Technology Readiness

A framework for understanding what it means to be ready for technology transfer and development

Technology transfer and development is a key part of the process of transforming economies to enable inclusive green growth within the framework of sustainable development and poverty eradication that promotes achievement of nationally defined poverty reduction and sustainable development objectives, and global objectives such as the 2 degrees Celsius temperature limitation objective agreed under the UNFCCC.

This paper sets out a view of the various capacities that are required for countries to be ready for technology transfer and development. That is, to plan for, catalyze, sustain, and monitor and report on technology transfer and development, in ways that are fully integrated with national development priorities and achievement of the MDGs.

This paper also argues for a technology transfer mechanism that is country owned, driven by innovation, research, and integrated with national development strategies for inclusive green economies. Building up such a system requires extensive capacity building at the national and local level. However, only when technology transfer is owned and driven by the recipient countries themselves will it lead to transformation of economies and ensure that developing countries are not ad infinitum dependent on external technological assistance.

Outside of the UNFCCC proceedings, technology related issues are closely associated with poverty reduction efforts and the broader sustainable development agenda. Technology related matters are an important aspect of ongoing international discussions on inclusive green economy, the post-2015 development framework, and Sustainable Development Goals. Greater understanding of the capacities required for technology transfer and development can help identify synergies across similar discussions in various international processes and lead to further action at the country level.

UNDP is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. We are on the ground in 177 countries and territories, working with them on their own solutions to global and national development challenges. As they develop local capacity, they draw on the people of UNDP and our wide range of partners.

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Preface and Overview

This discussion paper is part of a series of publications that draws upon the experience generated by the United Nations Development Programme's (UNDP) climate change adaptation and mitigation activities in over 140 countries over the past two decades.

The paper presents a framework for understanding what it means for developing countries to be ready for technology transfer and development in the context of their national efforts to identify and address their climate change mitigation and adaptation needs.

The definition of technology transfer used in this paper is that of the Intergovernmental Panel on Climate Change (IPCC) also used by the United Nations Framework Convention on Climate Change (UNFCCC), that technology transfer refers to a broad set of processes, covering flow of knowledge, experience, and equipment, including hardware and software, for climate change adaptation and mitigation amongst stakeholders and between and amongst developed and developing countries. The definition of technology transfer includes technology cooperation and diffusion of technology.

This paper is not intended to be an all-encompassing review of technology activities, but rather it builds on the work of UNDP in identifying the components of climate finance readiness (UNDP 2012) and extends the same capacities oriented approach to that of technology transfer and development.

The definition of technology readiness advanced in this paper is *the set of capacities to plan for, catalyse, sustain, and monitor and report on technology transfer and development, in ways that are fully integrated with national development priorities and achievement of the Millennium Development Goals (MDGs).*

The purpose of this paper is to argue for a new approach to technology transfer, an approach that is bottom-up, country-owned, which stimulates local entrepreneurship and innovation. Business as usual of promoting technology transfer through ' cleaning houses' and/or top-down centralized technology transfer mechanism and network will not lead to the changes in the technology mix at the national and local levels needed to address climate change and transform economies towards long-term sustainable production and consumption patterns.

The intended audience for the paper is primarily policy makers in the climate change and energy sectors, particularly at the national level in developing countries, and also for international development policy practitioners.

Introduction: Policy Context

The size of the climate change challenge facing the international community is large and growing. Climate change threatens to reverse hard won development gains and it disproportionately impacts vulnerable groups such as women and children, particularly those in the poorest countries most vulnerable to the adverse effects of climate change such as drought, flooding, and sea-level rise.

In order to reach the internationally agreed objective of keeping global average temperature rise below 2 degrees Celsius from pre-industrial levels major shifts in consumption and production patterns will be required. Furthermore, scaled-up efforts will need to be taken to build the resilience of those most vulnerable to climate change, particularly for those in developing countries who are least responsible for increasing concentrations of greenhouse gases in the atmosphere.

As the climate challenge grows, technology transfer and development will become an increasingly important component of international and national responses. There is a need for greater understanding of the capacities required by developing countries to develop and access technologies to meet their climate change and development needs.

Currently there are major inequalities among countries in accessing technologies and finance. For example, 2010 had a record $243 billion global investment in clean energy. However, only 10% of these investments occurred outside of the G20 countries. Many developing countries have yet to attract the right technologies and finance because they are still creating the right policies, regulations, finance, and institutions to achieve their goals. This can compromise the abilities of governments (national and local), communities and households to take advantage of opportunities to transition toward a more sustainable development.

Technology transfer and development related to climate change mitigation and adaptation activities is also essential to achieve the objectives of the United Nations Framework Convention on Climate Change (UNFCCC) and any future global climate change agreement.

Technology is embedded within the work of the UNFCCC, where developed countries are obliged to take all practical steps to 'promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly to developing countries to enable them to implement the provisions of the Convention' (UNFCCC 1994). A 'Expert Group on Technology Transfer' is part of the UNFCCC process, and, in 2010, parties further agreed to develop a Technology Mechanism comprised of a Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN). Both the TEC and the CTCN are still in a nascent stage, and the relationship between those entities and the other bodies of the UNFCCC, including the Green Climate Fund, is still under discussion.

In light of these realities and the state of international discussions on technology transfer and

development there is a need for greater understanding of what specific capacities are required to help developing countries use technology to meet their poverty reduction, climate change, and overarching sustainable development objectives in order to build more resilient economies, advance environmental protection, and increase prospects for sustainable human and economic growth.

This paper aims to contribute to that discussion by providing a conceptual framework for understanding what it means for developing countries to be ready for technology transfer and development in the context of their national efforts to identify and address their climate change mitigation and adaptation needs taking into account the concept of inclusive green economy advanced by the outcomes of the 2012 UN Conference on Sustainable Development (UNCSD) "Rio+20".

This paper will start by describing a framework for technology readiness and then examine each component of the framework in greater detail, drawing on examples from UNDP and other work on technology transfer and development.

What does it mean to be ready for technology transfer and development?

The concept of "readiness" is a relatively new term in the climate change policy community referring mostly to climate finance activities, particularly in the REDD+ and market readiness areas. In an earlier paper in this series UNDP (2012) called for a comprehensive definition of climate finance readiness[1] and proposed a framework for understanding what it means to be ready for climate finance according to specific capacities required at the national level. This current paper takes a similar approach, by identifying the capacities required for developing countries to be ready for technology transfer and development.

The definition of technology transfer used in this paper is that of the Intergovernmental Panel on Climate Change (IPCC) also used by the United Nations Framework Convention on Climate Change (UNFCCC), that technology transfer refers to a broad set of processes, covering flow of knowledge, experience, and equipment, including hardware and software, for climate change adaptation and mitigation amongst stakeholders and between and amongst developed and developing countries. The definition of technology transfer includes technology cooperation and diffusion of technology. Technology development is also considered in this paper, including the research and development, adoption, deployment and dissemination of environmentally-sound technologies.

Technology readiness is therefore further defined as *the set of capacities to plan for, catalyse, sustain, and monitor and report on technology transfer and development, in ways that are fully integrated with national development priorities and achievement of the Millennium Development Goals*.

This definition contains four core components of technology readiness (**Table 1**):

- **planning** for technology transfer and development;

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[1] Climate finance readiness: the capacities of countries to plan for, access, deliver, and monitor and report on climate finance, both international and domestic, in ways that are catalytic and fully integrated with national development priorities and achievement of the MDGs (UNDP 2012)

- **catalyzing** technology transfer and development;
- **sustaining** and scaling-up development and deployment of technology; and
- **monitoring**, **reporting**, and **verifying** technology transfer and development efforts.

These components are further elaborated in the sections of the paper that follow.

Technology Planning	Catalyzing Technology Transfer & Development	Sustaining Development & Deployment of Technology	Monitor, Report & Verify
• Identify technology needs and options • Identify policy-mix and sources of technology, financing	• Formulate project, programme, sector-wide approaches to access technology • Finance technology transfer and development • Engage private sector through partnerships	• Build local research and development (R&D) • Build local supply of expertise and skills • coordinate implementation and access technology networks at local, national, regional, and international levels	• Monitor, report, and verify flows of technology transfer

Table 1: Components of Technology Transfer and Development Readiness

1 Technology Planning Capacities

Technology planning capacities are critical in order to make technology selections that are inclusive, equitable, and compatible with sustainable long-term development. Developing these capacities can be seen as an initial step to prepare for technology transfer and development, but it can also be seen as part of an iterative process where assessment occurs continuously during the cycle of technology transfer and development all the way through to deployment.

1.1 Identify Technology Needs and Options

Identifying the most effective and efficient technologies requires a thorough understanding of national and local climate change and sustainable development priorities.

Given the diversity of technology needs and related capacities among developing countries, and the wide range of approaches and mechanisms available for technology transfer and development, planning is an important capacity that is required, particularly at the policy and institutional level.

At the policy level, capacities are required to integrate technology considerations into existing national sustainable development policies, frameworks, and objectives. At the institutional level, organisations, both within government and outside must be equipped with the capacity to conduct technical evaluations of the economic, social, and environmental impacts of technology choices taking into account long term sustainable development objectives.

Within the context of the UNFCCC, parties have agreed to the use of a mechanism known as a Technology Needs Assessment (TNA). The TNA is a set of country-driven activities that identify and determine the mitigation and adaptation technology priorities, particularly for developing country Parties. They involve different stakeholders in a consultative process, and identify the barriers to technology transfer and measures to address these barriers through sectoral analyses. These activities may address soft and hard technologies, such as mitigation and adaptation technologies, identify regulatory options and develop fiscal and financial incentives and capacity building (UNFCCC 2002)

TNAs can assist countries to determine their own needs, enabling strategic decisions regarding technology and policy selection to meet their objectives. One of the ways that UNDP supports countries in assessing their needs is through the TNA Handbook (**Box 1**).

In the *Technology Needs Assessment Handbook*, UNDP provides a systematic approach for conducting technology needs assessments. Conducting a TNA assesses various ways to enhance capacity in developing countries to:

- Select from a set of available environmentally sustainable technology options;
- Increase adaptive capacity and decrease vulnerability to climate change impacts;
- Develop important links among stakeholders within the countries to support future investment and barrier removal (including the formation of networks);
- Diffuse high priority technologies and measures throughout key sectors of the national economy, and;
- Acquire a broader picture of technology needs for a region or group of countries, so that international technology support programs or initiatives could be oriented towards a more cross-country or regional approach.

Box 1:   Technology Needs Assessment Handbook

When assessing technology needs with a focus on reducing GHG emissions and vulnerability to climate change, it is important that the technologies selected are clearly in line with the countries' development strategies. This addresses the concern that without consideration of development priorities in recipient countries, transfer of technologies as well as use of limited resources will be unsustainable. Therefore, the TNA handbook first assists in describing a country's development needs and priorities before moving to the actual technology assessment. These priorities will also be formulated in light of long term economic and social trends in the countries, such as increased industrialization and urbanization, as these will have an impact on the eventual technology choices that also support the Millennium Development Goals (MDGs) and poverty reduction objectives.

Assessing the most appropriate technology mix for a country includes (1) identifying technology mixes which are 'win-win' (with environmental, social, and economic benefits) and lead to long-term social, economic and environmental sustainability, (2) identifying barriers to technology transfer, and (3) identifying the available policy options to remove barriers, catalyze investment and drive change towards stated objectives.

Building on a technology needs assessment, the identification of the appropriate policy-mix to support technology transfer and development at the national level is a critical feature of technology transfer approaches which are driven by 'bottom up' considerations. This will be discussed in the next section which focuses on moving from identifying technology options to integrating technology choices into national policy, plans, and strategies for implementation.

2 Capacities for Catalyzing Technology Transfer & Development

2.1 Formulate project, programme, sector-wide approaches to access technology

Technology transfer does not occur in isolation. Technology plans, strategies, projects and financing must be tailored to the country context. The needs of developing countries vary widely and the technology solutions for emerging economies are very different from those of Least Developed Countries. In this way, coordinated plans for technology transfer must embed technology into national and sub-national policies and plans. Ideally, countries can mainstream their technology plan into their national climate change and inclusive green growth strategies to ensure institutional integration and sustainable technology choices and dissemination.

In order to be ready for technology transfer, recipient countries require capacities to formulate and develop appropriate policies, services, tools, and best practices for technology development, diffusion, and transfer. Defining the technology mix most appropriate for their development purposes through a technology needs assessment, countries are then in a position to identify the correct mix of tools, regulations and incentives in order to mainstream low-carbon and climate-resilient technologies and technical roadmaps into national development, climate change, and inclusive green growth strategies (**see Box 2**). The missing link is the necessary training at country (sub-regional and regional) level to facilitate the diffusion and adaptation of the nationally-appropriate tools, services and policies. UNDP's rich experience in conducting the requisite country-driven technical workshops can help focus recipient countries to develop and adapt technology related tools, services, policies and practices.

UNDP has initiated a programme to assist countries in assessing and mainstreaming low-carbon and climate-resilient strategies into their overall national development plans. The assessments cover present and future climate change scenarios, current and projected sustainable development needs, and response options including technology. The **Green Low-Emission, Climate-Resilient Development Strategy (LECRDS)** consists of the following steps:

1. Design multi-stakeholder participatory climate planning and coordination process
2. Prepare climate change profiles and vulnerability scenarios
3. Identify strategic options leading to inclusive green, low-emission, climate-resilient development trajectories
4. Prioritize strategic options through technological, social, and financial feasibility and cost-benefit analysis
5. Prepare green, low-emission and climate-resilient development roadmap

Such a process can assist countries in the planning and mainstreaming process of aligning climate technology transfer strategies with not just their overall climate strategy, but also with their national sustainable development plans. Technology transfer, development and deployment – both indigenous and exogenous – is a key component in the creation of a Green Low-Emission, Climate-Resilient Development Strategy.

Box 2: Green Low-Emission, Climate-Resilient Development Strategy (Green LECRDS)

2.2 Financing technology transfer and development

The capacities required for developing countries to finance technology transfer and development for climate change mitigation and adaptation actions are similar to those described under the umbrella framework of climate finance readiness described in the previous UNDP paper in this series (UNDP 2012). The challenge is to ensure that the complex channels and myriad sources of climate change finance are matched to the identified technology needs of developing countries so that funding can act catalytically to scale up activities and provide financial sustainability to projects and programmes so that technology can be most effectively and efficiently deployed.

Accessing multilateral finance can occur through a number of modalities, including access via multilateral agencies which act as fund managers, implementing bodies, and executing bodies (national level domain can also act as executing bodies under this modality). Alternative structures with devolved responsibility to the national level for implementation, execution, and sometimes also fund managerial functions can be found in direct and 'enhanced' access modalities, respectively (ODI and UNDP, 2011; UNDP 2012).

The more devolved the responsibilities to the national level, the more capacity is required at that level to meet the requirements of implementation and execution functions. For direct and enhanced access modalities even greater capacities for financial management are required in order to meet the accreditation standards set up by multilateral funds such as the UNFCCC Adaptation Fund.

There are a variety of sources of information available to assist countries with accessing finance, including UNDP's work on Catalyzing Climate Finance, Climate Finance Readiness, Enhanced Access, and National Climate Funds (see references).

2.3 Build partnerships to engage the Private Sector

Developing capacity for building partnerships is a critical component for technology readiness. The types of partnerships required to catalyze technology transfer and development include South-South, North-South, and triangular cooperation and can occur at local, national, regional, and global levels and involve a range of partners, including the private sector. Partnerships can be developed for technical assistance, financial support, and to assist capacity building efforts.

The private sector has an important role to play in technology transfer and development. Grant financing from public sources alone will not be enough to meet growing demand for technology transfer in developing countries. In terms of technology readiness, capacities are required to effectively engage the private sector in partnerships at all levels, from local to international, and with both foreign and domestic private sector actors. Countries have identified the need for assistance in building capacity to mobilize these actors. Given that many technologies will be sustained by private investment, close partnerships with industry actors can ensure that technologies are developed and deployed strategically within the context of the market. In other words, partnerships with industry can help guide the creation and installation of the appropriate mix of incentives, regulations and frameworks to access, sequence, and combine private finance. This will help the technology-recipient country to depend less on the import of

technologies that are not as well tailored to a country's development needs and will make a long-term and sustainable impact.

Mobilising the private sector at the national and sub-national level can also support local entrepreneurship. Developing countries need guidance to install the institutional and regulatory frameworks to support local innovators and private sector entrepreneurs. For example, UNDP engages in innovative public-private partnerships to reduce investment risks, optimize the use of diverse sources of finance, and pool public and private sector talents and strategic capabilities, and enhance rapid scaling-up of energy access. UNDP projects have been instrumental in initiating the development of new markets, through direct demonstration of new technologies as well as serving as a catalyst for private sector firms to develop similar projects. An example from UNDP's experience in working at the country level to enhance public-private partnerships is through the Public-Private Partnerships for Service Delivery (PPPSD) mechanism (see **Box 3** for details). The work of the UN Capital Development Fund (UNCDF), with its broad economic development mandate focuses on supporting strong management of public and private financing mechanisms within decentralized systems is also relevant in this area. An additional example is the South-South Global Assets and Technology Exchange (SS-GATE) which is a UNDP hosted platform for business transactions through a market mechanism, matching entrepreneurs in developing countries to investors abroad, including for climate change related technologies.

Public-Private Partnerships for Service Delivery: A brief overview

PPPSD is a UNDP programme that seeks to increase the access of the poor to basic services such as water, waste, energy, education and health by promoting inclusive partnerships between local government, business and communities.

PPPSD Country Initiatives -The programme works with partners at the local level to assist in the planning, design and implementation of private-public partnerships in support of services to the poor in the context of the MDGs. PPPSD projects are selected on a demand driven basis and are always integrated into an existing, operationally effective programme which forms part of the activities of a UNDP or other UN Agency Country Office.

PPPSD Global Learning Network- The Global Learning Network (GLN) is a decentralised international partner network of individuals, centres of excellence, institutions and programmes interested in sharing knowledge and pooling resources for joint activities related to local level public-private partnerships. The GLN supports the aims of the PPPSD programme at the global level. It aims to increase the effectiveness of local PPPs by providing the link between generating experience in the field and the analysis of this experience into resources which can be shared and used by others to strengthen their approach. Resources are developed from local level knowledge, facilitating the exchange of PPP experiences through networking events, and developing PPP professional capacity through design of training materials.

Box 3: Public-Private Partnerships for Service Delivery (UNDP Knowledge, Innovation and Capacity Group)

3 Capacities for Sustaining Development and Deployment of Technology

Technology transfer and development is an iterative process that requires inputs to sustain and scale-up efforts in order to reach national objectives for climate change adaptation and mitigation, as well as poverty reduction. The readiness capacities associated with sustaining technology transfer and development include the need for an enabling environment in developing countries that ensures that diffusion of environmentally sound technology reaches those most vulnerable.

3.1 Build local research and development (R&D)

The R&D component of building capacity for technology development cannot be easily contained in either of the "catalysing" or "sustaining" components of this technology readiness framework developing endogenous skill sets and knowledge base is essential in maintaining the momentum of initial technology transfers to developing countries. The cultivation of local R&D expertise is essential to both being ready for technology transfer and being able to scale-up technology deployment at the national level over time given that the development and deployment of technology is a dynamic process, moving from pilot projects to scaled-up programmatic, sector, and economy-wide approaches as experience and capacities increase.

As a key service provider on technology, the UN has decades of experience in providing neutral support for R&D of technologies. UNDP has piloted technology projects around the world and codified best practices and lessons learned from these experiences. This can serve as important guides for countries as they undertake research, development and demonstration of new climate-friendly technologies. Examples of such approaches can be seen through programming under the Global Environment Facility, the Multilateral Fund for the Implementation of the Montreal Protocol, and other national, bilateral and multilateral sources (for example see **Box 4**).

The UNDP-supported, GEF-funded project on Fuel Cell Bus (FCB) Commercialization in China combines many stakeholders, including private sector and industrial enterprises. With China's research and development activities in fuel cell science and technology relevant to fuel cell buses, the project addressed technological barriers through:

1. **Field demonstration** of the operation of FCBs in Beijing & Shanghai, including the design, construction and operation of hydrogen refilling stations (one each in Beijing and Shanghai);
2. **Institutional capacity building** relating to commercial operation, maintenance, or manufacturing of FCBs in China; and,
3. **Capacity building on FCB technology** and FCB technology applications among key stakeholders actors, including policy makers and potential investors in the private sector, and among the general public, including technical assistance on capacity building on public transport policy and planning.

The project has been a centerpiece of technological innovation for China. China and Brazil have now ongoing fuel cell bus projects, initiated with seed money from UNDP-GEF.

Box 4 Fuel Cel Bus Commercialization in China (UNDP GEF)

An additional example is the United Nations University - Institute of Advanced Studies (UNU-IAS) which helps regions (at the sub-national level) get support to address local needs. UNU-IAS has over 100 regional centres of excellence (RCEs) that provide targeted and tailored support for countries by supplying advice, information, training, and analytical tools and best practices in learning and capacity building for sustainable development. Learning projects of UNU-IAS's RCEs are designed for the sub-national learning communities represented by research, learning and decision-making organizations.
RCEs stimulate and encourage collaboration with the private sector, public institutions, academia and research institutions, working on themes which include, among others, traditional knowledge, sustainable consumption and production, and climate change. Being a partner to multiple academic networks UNU-IAS is strategically positioned to provide connections to the extensive private sector networks for innovation, knowledge and training.

3.2 Build local supply of expertise and skills

"Through its work, UNDP has learned that some of the most important innovations come from communities and people already taking action to adapt to a changing environment. It's important that in discussions of technology and innovation,……….member states consider the support poor countries need to identify, encourage, and replicate local good practice."

Helen Clark, UNDP Administrator

In order to implement technology transfer that is 'bottom up' and strongly anchored in community interests there are many skills and capacities required at the institutional and local level.

Some basic capacities that are required at the institutional level to facilitate delivery may include:

- technical capacity to select appropriate technologies, with adequate information on available choices
- procurement and recruitment capabilities
- capacities to negotiate commercial agreements
- contracting skills and provision of training for installation services
- capacity for overseeing implementation and maintenance of technology

Some basic capacities that are required at the local level may include:

- consumer awareness of technology options and impacts of technology choices
- capacity to share indigenous and local knowledge on technology best practices
- opportunities for local entrepreneurship and development of technology focused small and medium enterprises
- knowledge of proper use of hardware technologies at the household level

3.3 Access local to globally integrated networks to foster technology transfer

Multi-stakeholder networks are required at all levels to sustain and scale-up technology transfer and development. UNDP envisions a local to globally (or vice versa) linked technology transfer mechanism comprised of a hub of inter-connected national and local institutions supported by regional and global centres of excellence (see **Figure 1**). The hub and the regionally-represented network support technology transfer in each country by providing targeted technical assistance, policy, and finance services to both national and local public and private partners.
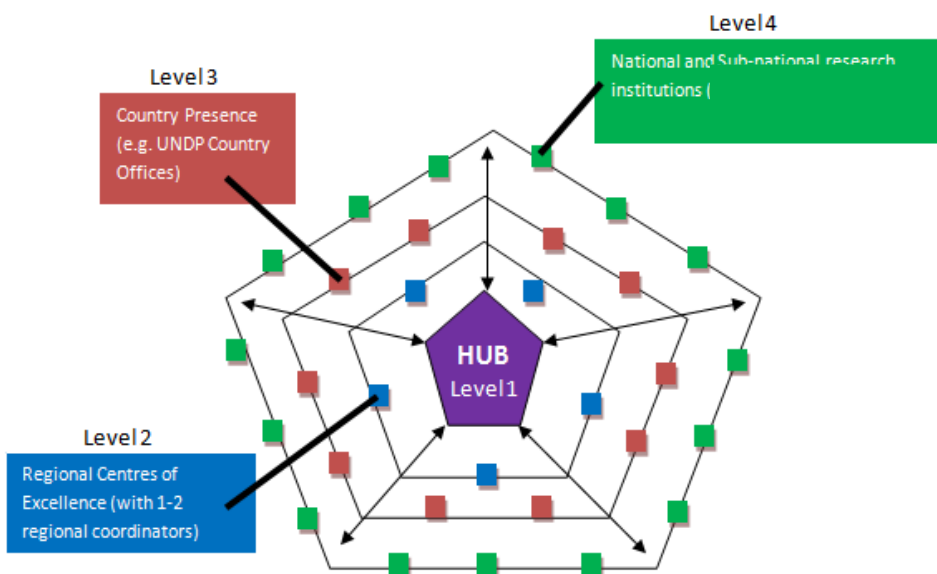

Figure 1   A global to locally integrated technology transfer network

Figure 1 demonstrates how a technology transfer mechanism can be designed to operate as an inter-connected web of national, sub-national, regional, and global partners. At the middle of the graphic are major hubs, preferably in developing countries that take on the coordination role(s) (Level 1). It is surrounded by a supporting structure of regional centres of excellence (Level 2) that connect directly to the hub and to each other. The third ring represents the presence at the national-level. The UN and its Resident Coordinator system could leverage is presence in 177 countries and territories for this purpose. The fourth ring represents research institutions at the national and sub-national levels where countries can build and exploit local capacity in R&D, in cooperation with the private sector. When taken together, the webbed network brings together the comparative advantages of its member organisations to help countries address their specific technology circumstances and needs. The various entities share information with each other, including for the mobilisation of skills, policies, and finance to support effective technology transfer. Financial networks can assist countries to catalyze and increase public and private investment. Networks can also provide peer-to-peer advice, technical assistance and capacity building that strengthen individual entities within the networks, making the entire system stronger. By connecting institutions that specialize in areas related to technology transfer (e.g. energy, finance, agriculture, transport), countries may also access specialized expertise. Technical and academic networks can provide a source of scientific data, product information, analysis and tools to help countries identify the right technologies for their needs.

An effective engagement mechanism at the national level is needed to connect and mobilise the best available local scientific and technical expertise. The role of a network of national level stakeholders (urban and rural) who are involved in energy, climate change planning, and adaptation activities, as well as technology owners and practitioners, entrepreneurs, communities, and sector representatives is critical to the overall development, diffusion, and transfer of technology. Through integrated networks, the exchange of expert knowledge, indigenous and tacit knowledge and a range of perspectives can lead to the development of a shared vision for moving forward. Experts at the local level who have intimate knowledge of national cultural, social, and economic priorities and are often in the best position to ensure that technology is applied appropriately, efficiently, and equitably. Ideally, through the creation of relevant and appropriate networks of public and private stakeholders, a technology transfer community will be created at the country level.

Through the integrated network approach described above the endogenous capacity of countries is engaged in technology transfer, which furthers national development objectives, as opposed to top-down technology transfer mechanisms. Ultimately, it is local and national governments along with local and international private sector partners that will drive technology transfer and development rather than an external clearing house and/or top-down global technology transfer mechanism.

4 Monitoring, Reporting, and Verification Capacities

Monitoring, reporting, and verification (MRV) is a subject in the UNFCCC negotiations that often arises in the context of discussions around climate change mitigation by developing countries, but also in the context of MRV of support provided by developed countries to mitigation and adaptation actions by developing countries. In this context, and as with climate finance readiness, MRV capabilities are an increasingly important component of technology readiness to promote transparency and effective delivery. Accurate information is required in order to assess global progress towards the globally agreed objective of limiting global average temperature rise to less than 2 degrees Celsius above pre-industrial levels.

4.1 MRV of Technology Transfer

Effective feedback mechanisms must be in place to assist countries to collect data on technology transfer and its impact on sustainable development and greenhouse gas reduction efforts. Developing indicators for and tracking information regarding the research, development, identification, deployment, and dissemination of environmentally-sound technologies can provide a vivid picture of the results achieved and promote learning by doing. This data can also be collected by a global network like the CTCN for a more accurate global outlook on technology. Multilateral organisations, including the CTCN and UN country teams, are therefore well-placed to facilitate knowledge sharing between and among institutions and networks, both public and private.

In this context MRV systems can help to create a feedback loop for constant learning and improvement to ensure that results are achieved in the most efficient and effective way possible. This feedback loop also ensures developing countries will continue to access and finance new technology by creating a track record of success in implementing sustainable technology. The advance of payment for performance systems is an example of where capacities for MRV are critical for gaining access to finance for projects. Tracking flows of finance and technology between the global North and South, as well as South-South is critical for monitoring implementation and transformation of economies towards their sustainable development objectives.

5 Conclusion

Technology transfer and development is a key part of the process of transforming economies to enable inclusive green growth within the framework of sustainable development and poverty eradication that promotes achievement of nationally defined poverty reduction and sustainable development objectives, and global objectives such as the 2 degrees Celsius temperature limitation objective agreed under the UNFCCC.

This paper has set out a view of the various capacities that are required for countries to be ready for technology transfer and development. That is, to plan for, catalyze, sustain, and monitor and report on technology transfer and development, in ways that are fully integrated with national development priorities and achievement of the MDGs (see below in **Table 2).**

This paper has also argued for a technology transfer mechanism that is country owned, driven by innovation, research, and integrated with national development strategies for inclusive green economies. Building up such a system requires extensive capacity building at the national and local level. However, only when technology transfer is owned and driven by the recipient countries themselves will it lead to transformation of economies and ensure that developing countries are not ad infinitum dependent on external technological assistance.

As noted previously, in 2010 Parties to the UNFCCC agreed to establish the Climate Technology Centre and Network (CTCN). The CTCN, linked to the UN Resident Coordinator system and other existing UN supported systems at the country level such as the activities of UNU and UNCDF, can help make existing co-operation more systematic and bring technologies and know-how to vulnerable and poor countries at the scale needed to help them mitigate and adapt to climate change. As this aspect of the technology mechanism is further defined by subsequent decisions taken by governments, an understanding of technology readiness, what it means for developing countries to be ready for technology transfer and development, can assist parties in the design of the UNFCCC technology mechanism and help identify assistance needed from international partners such as UNDP.

Outside of the UNFCCC proceedings, technology related issues are closely associated with poverty reduction efforts and the broader sustainable development agenda. Technology related matters are an important aspect of ongoing international discussions on inclusive green economy, the post-2015 development framework, and Sustainable Development Goals (the process for which was launched by the UN Conference on Sustainable Development 2012 in Rio de Janeiro, Brazil). Greater understanding of the capacities required for technology transfer and development can help identify synergies across similar discussions in various international processes and lead to further action at the country level.

	Components of Technology Transfer and Development Readiness			
Levels of Capacities Required	**Technology Planning**	**Catalyzing Technology Transfer & Development**	**Sustaining Development & Deployment of Technology**	**Monitor, Report & Verify**
National Policy Level	• integrate technology needs into national climate change and sustainable development policies and strategies (ie. TNA tool)	• formulate project, programme, sector-wide approaches to access technology, (ie. Green LCRDS) • create enabling environments (ie. regulation, financial incentives)	• support access to and development of integrated networks at national level and connections to other levels (local, regional, international) • national policy support for technology research and development	• capacities to monitor, report, and verify flows of technology transfer (linkages to international fora, ie. UNFCCC)
Institutional & Local Level	• planning capacities to identify technology needs and options available	• capacities to access financing for technology transfer and development • capacity to engage in partnerships with the private sector (ie. PPPSD, UNCDF, SS-GATE)	• Build local research and development capacities • Build local supply of technology expertise, skills and awareness, including at household level and for small & medium sized enterprises	• Institutional capacities and local skills for data collection

Table 2 Components of Technology Transfer and Development Readiness and associated capacities required

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