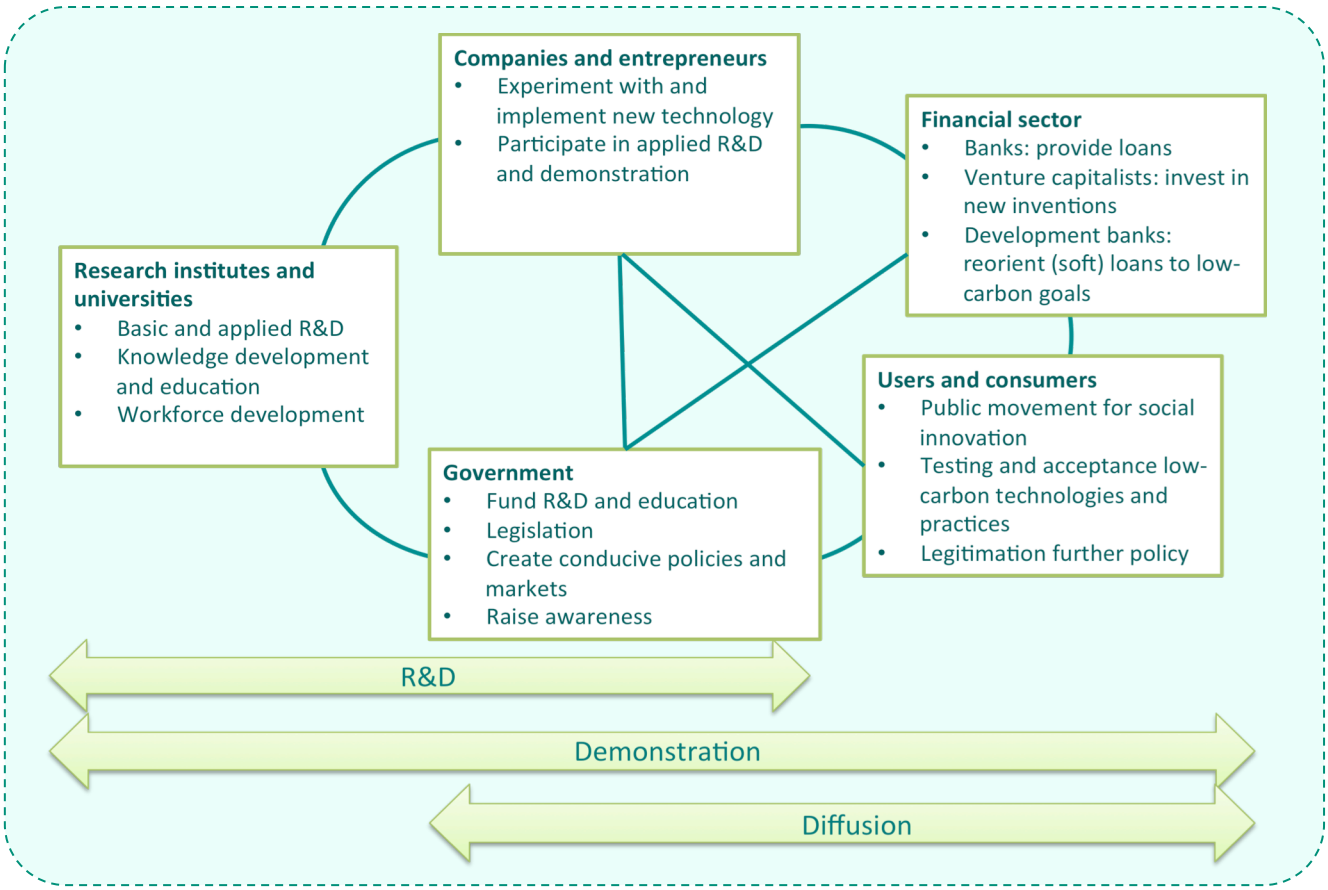
In a previous Policy Brief (Byrne et al 2012), an overview is given of what low-carbon innovation in countries in various stages of economic development may entail. Against this background, Byrne et al (2012) also explore the possible activities in the realm of low-carbon innovation. They conclude that:

"Internationally-driven policy initiatives such as the Technology Mechanism of the UNFCCC, and its associated Climate Technology Centre and Network

(CTC&N), open up opportunities to help build low-carbon innovation systems of the kind described here. Likewise, other multilateral or bilateral initiatives such as Climate Innovation Centres (CICs) could also contribute to innovation system building in developing countries (Sagar 2011). However, it is important to remember that these will need to be aligned and synergistic with national policy frameworks if developing countries are to realise self-determined low-carbon innovation."

An alternative formulation of the overarching function of the Technology Mechanism is therefore to provide capacity building and scientific, technical, financial, and managerial expertise to developing countries for them to implement actions in relation to the core activities of the technology cycle according to their own technology needs to address climate change.

Figure 1. A representation of functions and linkages between actors in the innovation system and their relation to the technology cycle. In the R&D phase, mainly research institutes, companies and entrepreneurs and government are involved. In the diffusion phase, the financial sector and users and consumers play important roles whilst the research sector is less important. In technology demonstration, all actors play a role which makes technological demonstration difficult to organise (graph by authors).



Contrasting views on technology cooperation

Although the academic literature shows agreement on what type of interventions could be effective in developing countries, the climate negotiations seem to show contrasting views that can roughly be organised in two visions. These views can be distilled from interventions during UNFCCC meetings or written submissions by Parties to the UNFCCC over the years.

One vision, advocated mainly by industrialised countries, supports the idea that development and transfer of technologies could be realised by creating "enabling environments" in developing countries for the private sector to be able to invest and implement projects with climate-friendly technologies attached to them. An alternative vision, supported mainly by developing countries, considers that every step in the technology cycle, from RD&D to commercialisation and diffusion, is equally important in its contribution to sustainable development; in this vision the public sector has a more active role to play.

The two visions could be seen as complementary rather than contradictory from the perspective of low-carbon innovation systems. Indeed, the vision put forward in figure 1 and similar views in the literature (Grubb 2008; Grubler et al 2012) incorporate both the "enabling environment" view and the view that

every step in the technology cycle matters. Provided there is balanced governance, the Technology Mechanism could help integrate these visions through the work of its two pillars, the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTC&N).

Technology Mechanism – agreed areas of work

In the Cancún Agreements, Parties agreed on a number of areas of work that should be given priority by the Technology Mechanism (UNFCCC 2010). These areas include, among others, the development and enhancement of indigenous capacities and technologies of developing country Parties, including cooperative research, development and demonstration programs; increased public and private investment in technology development, deployment, diffusion and transfer; the deployment of soft and hard technologies for the implementation of adaptation and mitigation actions; the improvement of climate change observation systems and related information management; and the strengthening of national systems of innovation and technology innovation centres.

Implementation of activities within these priority areas will need the participation of both the public and the private sectors, as well as multilateral institutions such as the financial mechanism under the UNFCCC and its recently created Green Climate Fund; another indication that the different visions on technology development and transfer should be seen as complementary to each other. Currently, the areas of work are linked to the organisational arms of the Technology Mechanism: the Technology Executive Committee (TEC), and the Climate Technology Centre (CTC) and Network.

The role of the Technology Executive Committee

Since the priority areas are quite diverse and different countries may have different priorities and needs, the Technology Executive Committee, among other functions also defined in Cancún, should ensure that the Technology Mechanism as a whole supports the implementation of activities across all priority areas. In turn, sufficient financial support should also be provided to the Technology Mechanism to perform its functions. In order to achieve this wide-ranging assistance, a balanced governance of the Technology Mechanism is key.

The TEC, as a body of the UNFCCC, guarantees the balanced participation of all regions through its membership and, consequently, contributes to the balanced governance of the Technology Mechanism. Therefore, it is the institutional duty of the TEC to provide policy advice across the technology cycle, as well as activities within the priority areas, are supported by the Technology Mechanism in accordance with the technology-related needs expressed by countries.

The role of the Climate Technology Centre and Network

The Climate Technology Centre and the Network are the implementation arms of the Technology Mechanism. They have been created to interact with countries on the ground, providing the necessary expertise and support to implement actions thoughout the technology cycle and in relation to priority areas established in the Cancún Agreements.

In particular, the Climate Technology Centre, to be hosted by an existing institution related to technology development and transfer at the international level, is to build and coordinate the regional and national institutions that will be part of the Network. It is expected that the Climate Technology Centre will set priorities according to the demand for assistance coming from developing countries based on the recommendations given by the TEC in this regard.

The Network of regional and national institutions to be built and coordinated by the CTC is expected to provide – on the ground – scientific, technical, financial, and managerial expertise, as requested by developing countries, to implement actions across the technology cycle that contribute to the development and transfer of technologies.

The criteria under which the institutions are going to be evaluated before joining the Network are yet to be discussed and agreed in the UNFCCC. This will most likely commence during COP18 in Doha, Qatar. These criteria should be inclusive enough to allow for a diverse range of institutions – public and private – to join the Network. These institutions should provide not only the different kinds of expertise necessary to deal with all technology-related issues associated with the priority areas of work, but also different local views about technology and its contribution to sustainable development.

The Technology Mechanism as part of the international climate regime

As not only the Technology Mechanism but also other parts of the institutional system under the UNFCCC, such as the Standing Committee, the Green Climate Fund and the Adaptation Committee, are becoming fully operational, questions arise around integration and coherence in how each part of the system operates and relates to other parts. Many interlinkages between the different institutional components have not yet been defined. It is for example not clear yet, how exactly the TEC will

interact with the Standing Committee on climate finance and the Green Climate Fund.

Similarly, the relation with the Adaptation Committee and the Technology Mechanism's role in supporting the process around the National Adaptation Programmes of Action (NAPAs) has not yet been clarified. Whereas many adaptation actions in developing countries have largely focussed on mainstreaming adaptation into development planning, policies and programmes, technology cooperation has had more of a stand-alone role. Hence, specifically in the area of adaptation, there is still work to be done in clarifying how the Technology Mechanism can best complement and support NAPAs and related work on adaptation.

Integration and coherence between the different institutional components of the international climate regime will be essential for their effective operation. In view of the open questions around this topic, we recommend that the Technology Mechanism, specifically the TEC, make full use of its mandate to cooperate with other bodies under the UNFCCC and clarify open questions around this cooperation as soon as possible. In addition, rather than embarking on separate activities, the Technology Mechanism could support NAMA and NAPA activities.

What could a fully-fledged Technology Mechanism do?

The Technology Mechanism has a number of stated aims, but the current areas of work and activities are unlikely to deliver everything. Here, based on literature reviewed in earlier work, we suggest a number of additional activities that the Technology Mechanism could undertake. The TEC is already exploring work in the field of enabling environments and collaboration in research, development and demonstration. Given the mandate of the Climate Technology Centre to facilitate the Climate Technology Network with a broad participation of relevant national, regional, sectoral and international technology networks, organisation and initatives, there is also an opportunity for the Technology Mechanism to take on a broader brokering role, linking technology initiatives with finance providers, stimulating and encouraging cooperative RD&D, linking innovation processes in different sectors within a country or in different countries and identifying where lessons learned from successes and failures with technology development, demonstration and transfer in one part of the world could be relevant elsewhere. In addition, we recommend that the Technology Mechanim looks into means of financing through climate funding, such as through the newly formed Green Climate Fund (GCF).

Enabling environments for technology development and transfer

The creation of enabling environments to facilitate the development and transfer of technologies have been discussed for many years under the UNFCCC and other forums. Discussions about enabling environments are currently conducted in the work of the TEC.

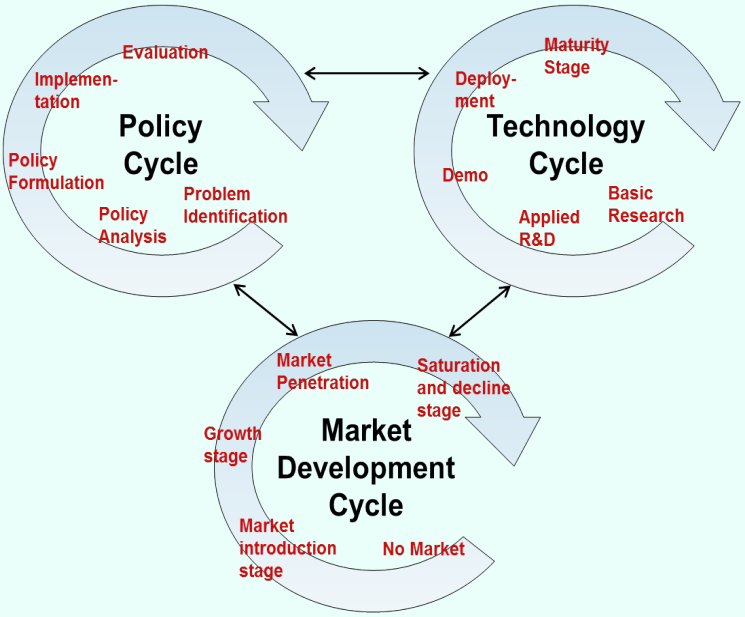
Enabling environments in developing countries are related, firstly, to creating the appropiate regulatory framework that provides incentives for the private sector to invest, develop and implement projects that can bring along climate-friendly technologies that are usually at the commercial stage (Bruggink 2012); and secondly, to building technical and institutional capacities necessary to adopt and adapt technologies for their implementation at local level. Thus, technology transfer would be a likely result of "pull factors" at the technology recipient end, i.e. developing countries (UNFCCC 2003).

However, this approach, by itself, is unlikely to bring support across the technology cycle, or to activities within all priority areas, or to certain technologies at a (pre)commercial stage. Examples include some technologies needed for adaptation to climate change (UNCTAD 2003). Therefore, the creation of enabling environments in industrialised countries is also needed in order to promote and stimulate technology-related cooperation and engage the private sector in the process, including joint research, development and demonstration programmes that allow the exchange of know-how and experiences among participant countries.

Thus, stimulating private sector participation, initiating government to government transfers, and increasing financial and technical support for enhancing indigenous technical capacities, measures commonly cited as "push factor" actions, should be undertaken by developed countries as part of the creation of enabling environments (UNFCCC 2003).

The Technology Mechanism should promote this more balanced approach, where both pull and push factors are equally important and where both public and private sectors have distinctive but key roles to play for an effective and long-lasting cooperation on development and transfer of low-carbon technologies.

Box 1 GIZ's capacity development method



The German agency for International Cooperation (GIZ) has developed a practical approach to determine interventions in the enabling environment around sustainable energy: in the policy, technology and market "cycles", it determines where in these cycles the particular undertaking (e.g., Concentrated Solar Power in Morocco, solar home systems in Senegal) can be categorised, and selects an intervention based on this. For solar energy in Morocco, for instance, policy is oriented towards implementation, technology towards demonstration and in the market cycle, solar energy is in the market introduction phase. Hence, finance from KfW (the German public sustainable investment bank) is complemented with skills and capacity building by GIZ.

Source: www.ecomena.org and Enskat (2012)

Cooperative research, development and demonstration

Cooperative research, development and demonstration (RD&D) into innovative technologies among countries, firms or research institutions is, for many experts, the right move towards a more meaningful process leading to the development and transfer of technology that includes not only the buying and selling of hardware and software, but also the exchange of knowledge and experiences among participant countries (Worrell et al. 2001).

Cooperative RD&D could lead to the creation of new private enterprises and public-private joint ventures, and, through joint patents, to the solution for some intellectual property rights controversies. Whenever these cooperative RD&D projects are successful they lead to the sharing of intellectual property rights and joint patents (Hagedoorn 2003). In fact, it has been demonstrated that cooperative RD&D efforts among institutions, including through joint ventures with cross-licensing agreements, have at least two beneficial effects: first, by allowing the participant institutions to share their research output, cooperative RD&D increases the efficiency of these activities and eliminates wasteful duplication; and second, by sharing the costs of RD&D activities, it increases the incentives to conduct such activities and reduces any negative spillover effects while continuing the efficient sharing of information (Katz 1986).

In addition, cooperative RD&D would support the demonstration of new technologies, the stage of the technology cycle where neither the public nor the private sector are willing to take investment risks, although demonstration of new technologies is key to successfully close the technology cycle (EGTT 2009; Box 2).

Cooperative RD&D activities, together with public-private joint ventures, promote cross-border movements of skilled scientists, technicians and workers exchanging know-how and experiences; two forms of embodied information that can be crucial for the effective transfer of technology (de la Tour et al. 2010). If cooperative RD&D involves the exchange of personnel and temporary placement and exchange of specialised and educated workers, this would have additional benefits in terms of personal development of those workers.

In this sense, multi-stakeholder partnerships, which may include actors at international, national and local levels, offer pathways through which technology is transferred and developing country capacity enhanced, while the interests of developed country private enterprise innovators are also protected (Morsink et al. 2011).

Moreover, in a set of recommendations given by the International Energy Agency (IEA) to the Clean Energy Ministerial to accelerate progress in the development of energy technologies, the IEA suggests that "governments should consider joint RD&D efforts to improve the performance and reduce the costs of technologies at the early innovation phase, including sharing lessons learned on innovative RD&D models" (OECD/IEA 2012).

Cooperative RD&D programmes not only strengthen the technology development and transfer process because they harness resources and expertise and the complementary strengths of partners, but also ensure the sustainability of the process in the long run.

Box 2 CGIAR: International R&D on agriculture

The best-known example of successful international R&D cooperation is the Consultative Group on International Agricultural Research, with 12 crop-focussed research centres, primarily in developing countries. Since the 1960s, CGIAR has been crucial in yield increases and public-good applied R&D for agriculture. In addition, CGIAR has provided thousands of researchers from industrialised and developing countries a career and knowledge of applied agricultural R&D in different contexts. Recently, CGIAR has focussed more on "generational challenges", including climate change, and on integrating with other research institutes programmes.

More information: www.cgiar.org

Financing technology development and transfer

The activities planned and proposed above for the Technology Mechanism have the potential to be highly cost-effective from a social-cost perspective, but they will be difficult to finance through the market. Public funding into RD&D and later stages of the technology development cycle is necessary at least in part to overcome market and financial barriers.

The type of public support required depends amongst others on the stage of technology development, the context of the innovation system, and the specific financing barriers encountered. When technologies are scaled up and move from the R&D to the demonstration phase, for example, the need for investment capital increases significantly compared to the previous R&D stage, while companies still have low ability to raise this capital. This situation is referred to as the 'valley of death' (Auerswald and Branscomb 2003; Murphy and Edwards 2003). In addition, in many developing countries, companies face financing barriers in early stage project development due to the immature nature of the policy and regulatory framework for the technologies and weak investment climate.

Both of these challenges can be overcome by targeted public finance interventions such as publicly backed venture capital funds or support for transaction costs (Ritchie and Usher 2011). Moreover, capacity development and building national institutions are costs that the private sector is not willing to make, as the benefits are distributed and hard to reap for an individual investor. Public investments are also needed here.

However, whereas technology transfer and diffusion of commercially available technologies is frequently funded under mitigation or adaptation programmes that are not technologically specific, R&D and technology demonstration activities are rarely part of international climate change mitigation and adaptation programmes. This is partly due to the inherently risky, unpredictable and long-term nature of R&D and technology demonstration activities, requiring long-term planning horizons, frequently of more than 10 years, with uncertain outcomes that are difficult to attribute to specific interventions. These characteristics often contrast with requirements by the financial and business communities and international donors to demonstrate tangible results. Moreover, few international donors are able to commit funding over such long timespans.

The Technology Mechanism should demonstrate the value and necessity of funding for technology R&D and demonstration activities in developing countries in the GCF and to international donors to catalyse increased international support. This could include demonstrating the wider benefits of supporting a country's low-carbon innovation system and of cooperating with local research organisations. Moreover, suggesting relevant monitoring and evaluation approaches for technology R&D and demonstration could help the financial and business communities and donors in demonstrating the results from funding such activities.

Channels of funding could be diverse. Bilateral and multilateral development assistance, for instance for institutional development, could be explored, especially in the areas of low-carbon innovations relevant to specific developed countries. Some technology collaboration in the field of low-carbon innovation is already on-going: for example, Germany and several developing countries in the field of renewable energy (IRENA 2012, forthcoming).

Box 3 UNDP-GEF project "Demonstration for Fuel Cell Bus Commercialisation in China"

The project, which ran from 2002 to 2010, aimed at stimulating technology transfer by supporting the demonstration of Fuel Cell Buses and the construction of the required fuelling infrastructure in Beijing and Shanghai.

In the first phase, three fuel cell buses were field tested in Beijing; in the second phase, demonstration activities were expanded to Shanghai. In parallel, the project aimed at increasing indigenous research and development capabilities related to fuel cell technologies. An important success factor identified in the project evaluation was collaboration between all project participants, which included the GEF, UNDP, the Government of China, academic institutions and private sector firms. GEF funding for the project of $11.6 million was complemented by $23 million of Chinese co-funding. Strong support from all project participants was required for this project .

Source: GEF (2012)

Multilateral financing could take place through, for instance, the GEF or the World Bank (see Box 3). As examples, the World Bank is funding Climate Innovation Centres in Kenya and other developing countries and the GEF is likely to fund climate technology transfer centres through the African and Asian Development Banks, as well as the EBRD (GEF Council 2012). These efforts can be interpreted as trying to fortify aspects of low-carbon innovation systems in developing countries and could be integrated or aligned with the activities of the Technology Mechanism through the Climate Technology Centre and Network for activities to be mutually beneficial. Moreover, public-private partnerships such as CTI-PFAN, which includes private sector investors, banks and financing advisory consultants, have proven to be a succesful approach for financing early stage project development and thereby supporting technology transfer.

The recently established GCF could become another important channel of multilateral financing for technology transfer and potentially also R&D activities in developing countries. The GCF will have funding "windows", which are designated parts of the full fund that are dedicated for a specific purpose. Initially, these funding windows are intended for adaptation and mitigation, but the establishment of a technology window is under discussion. Such a funding window for technology development and transfer would be desirable to ensure international support for technology development and demonstration activities. The Technology Mechanism should engage with the GCF in operationalising that funding window.

Conclusions and recommendations

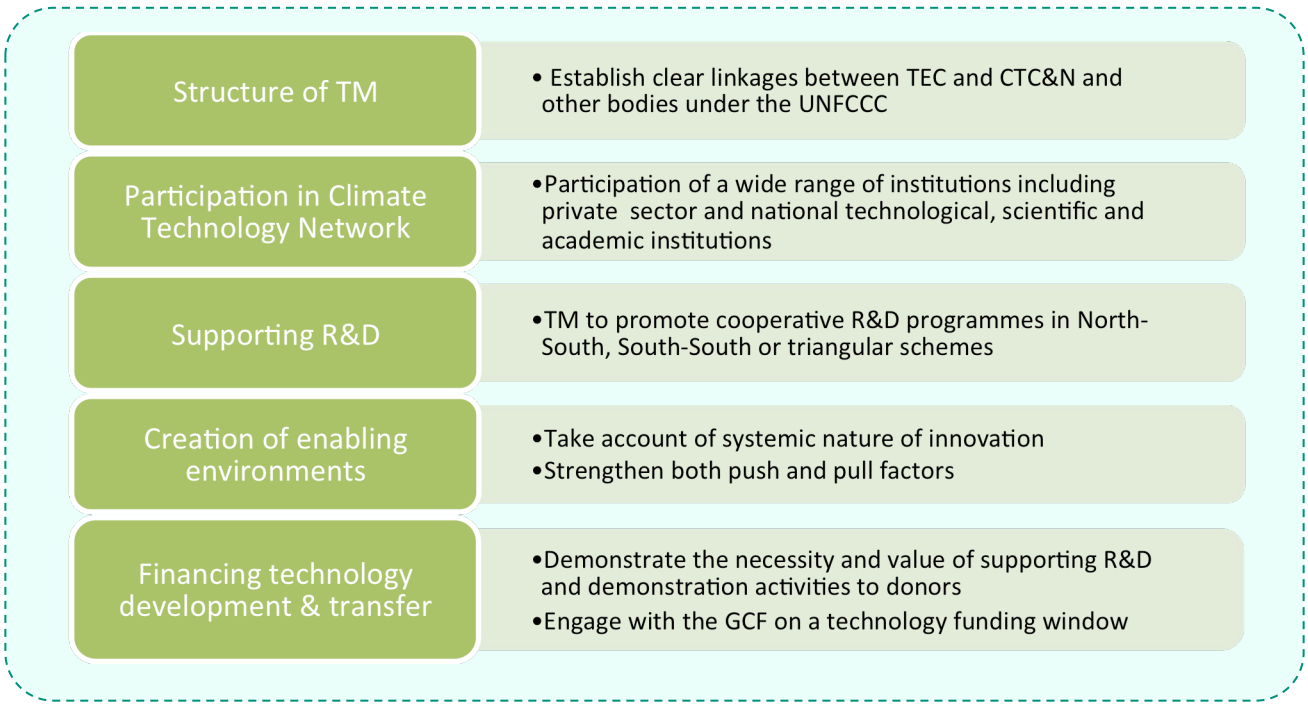
In view of what has been said above, several recommendations are offered below (Figure 2). In the first place, for the Technology Mechanism to be successful, it is necessary that countries and their representatives at the UNFCCC establish balanced rules for the governance of the Mechanism. Integration and coherence between the different institutional components of the international climate regime will be essential for their effective operation. There need to be clear linkages between its pillars, the TEC and the CTC&N, as well as linkages with the financial mechanism under the UNFCCC. The Technology Mechanism, specifically the TEC, should make full use of its mandate to cooperate with other bodies under the UNFCCC and clarify open questions around this cooperation as soon as possible. Moreover, the Technology Mechanism should facilitate and support activities across the technology cycle and within all priority areas of work as defined in the Cancún Agreements.

Second, it will be of utmost importance that all countries promote the participation of their technological, scientific and academic institutions in the Network to be built in the coming years. This engagement will assist a more fluent exchange of know-how and experiences as well as strengthen their indigenous technical capacities. There is an opportunity for the Technology Mechanism to take on a brokering role, for instance, in linking technology initiatives and innovation processes in different sectors within a country or in different countries.

Third, governments from both developed and developing countries should be aware of the barriers to the development and transfer of technologies, and contribute to the creation of enabling environments

that facilitate technology-related actions encompassed in the technology cycle and within the priority areas of work as needed (Byrne et al, 2012). The systemic nature of innovation, the socio-technical context and the need to strengthen pull and push factors to effectively drive the development and transfer of technologies needs to be taken into account when discussing enabling environments..

Figure 2. Recommendations for the Technology Mechanism (TM)



Fourth, special attention should be given to cooperative RD&D programmes in North-South, South-South or triangular schemes that can promote the exchange of knowledge and experiences as well as other benefits among participant institutions. Benefits from the participation in cooperative RD&D activities are multiple, including the potential foundation of joint ventures to produce and commercialise the products of the RD&D activities.

Finally, securing sufficient financial support will be crucial for successful technology development, deployment and transfer in developing countries. Support for R&D and technology demonstration activities in developing countries is rarely part of international climate change mitigation and adaptation programmes. The Technology Mechanism should support the GCF in operationalising a funding window on technology development and transfer. To argue for this, the Technology Mechanism should demonstrate the value and necessity of technology R&D and demonstration activities in developing countries in the GCF and to the financial and business communities and international donors.

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