The UNFCCC approach to climate change technology transfer:

Assessing the gaps through econometric analysis and business insights

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Introduction

- **PROBLEM**
  - High growth of GHG emissions in developing countries
  - No commitments under the UNFCCC
- **POTENTIAL POLICY SOLUTION**
  - Setting caps to GHG emissions of developing countries
    - Not accepted by DC in view of historical responsibility of IC, right to develop at similar level than IC and lack of technological capability
- **ALTERNATIVE POLICY SOLUTION**
  - Support by IC to DC through low carbon TT
    - Recognised as one of the key pillars of a post-2012 agreement,
    - UNFCCC unsuccessful to accelerate TT to the required level

Objectives

- Identify gaps of the UNFCCC process to accelerate TT
- Review explanations and solutions provided by econometric studies
- Review explanations and solutions provided by case study approaches and business literature
- Provide policy recommendations to bring the UNFCCC process closer to actual needs of policy makers and private sector
- Highlight research needs

History of TT in the UNFCCC

- TT present since the initial Convention text (1992), that introduces some static elements of TT
  - TT as an end in itself where governments should have full control of tranfered technologies
  - Division between developed (donors) and developing (recipients) countries
  - Developed countries shall support not only the transfer of low carbon technologies but also development and enhancement of endogenous capacities through transfer of know-how
- TT present in every COP, some highlights:
  - KP 1997 creates the CDM with the potential to TT to DC
  - COP 7- Marrakech 2001- Decision to reinforce TT. Creation of TNA, TT:CLEAR, EGTT. Recommendations on enabling frameworks.
  - In COP 13-Bali 2007- Technology as one of the four building blocks

History of TT in the UNFCCC (II)

- COP 15- Copenhagen, failed to produce a legally binding agreement. The Copenhagen Accord establishes a Technology Mechanism to accelerate technology development and transfer (…) guided by a country-driven approach and based on national circumstances and priorities.
- Main remaining areas of discussion as regards TT:
  - Institutional structure: Unclear role, membership and structure of the TM
  - Intellectual property rights: Considered as essential for innovation by IC and as a barrier to TT by DC
  - Finance: Funds mentioned by the CA but no mention to eligibility criteria or allocation mechanisms
  - Enabling environments: IC emphasise need of policy reforms and enabling environments at the national level in DC. DC to the need of IC to promote TT from their country suppliers.

Effectiveness of UNFCCC mechanisms

INSTITUTIONS: EGTT

Contributed to improve understanding on financial and capability gaps to TT

- Fact finding mechanism
- Has delayed necessary actions
- Members are political appointees, not experts
- Unclear design of replacement TM
- Turn to bilateralism

INFORMATION: TNA AND TT:CLEAR

Contributed to understanding of in-country capacity gaps and to the diffusion of some technology info.

- Gaps have not materialised in projects or programmes
- No coordination with national planning processes
- No systematic finance

FINANCIAL VEHICLES: CDM AND GEF

CDM has reduced the payback period of investments with TT
Many CDM projects have TT
Markets more effective than funds

- No reliable data of TT inside and outside the Convention
- Impossibility to measure effectiveness beyond BAU
- Estimations show funds far below required needs
- Convention funds follow the same pattern as FDI
- Project-based nature does not address barriers nor foster large scale deployment and innovation

Main gaps of the UNFCCC process

1. **Lack of reliable measurements of TT inside and outside the Convention**
   - Effectiveness has so far been measured through unreliable financial indicators of FDI and through TT claims in PDD projects.
   - TT is not exactly financial flows, a measurement of knowledge spillovers and emission reductions needs to be incorporated
   - Measurements required for eligibility criteria for NAMAs support and for compliance if developed countries commit to transfer technologies.

Main gaps of the UNFCCC process (II)

2. **Understanding of TT as an end over which supplier countries have control**
   - The private sector owns most low carbon technologies
   - The private sector responds to demand and enabling environments in recipient countries
   - The UNFCCC appears disconnected from the enabling frameworks that facilitate private investment and the strategies at company level to absorb foreign knowledge.
   - The UNFCCC is also disconnected from the strategic behavior at company level to attract and transfer foreign technologies

Main gaps of the UNFCCC process (III)

3. **Not filled the gaps left by private investment**
   - The different UNFCCC mechanisms potentially acting on TT are not integrated in national planning processes and deliver technologies on a project basis that does not permeate with the rest of the economy.
   - UNFCCC mechanisms are insufficient to remove existing barriers, leverage a large scale of private investment and promote the development of endogenous technologies in DC
   - The CDM has followed the same patterns as FDI, focused in BRIC countries and technologies at the later stages of the learning curve

Main gaps of the UNFCCC process (IV)

4. **Division of the world in developed and developing countries does no longer hold**
   - Need of a new paradigm beyond the paternalistic division of developed countries as providers and developing countries as pasive recipients
   - A group of large and dynamic emerging economies inside the group of developing countries is actively absorbing foreign technologies and developing and transferring endogenous ones. Their importance was made evident in Copenhagen
   - A majority of the developing world seems unable to attract foreign technologies
   - There is a need for a differentiated approach per developing country circumstances

Main gaps of the UNFCCC process (V)

5. **Long decision making processes have returned interest in bilateralism**
   - Slow decision making fails to provide the strong signals that the private sector needs to undertake costly and risky investments in low carbon technologies
   - Copenhagen has marked the end of democratic institutions and the start of oligargic formations like the G-20, where small group pacts may become more important than multilateral treaties.

Econometric studies of CC TT

- Econometric studies on CC TT build on a consolidated field of economics of technology diffusion
- They can provide answers to some of the gaps of the UNFCCC TT process:
  - Measurement of CC TT
  - Identification of factors conductive to enabling environments and collaboration between technology suppliers and recipients
  - Policy recommendations to enhance TT to developing countries
- Three types of studies:
  - General economic literature of technology diffusion
  - Literature focused on effects of foreign activity on energy intensity
  - Literature focused on factors affecting ouput of technology through CDM projects and patents

Defining and measuring TT in econometric studies

- Difficulty of measuring TT:
  - Technology has not measurable physical presence or a well defined price. It is embodied in products and processes and involves not only equipment but also skills and know-how
  - Financial indicators such as FDI, imports, licenses or royalty payments are proxies but do not reflect knowledge spillovers
- Measurement of TT in econometric studies
  - Association models: test if a specific foreign activity (FDI, trade, foreign R&D) leads to a particular domestic technology outcome (productivity growth, carbon emissions or energy intensity reduction) (empirical)
  - Models explaining only channels of TT, and not their effect: CC patents, CDM projects involving TT: No info on knowledge spillovers (empirical)
  - Structure models: energy or emissions intensity as a function of local and foreign stock of knowledge (empirical and theoretical)
  - General equilibrium models: explore quantitative relationships between R&D, technology diffusion and domestic productivity. (general)

Key factors with an impact on TT

- High demand size and economic growth attract FDI and trade, potential channels of TT, but do not guarantee emission reductions
- Effect of FDI and trade on emission reductions depends on country specific characteristics: usually scale and composition effects outweigh technique effect
- Scale and composition effects lead to increased emissions from FDI and trade in countries at the earlier stages of development
- National commitments to climate change mitigation have a positive and significant influence on TT
- FDI more likely to lead to benefits for the host country when affiliates import leading-edge foreign technologies, purchase their inputs in the host country and enjoy product and technological autonomy
- A minimum threshold level of human capital and infrastructure
- Local R&D activities are a pre-condition for successful absorption of foreign TT. Specific more important than general technological capacity
- The further to the technological edge the highest the marginal returns from R&D investments
- Protection of IPRs fundamental for promoting innovation and ensuring that developing countries get the most advanced technologies

Policy implications of econometric studies

Need of a differentiated approach:

- Large and dynamic economies- Foster the technique over scale and composition effects:
  - Targeted FDI, imports and licenses of CC technologies
  - Increased environmental awareness and regulations
  - Local R&D investments and active interaction with IC
  - Strong IPR enforcement
- LDCs: low emissions, demand and technological capabilities
  - Capacity building and human capital as a preconditions
  - Financial support for acquisition of foreign technologies
- Large spectrum of other DC.
  - Strengthening human capital
  - Creating comparative advantage by building specific capabilities
  - Support to local companies
  - Creation of a local demand through regulations and commitments

Business insights

- The private sector owns most technologies and delivers the largest share of TT to developing countries
- Case study and business insights literature contributes to understanding the conditions that enhance private investment
- Two types of literature reviewed:
  - Business organisations providing consensus views to feed international negotiations
  - Case-studies providing the micro-level perspective of barriers and drivers to successful TT

Business definition of TT

- TT as a by-product of day to day commercial operations such as equipment sales, leases, services or procurement contracts, joint ventures, licensing agreements or investments
- Diffusion preferred to Technology transfer
- No distinction between developed and developing countries. Sales, investment and licensing agreements are made if they make economic sense, they provide a strategic fit and involve a level of risk commensurate to the expected returns
- Knowledge provides a competitive advantage and it cannot be shared without a sufficient compensation
- Technology diffusion is not measured, instead operating indicators (installed capacity, annual production) or economic data (investments, revenues, profits) reflect extent of technology diffusion

Enablers of TT

- National level
  - Commercial viability: long-term financial security and cost recovery: eg. India and China energy and transport markets
  - Strong signals through policy support and economic incentive schemes: eg foreign and local wind energy in India and China
  - Adequate institutional frameworks: stable policies, transparent investment regulation, conductive local conditions, IPR protection
  - Absorptive capacity: functioning education system, receptive environment, targeted capacity building
  - Critical mass of human capital
  - Natural resources provision
  - Support to local industries: India and China adapted customs duties. China local content requirements

Enablers of TT (II)

- Company strategies
  - Most success stories in BRIC countries: India and China, possibly not applicable to other DC
  - Absorption of foreign knowledge essential to development of endogenous technologies, mainly through licensing or acquisition of foreign companies, R&D in knowledge hubs, employees training in foreign countries, linkages with local suppliers through local content requirements
  - Local R&D and a base of highly skilled workers are key to leverage foreign knowledge
  - Foreign TT more likely in industries not established in recipient countries
  - Trade-off between license fees and loss of potential markets due to loss of knowledge base: enough competition to provide companies willing to license
  - CDM has only worked when the fundamentals are in place
  - National policies providing strong signals have been more powerful
  - Technical and financial risks one of the major deterrents to implementation of low carbon technologies

Limitations of econometric and case study approaches

- Limited econometric literature on effects of TT on energy and carbon intensity , with non conclusive effects
- More abundant econometric literature on channels of technology transfer (patents, CDM) does not show success of TT on achieving emission reductions
- Limited case study literature on company level strategies to transfer and absorb technologies depending on recipient country circumstances
- Both econometric and case studies tend to focus on success stories of India and China, while further research is needed for no-BRIC countries, that need additional mechanisms to attract foreign technology

Conclusions

- Different understanding of TT by institutional process and the private sector. An end for institutions, a means to grow, earn profit and survive for the private sector.
- Some of the key elements of the UNFCCC view of TT do not longer hold: division of the world in developed and developing countries. The world has changed, while this vision has remain static in the UNFCCC until Copenhagen. This division does not exist in the private sector.
- Need to address the UNFCCC process to the gaps left by the private sector: non-BRIC countries.
- Need to provide appropriate measurement of TT for the NAMA process.
- Strong signals at the national level are required instead of slow multilateral decision processes

Further research

Explore the idea of differentiated approaches to TT at a macro and micro level:

- Macro level: Evolution of political clusters of Parties positions towards TT in the UNFCCC negotiations vs evolution of economic and technological clusters countries since 1992. Does technological development feed into political discourse?
- Micro level: Firm level strategies to acquisiton and transfer of climate change technology transfers depending on developing country characteristics. Trade-off knowledge transfer vs increased income. How is this trade-off different between BRIC and no-BRIC countries?