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Tec Brief
Strengthening national systems of innovation to enhance action on climate change

1. Introduction

Technological change is one of the key arms in our arsenal to combat climate change. A country's capabilities that drive and enable this change thus take on a critical role. The implications of our ability to manage a climate technology transition are enormous: a recent study suggests that to keep the global rise in temperature to less than 2°C the additional costs of deploying energy technologies between 2016 and 2050 are USD 40 trillion (IEA 2015). Since developing countries may account for up to 90 per cent of energy demand growth to 2050 (IEA 2015), the importance of their technological capabilities to manage this transition effectively and efficiently cannot be overstated.

A country's technological capabilities are determined in part by the effectiveness of its national systems of innovation (NSI). The NSI is the network of actors, institutional contexts and linkages that underlie national technological change. The NSI should thus play a central role in supporting country efforts to enhance action on climate change mitigation and adaptation. It also helps a country to meet other developmental challenges and add value to their national economy.

A national system of innovation consists of:

- **Actors**: Organizations that participate in technology development and transfer
  e.g. technology firms, universities and financiers
- **Institutional context:** Norms, cultural practices and laws which shape actor efforts
  e.g. government policies that affect how the private sector invests in a particular sector
- **Linkages:** Interactions and relations between the actors and the institutional context
  e.g. flows of information and knowledge, and collaboration between firms, universities and research institutes.

We, the Technology Executive Committee (TEC) of the UNFCCC, acknowledge the key role that NSIs play in combating climate change. In this TEC brief, we outline the current state-of-play of NSIs in developing countries. We then highlight how developing countries and the international community may work together to support these countries to strengthen their NSIs, enhancing both national climate action and sustainable development.

2. National systems of innovation in developing countries

The key question of this brief is: *how can we support developing countries to build their technological capabilities and enhance their climate efforts?* As we note in the introduction, to strengthen technological capabilities we need to strengthen our NSIs. And to understand how together we can strengthen our NSIs, first we have to look at what needs to be strengthened: what is the current situation in developing countries?

This is difficult to answer. Firstly, there is little information on the state of developing country NSIs. Most studies focus on developed countries, presumably because these countries have the greatest innovation activity and demand for such studies. There is some information on the larger developing countries (Brazil, China, India and South Africa) but little on the small and medium-sized ones. Secondly, many aspects of a NSI are country-specific and thus vary widely across countries. These national characteristics can have a significant influence on shaping innovation outcomes, which might be why we see countries at similar levels of economic development with different innovation landscapes and trajectories. Thirdly, the key innovation activities that a country undertakes may depend on its size and income level. For example, small and medium developing countries may be focused on incremental and adaptive innovation, while OECD countries, in addition to these activities, may also be focused on pushing the technological frontier.

However, there are a range of activities that are needed for successful innovation, irrespective of national characteristics (Edquist 2011) and income level. And while innovation is not a linear process and involves change of many kinds – including cultural, organizational, behavioural and technological (Stirling, 2015) – we believe that there is merit in investigating NSI effectiveness by looking at activities along the traditional technology cycle (research and development, demonstration, market introduction and commercialization, and diffusion). Given the limitations noted above, and the limited space of this brief, we must emphasize that we do not provide a complete picture of the state of play of country NSIs. However, in the following section we will analyse some activities that help us build a general understanding of the state of developing country NSIs. Some of these activities are broader than climate change and are economy-wide. This is based on the notion that the NSI is the foundation for innovation in any technology area, including climate technologies.

Economy-wide innovation

Innovation indices

One way to estimate a country's innovation effort is to consider indices that combine the analysis of various innovation activities into one measure. A commonly-cited index of innovation performance is the Global Innovation Index (GII), which contains 81 indicators that cover a variety of national innovation activities. We find that innovative capability and performance varies with income level, with developed countries being the innovation leaders (see Figure 1). Notably however, many developing countries are seen as efficient innovators with regards to their innovation output/input. These countries are high-achieving relative to their gross domestic product (GDP), with similar innovation efficiency to high-income countries.

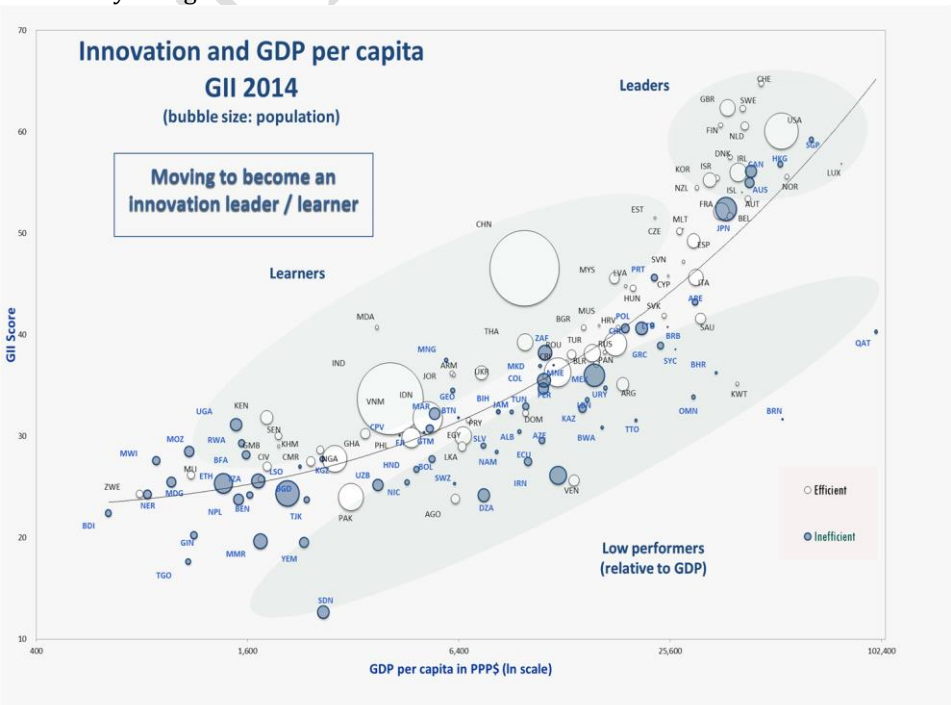

Figure 1: Country Global Innovation Index score vs. GDP per capita in PPP$. (Source: GII 2014)

Gross expenditure on research and development

To approximate the level of activity at the earlier stages of the technology cycle, we can look at gross research and development (R&D) expenditure. As with the GII, this indicator highlights the relative thinness of developing country innovation activities (Figure 2). There is a clear correlation between income level and scale of R&D effort, although there is some variation among countries with similar GDP.

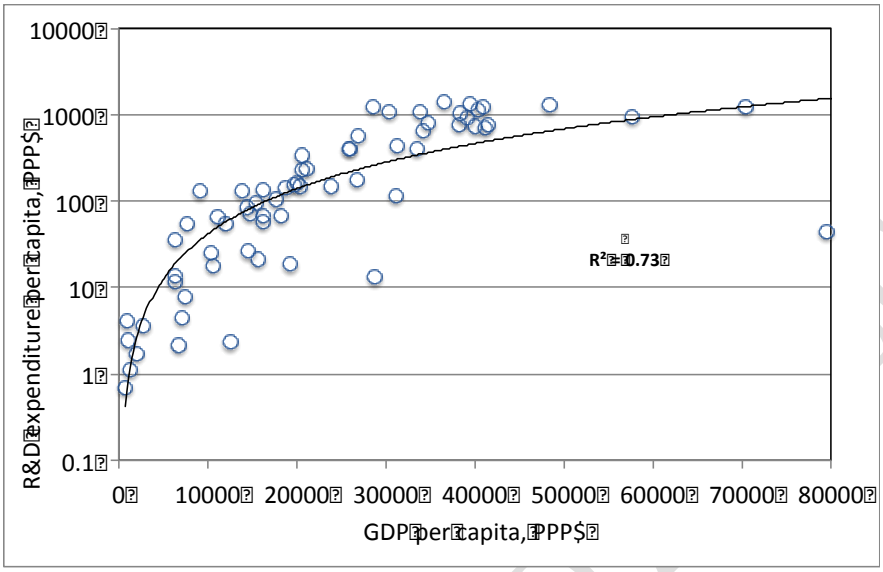

Figure 2: Gross R&D investments per capita vs. GDP per capita
(Source UNESCO UIS and World Bank world development indicators)

Research in universities

Another indicator used to assess the state of a NSI is university research. Universities provide the skilled man-power that is needed for innovation and are also the source of new knowledge and technologies that underpin innovation. With universities being critical actors in NSIs, it is striking that their concentration within the developed countries is even more pronounced: of the 50 universities with the highest relative scientific impact across all disciplines in 2007-11, only two were from outside the Organization for Economic Co-operation and Development (OECD) member states [OECD 2014]. While the large developing countries (Brazil, China and India) are engaged in international collaboration, the normalized impact of their research output is below the world average. We note that there are many other research institutions that may also play a prominent role in building NSIs, including applied research institutions.

Climate technology innovation

In terms of climate technology innovation, again most studies focus on OECD countries since these have traditionally undertaken most of the climate technology innovation activities. On developing countries, the existing studies focus only on the large developing countries. Here we look briefly at two ways of estimating NSI capacity for climate technology innovation. We consider innovation inputs, i.e. a country's efforts to stimulate innovation, and then also the innovation outputs and outcomes, i.e. the outcomes of these efforts. As noted previously, in this section we provide only a snap-shot of some of the activities that may highlight climate technology innovation activity.

Climate technology innovation inputs

With regards to inputs, a country's research, development and demonstration (RD&D) is seen as a key indicator as it is expected to reflect the pipeline of new and improved technologies entering the national market. Investments in RD&D also attract and stimulate other national investments and efforts in innovation. However, there is limited data about climate-mitigation RD&D in countries other than government energy RD&D (ERD&D) investment data collected by the International Energy Agency (IEA). This data can still serve as a useful measure of climate technology innovation activities as the energy sector is a key contributor of greenhouse emissions. It is estimated that in 2013 non-IEA country government investments in ERD&D were a small fraction of the 17.3 billion purchasing-power-parity adjusted dollars (PPP$) invested by IEA country governments in 2013. A study examining ERD&D investments in large developing countries found that direct government investments in these countries in 2008 were about 1.4

billion PPP$[1] (Kempener, et al., 2010). There is even less understanding of innovation inputs such as RD&D for adaptation, in part because adaptation technologies are more difficult to define (and may often be soft technologies) but also because adaptation activities are often more local than those of mitigation.

Climate technology innovation outputs and outcomes

In terms of innovation outputs, patents are often used as an indicator of innovation as they are noted to be an approximate measure of technological progress and activity. And there is data available on energy-related patenting in large developing countries. An analysis of patenting data on climate technologies between 2000 and 2011 suggests that patents from China account for 13.7% of the global total, with India, Brazil, and South Africa each accounting for less than 1% (IEA 2013). There is little aggregated information on patenting data from small and middle-sized developing countries. Additionally, we note that patents may be a less effective measure of innovation in countries where little patenting activity occurs. We also note that one of the issues in examining patent applications by country of origin is that the applications could be made by local R&D centers of multinationals (IEA 2013).

With the NSI playing a key role in driving technological change, it is also interesting to observe if such change leads to a reduction in a country's carbon intensity. It can be observed that the low and middle income developing countries and the large developing countries are reducing their carbon intensity. This may be taking place by moving to low carbon energy sources as well as enhancing the energy efficiency of the economy. Only the least developed countries and some low and middle income countries are experiencing an increase in carbon intensity of their economies (see Figure 3), this occurs mainly as a consequence of structural change to their economies.

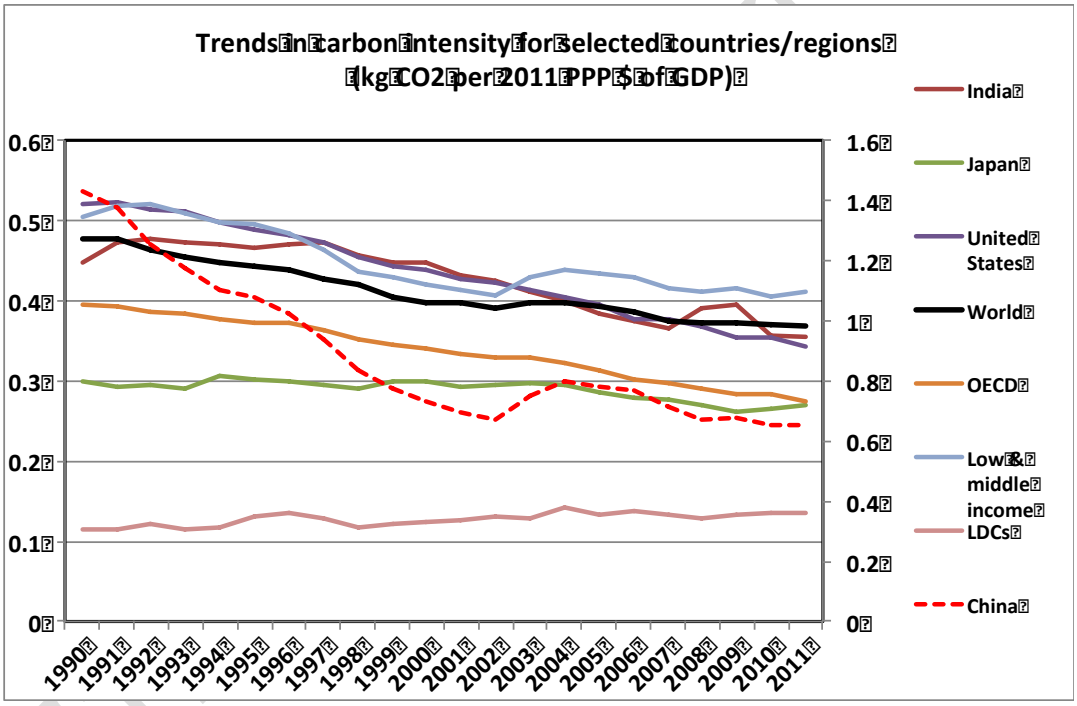

Figure 3: Trends in carbon intensity of selected economies and groups (1990-2011). For China, use right-hand-side vertical axis. (Source: World Development Indicators data set)

The overall state of play

In general, developing-country NSIs tend to be less developed, less dynamic and much less analyzed than those of developed countries. The limited studies that exist show that the large developing countries have visible innovation-related activities and outputs. China is an outlier among the developing countries in terms of the scale of its R&D investments, its ERD&D investments and its performance in both patenting as well as deployment of renewables. In fact, China is now seen as the world's largest investor in renewables (REN 2015). With China, India and other major developing countries recently making significant investments in renewable energy deployment, there needs to be a greater understanding of developing country contributions to climate technology innovation. On the whole, though, our understanding of NSIs in developing countries –especially in relation to climate challenges – remains very limited.

[1] The study also found that state-owned enterprises (SOEs) in these countries invested more than 12 billion PPP$ in ERD&D that same year, indicating that SOEs are an important component of the climate-related NSI in developing countries (Kempener, et al., 2010).

3. Strengthening key elements of national systems of innovation

With developing country NSIs less effective than desired, what can be done to strengthen them? Strengthening NSIs is a formidable task. It involves strengthening a range of actors, enhancing the institutional context in which they are operating, and catalysing the linkages between actors and the institutional context. Importantly, the national government (along with state and province level administrations, and even city administrations, in countries where they play an important role) is the central NSI stakeholder that leads efforts to strengthen the NSI. To achieve this, it may consider the following three complementary actions.

Action 1: Start with fundamentals

While countries such as the Republic of Korea stand out for transforming their NSIs in recent decades, success stories of a large-scale transformation are rare. Building on this example, what are the key policy actions that successfully transform a NSI? Firstly, these countries had a strong national focus on developing foundational capabilities. Key are policies that build a strong technical higher education and training system, as this serves both as a research base and a training ground for skilled **actors** at the heart of the innovation system. In this context, it is important to have strong collaboration among government bodies involved in the national innovation process, including those responsible for education, legal and regulatory issues. For the **institutional context**, the focus is on creating a general enabling environment (e.g. creating stable macroeconomic conditions and facilitating competition and entrepreneurship) and building demand through market formation. Emphasis is also on creating an environment that encourages investment in (i) building skills and technological capability, (ii) technology adoption and (iii) innovative activity. These activities may thus catalyse the involvement of the private sector, another key actor in the innovation process. Governments also strive to ensure that institutional contexts facilitate and promote learning by various actors within NSIs. Finally, equally important is to strengthen **linkages** between key actors, such as those between firms, universities, research institutes, quality or productivity organizations and technology transfer or extension bodies. Ultimately, the process of developing strong indigenous innovation capabilities is a long and arduous process. It generally starts with learning to introduce and master existing and newly developed technologies and engaging in incremental innovations. Later it leads to being able to develop 'new to the world' innovations based on new knowledge. Historically, governments have played an active and key role in driving and enabling such progress up the innovation ladder (see Box 1).

Box 1

Republic of Korea: Building a dynamic national system of innovation

The Republic of Korea is a prominent example of a country that has successfully built a strong and dynamic innovation system in just a few decades. In the initial stages, government policies promoted the importing and assimilation of technologies and their improvement over time by learning-through-manufacturing as well as reverse engineering. The policies also promoted a focus on specific industries such as steel, shipbuilding and automobiles. The government (i) introduced an export-oriented strategy which ensured competition and (ii) encouraged significant investments in R&D which developed competitive national firms. Government investments in education and human resource development also supported this capability-building. Notably, the government's policies evolved over time in response to the evolving perceived needs of the economy. The government's role also changed: at first it set targets and helped firms to meet these targets through suitable policies and provision of finance. Later, it became more of a facilitator and coordinator of policies and programs. (Based on Chung 2007)

Action 2: Focus on specific climate technologies

Strengthening NSIs broadly is an objective to aspire to for all developing countries. However, given the enormity of that task and the time-scale for success, a country may consider beginning with strengthening its NSI to meet specific climate and development challenges. In this way, a country can efficiently allocate its resources to strengthen innovation system elements that are most relevant to successful implementation of its priority technological pathways in the climate arena. To strengthen its NSI using this focused approach, a country might prioritize specific sectors and technologies, and identify the stages of the technology cycle that might require most support. We note that focused NSI strengthening is somewhat nuanced and subject to the particularities of a country's climate-technology choices.

Even for a given technology, different actors, institutional contexts and linkages may come into play at the different stages of the technology cycle. During the research stage, **actors** such as universities and research labs play a central role in the technical arena and government agencies are the primary source of policy action and direction, and play the largest role in funding. The **institutional context** is focused on providing an environment that nourishes research, invention, experimentation and the transfer of knowledge and know-how. As Box 2 highlights, the government may also undertake direct state investment to support innovation of the prioritized area, providing a base upon which

private actors may later build. **Linkages** are centered on exchanging scientific and technical information and financing opportunities.
At the development stage, the private sector becomes the key **actor**: they generally have the greatest incentives to collect information about how and under what conditions the technology will be used, affecting product specification. Private-sector entities may also engage in demonstrating the technology to test it and get user feedback. At this stage, funds from private sector entities or risk-capital providers are more relevant. Important **linkages** here include public-private partnerships, which may support the transition from applied research to technology demonstration and avoid the 'valley of death' of the technology cycle.

As the technology is commercialized, the focus shifts to establishing technology production. Efforts are made to ensure that producers and consumers successfully adopt the technology and that it is quickly and widely diffused. Private sector entities are again the central **actors**. However, in the case of climate technologies, governments can also be critical in defining and shaping the **institutional context** that creates markets and demand through appropriate policies and regulations. Different kinds of **linkages** come into play here, such as those between manufacturing firms, financiers, users, and governments For low-income countries and least developed countries, and those at the early stages of technological development, an important area of focus will be on supporting the organizations that promote the adoption and diffusion of these technologies in high priority areas.

Box 2
China: developing the wind sector
At the end of 2014, China had the largest installed wind power capacity in the world, and four of the ten biggest global wind power manufacturers were Chinese. This outcome is the culmination of a sustained effort by China to develop its wind sector. The first phase, from the mid-1908s to the mid-1990s, consisted of R&D projects that encouraged national wind farms and universities to demonstrate and test the wind technology in local conditions. From the mid-1990s to the early 2000s the second phase focused on technology transfer, localization, establishment of manufacturing facilities and market exploration, with manufacturing firms becoming the central actors. The third phase focused on a significant expansion of the wind turbine market and deepening of innovation capacity, with the objective of achieving technological leapfrogging. At each stage, the government employed a suite of suitable policies to achieve the desired outcomes. (Based on Dai and Xue 2014)

Action 3: Develop national strategic capabilities

Finally, perhaps the most important set of capabilities are strategic and coordination capabilities (Chaudhary, Sagar, and Mathur 2012). These elements - which form a key part of policy capabilities - are urgently needed in developing countries to allow national and sub-national (state or province level) governments to spearhead and accelerate the climate action needed. This action is focused on building the capacity of national **actors** so that they have the ability to develop priorities based on a country's mitigation and adaptation options and development needs. It also involves developing their ability to: (i) identify roadmaps to meet these priorities; (ii) identify the innovation gaps to be addressed for the country to successfully progress on these roadmaps; and (iii) coordinate activities across the innovation cycle. Such capabilities not only help to increase the probability of successfully undertaking actions 1 and 2; they also help to do so faster and more efficiently.

Box 3
The India Bureau of Energy Efficiency (BEE): Enabling change through strategy and coordination
The Indian BEE has played a central role in the recent past in enhancing energy efficiency programs in the country, with significant savings of energy and avoided generation capacity. To do so, it has taken a careful and strategic approach, identifying and prioritizing areas of highest impact through consultations with a variety of stakeholders. As a result, it began with a focus on appliances, lighting, buildings, and industry. In each area, a pathway for implementation of energy-efficiency programs was identified, taking into account the gaps (e.g., availability of technology, finance, human resources and suitable policies) and actors for different stages of the technology cycle. BEE also helped coordinate various actors and activities to enable effective implementation of the programs. In that sense, it is a 'systems operator' that is able to prioritize areas, spot key gaps, help address the gaps, and tweak the programs over time, based on learning from experiences in implementation (Based on Chaudhary, Sagar, and Mathur 2012)

4. Possible actions by key stakeholders

There are two major information gaps with regards to supporting developing countries to strengthen their climate technologies NSIs. Firstly, there is a lack of understanding of the state of developing country NSIs. Secondly, our understanding of how to effectively strengthen NSIs is still limited, as is also our understanding of the scope and effectiveness of programs to support developing countries in undertaking the three key actions of NSI building.

Both of these gaps lead to the need to develop a more systematic assessment of good practices, experiences and lessons learned in undertaking and supporting such efforts. It is only through this assessment that we can learn what works, what doesn't and what we can improve. And the outcomes of such assessments are applicable to both the country strengthening its NSI and the actors supporting such efforts. To achieve accelerated NSI strengthening we need to do more than build the national capacity of developing countries. We also have to build the capabilities of those who support such capacity-building. Table 1 outlines the key elements of NSI strengthening at each stage of the technology cycle.

Domestic actors

Section 3 outlined the possible actions that the national government, the central NSI actor, may undertake. Other domestic **actors** can contribute importantly to strengthening climate technology NSIs by better targeting their own capabilities and efforts towards climate-relevant innovation. These actors – e.g. private sector entities, civil society and academia – can also build **linkages** with other actors to strengthen the country's technical, financial and policy activities. For example: (i) civil society and academia can engage in the debate on national priorities and pathways to meet climate challenges; (ii) private sector entities can develop consortia to address specific technical challenges. They can also participate in public-private collaborative efforts to define national priorities, develop national strategies, undertake technology foresight exercises, and develop national action plans; (iii) government agencies and private sector entities can collaborate with finance providers to develop instruments that meet funding needs; and (iv) public agencies that support technology adoption and diffusion (such as technology extension services) can prioritize the provision of relevant information, advice and support for the diffusion of useful existing and newly developed climate technologies.

International actors

International actors can play an important role in complementing, catalyzing and accelerating national efforts on strengthening NSIs. These actors may include: national governments, international organizations, bilateral and multilateral agencies, R&D agencies, private sector entities, philanthropies, non-governmental organizations and civil society. International collaboration may take many forms, including strategic alliances, foreign direct investment, formal joint ventures, contracts, trade, joint development of technology and licensing (Gallagher, 2014). It should be noted that there are a number of on-going activities undertaken by international public actors to support climate-NSI strengthening, a few of which are outlined in the box below. These actors can contribute in many different ways, including by strengthening:

- Technical aspects of NSIs, by collaborating on scientific, engineering and other technical research and development, and facilitating the transfer of knowledge and know-how
- Financial aspects of NSIs, by providing finance to undertake technology demonstration and deployment and help overcome other barriers to innovation, e.g., through risk mitigation for early adopters. They can also provide financial support to help build linkages between domestic and international actors
- Policy and business-model design and development, by providing advisory services or developing good-practice approaches
- Local capacity of actors, especially in the least developed countries, by training engineers and scientists, entrepreneurs, financial actors (in risk evaluation and financing of climate technology projects), technology extension services and policy makers

Box 4

International efforts to strengthen national systems of innovation

Incubating climate technologies. The Kenyan Climate Innovation Centre (CIC) is the first of a series of CICs being set up by a World Bank-infoDev initiative in partnership with Denmark and the United Kingdom of Great Britain and Northern Ireland. The CICs aim to support climate technology innovation in developing countries by providing seed financing, network linkages, technical facilities, business training and support for the design of specialized policy interventions. The Kenyan CIC was seeded with a contribution of USD 15 million in Nairobi, Kenya in 2012 and focuses on three priority areas: water management; agribusiness; and renewable energy. Key activities undertaken by this CIC are services to help entrepreneurs accelerate their businesses; financing designed to meet business needs across their growth cycle; market intelligence, matchmaking, and policy advisory and advocacy.

Table 1:
Key elements for strengthening the national system of innovation
Source: Ambuj Sagar

Technology stage	*Cross-cutting: Strategic analysis and coordination*	*Basic and applied research*	*Technology development/adaptation (including demonstration)*	*Market-focused product and delivery-model development/adaptation*	*Commercialization*	*Large-scale diffusion*
Focus of national system of innovation strengthening	• Develop priorities based on mitigation and adaptation options, • Identify needs, local capabilities and resources • Identify implementation pathways and innovation gaps • Coordinate activities across innovation cycle	Build scientific research capabilities	• Build scientific, engineering, and design capabilities • Understand users and markets and the linkages between the two		• Build manufacturing capability • Create early markets • Mitigate risk for early adopters	• Refine the business model • Encourage large-scale deployment • Develop policy review and feedback systems
National-level activities	Identify strategic and coordination agency	• Provide domestic R&D funding • Support higher education and skills training • Encourage experimentation	Provide financial and technical support for: • Technology adaptation • Product development and demonstration		• Provide finance for scale-up of manufacturing • Mitigate risk of early adopters	• Support diffusion • Create demand
International activities	• Analyse climate and development opportunities • Analyse technology options landscapes, and local capability • Support implementation pathway design • Identify innovation gaps	• Support scientific research collaborations • Train human resources • Collaborate in joint technology development/adaptation		Provide financial and technical support for product demonstration, user feedback and design	• Provide support for manufacturers • Provide technical support for financial institutions and policy-makers for market and risk-mitigation-instrument design • Share good practices	• Provide technical support for policy-makers • Share good practices • Support diffusion

5. Possible actions by the Technology Mechanism

The Technology Mechanism can play an important role in strengthening NSIs in developing countries to support and accelerate their efforts to address climate challenges. The Technology Mechanism could:

Overarching

- Undertake analytical studies that deepen the understanding of the state of developing country NSIs with regards to climate technology innovation
- Prepare case studies and synthesize experiences from developing countries to help identify the challenges, good practices and lessons learned in strengthening NSIs with regards to climate technology innovation and executing climate technology implementation plans
- Communicate and share key findings, good practices and lessons learned to the COP and other key stakeholders
- Support developing countries to build their national systems of innovation with regards to climate technology innovation in a way which facilitates technology leap-frogging (use of new technologies) and takes in to account national priorities and development plans
- Support the strengthening of developing country NSIs, in accordance with decision 1/CP.16, paragraph 123 (c)(ii)
- Encourage developing countries to consider how to strengthen their NSI when they undertake technology needs assessments and formulate technology action plans (TAPs), and involve their NDE in developing and implementing their TAPs

Actors

- Support developing countries to identify national priorities and implementation pathways for climate technology development/transfer and deployment. These actions will support the country to identify relevant actors and innovation gaps that need to be addressed. This process may be assisted by supporting and encouraging developing countries to undertake technology needs assessments (TNAs) and prepare technology action plans. While TNAs have not focused specifically on NSI building, they play a key role in building the capacity of national actors to determine a country's climate technology priorities
- Support the strengthening of relevant local actors by supporting: human resource training; development of technical infrastructure; implementation of good practices; and collaborations and partnerships with international counterparts
- Support the building of national analytical capabilities of NSIs actors with regards to climate technology innovation
- Encourage developing countries Parties to consider the importance of strengthening their NSI, including their NDE, when submitting requests to the CTCN
- Invite developed countries Parties to highlight to the CTCN, through their NDE, how they could support developing countries to strengthen their NSI. Developed countries could be invited to list relevant national-level:
    - Areas of expertise
    - Private sector actors
    - Research institutions
    - Development cooperation agencies

Institutional context

- Support the design, strengthening and implementation of policies which facilitate the implementation of national climate technology plans, including by:
    - Holding stakeholder workshops
    - Facilitating the sharing of experiences, lessons learned and good practices
    - Providing policy recommendations
- Support the development of climate technology markets for strategic new technologies

Linkages

- Building on good practices and lessons learned, undertake focused activities (such as workshops, forums or webinars) to promote the strengthening of linkages and collaboration between actors at the local, national and international levels
- Support the creation or strengthening of geographical innovation clusters

6. Highlights

- **A national system of innovation (NSI) plays a central role** in supporting countries to undertake efficient and effective technological change in response to climate change. It also supports them to achieve their sustainable development objectives.

- **To accelerate global climate efforts, there is a need to support developing countries in strengthening their NSI.** Effective NSIs are essential to enhanced developing country capacity to absorb, distribute, diffuse and deploy climate technologies, adapt these technologies to their needs, and implement and maintain them. This will also support continued technological development and adaptation to regional needs.

- **Strengthening NSIs requires three key complementary actions**:
  1. Develop the fundamental elements: (i) build a strong education system, (ii) invest in RD&D and (iii) implement enabling policies (including to support market creation)
  2. Focus on specific climate technologies that help meet national climate and development priorities
  3. Build strategic and coordination capabilities of national actors

- **There is a need to conduct further assessment on the state of NSIs in developing countries**. The Technology Mechanism and key stakeholders are encouraged to play significant roles in developing an enhanced understanding of the state-of-play of the NSI of developing countries.

- **There is the need to enhance understanding on the effectiveness of initiatives supporting the strengthening of developing country NSIs**. The Technology Mechanism and other key stakeholders are encouraged to enhance efforts to share experiences, good practices and lessons-learned.

- **Developing countries are encouraged to consider** how to strengthen their NSI when they undertake technology needs assessments and formulate technology action plans with a view to enabling them to achieve their specified climate technology goals and submit requests to the CTCN.

- **Developed countries are encouraged to highlight to the CTCN, through their NDE, how they could support developing countries to strengthen their NSIs**.

7. Way forward

With a concerted national strategy, sustained policy efforts at the national level and effective international support, a developing country can strengthen its NSI. This will first and foremost require actions by the national government. However, international support can play an important role in helping to strengthen a NSI by drawing on wide-ranging experiences and expertise. Given the time that may be required to strengthen NSIs broadly, it may be useful to focus on national and international actions that can help accelerate prioritized climate technology innovation. To do so, a focused approach should be taken that emerges from identified climate priorities and implementation pathways and focuses on supporting the strengthening of specific NSI elements. In addition to learning from programs that aim to strengthen NSIs, greater efforts to build the science, technology and innovation capabilities of developing countries are critical to accelerating their climate actions.

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About the Technology Executive Committee

The Technology Executive Committee (TEC) is the policy component of the Technology Mechanism, which was established by the Conference of the Parties in 2010 to facilitate the implementation of enhanced action on climate technology development and transfer. Along with the other component of the Technology Mechanism, the Climate Technology Centre and Network, the TEC is mandated to facilitate the effective implementation of the Technology Mechanism.