
Do developing countries depend on European technology for Clean Energy Projects?

An investigation in 497 projects in the Clean development mechanism

Asel Doranova

UNU-MERIT

EXPERT WORKSHOP: Technology transfer and UNFCCC
February 4-5, 2009

Studying technological development in CDM

| | | |
|---------------|---|--------------------------|
| Macro level → | Technology flows and country knowledge base | <i>Project documents</i> |
| Micro level → | Technology providers & recipient interaction | <i>Survey</i> |
| | Technology recipients and absorptive capacities | |

Studying technological development in CDM

| | | |
|---------------|---|--------------------------|
| Macro level → | Technology flows and country knowledge base | <i>Project documents</i> |
| Micro level → | Technology providers & recipient interaction | <i>Survey</i> |
| | Technology recipients and absorptive capacities | |

What is CDM?

UN Framework Convention on Climate Change

Kyoto Protocol
market mechanisms

Emission trading

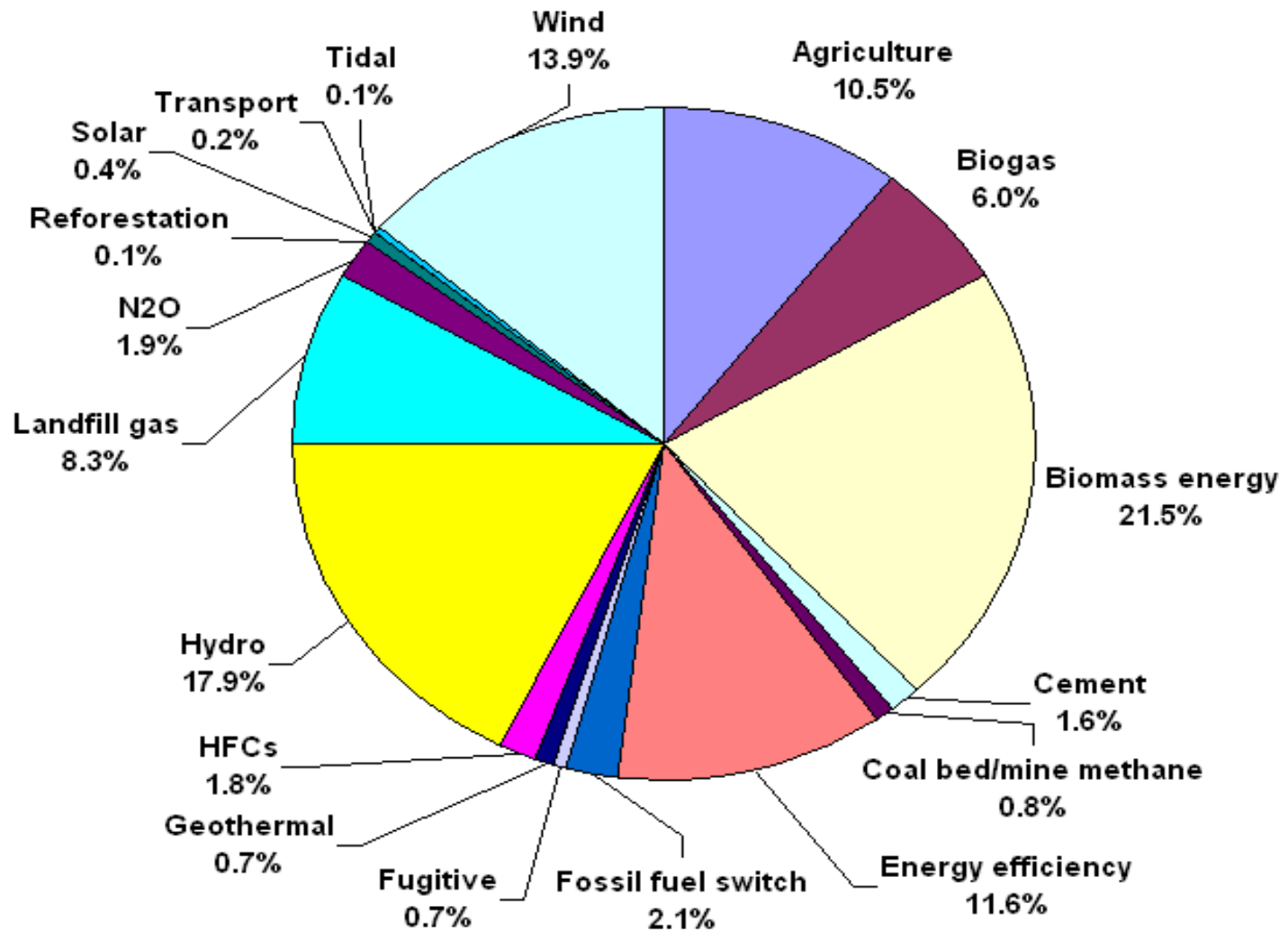
“North-North”

Joint
Implementation (JI)
projects
“North-North”

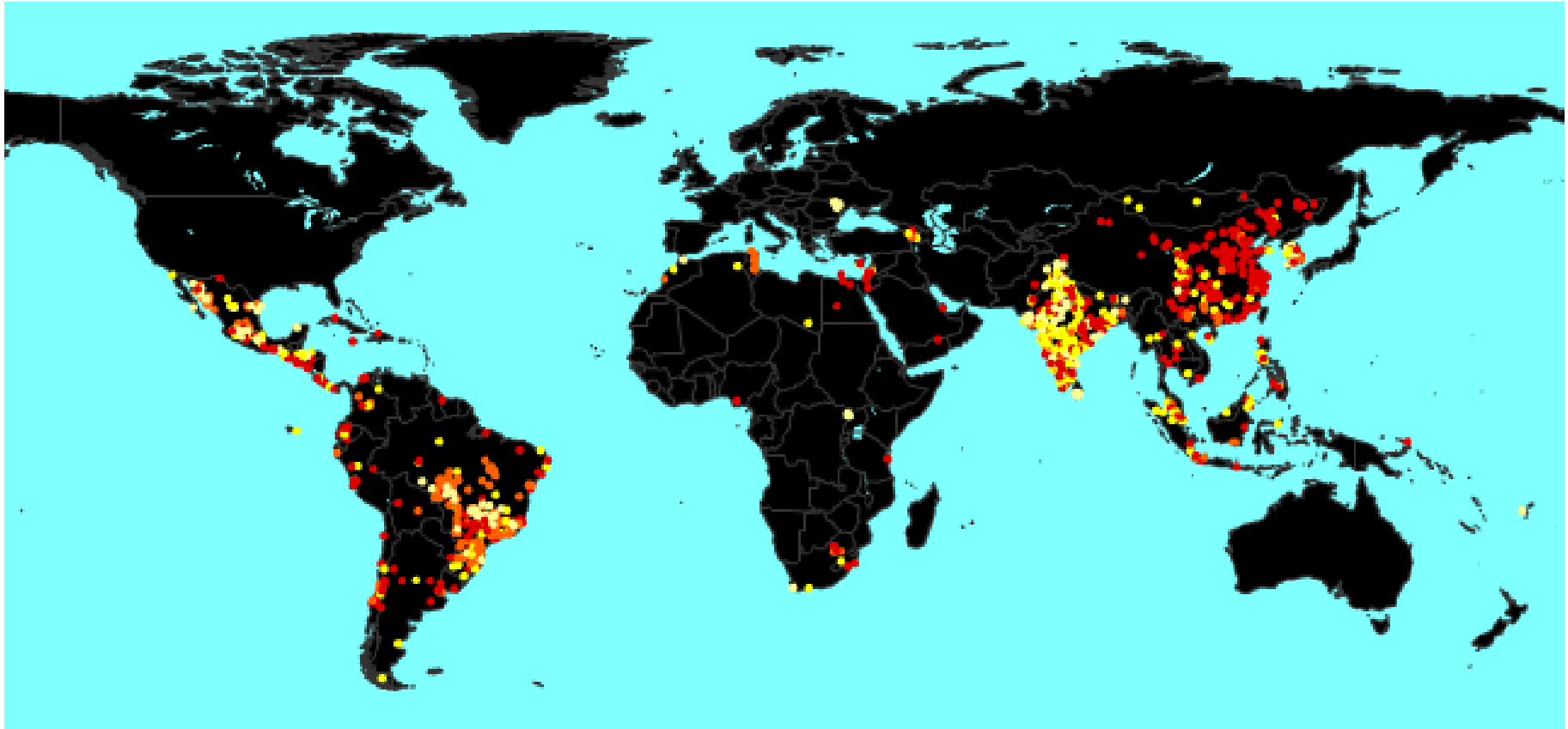
Clean
Development
Mechanism (CDM)
“North-South”

Project based emission crediting & trade

CDM project types



Locations of CDM projects



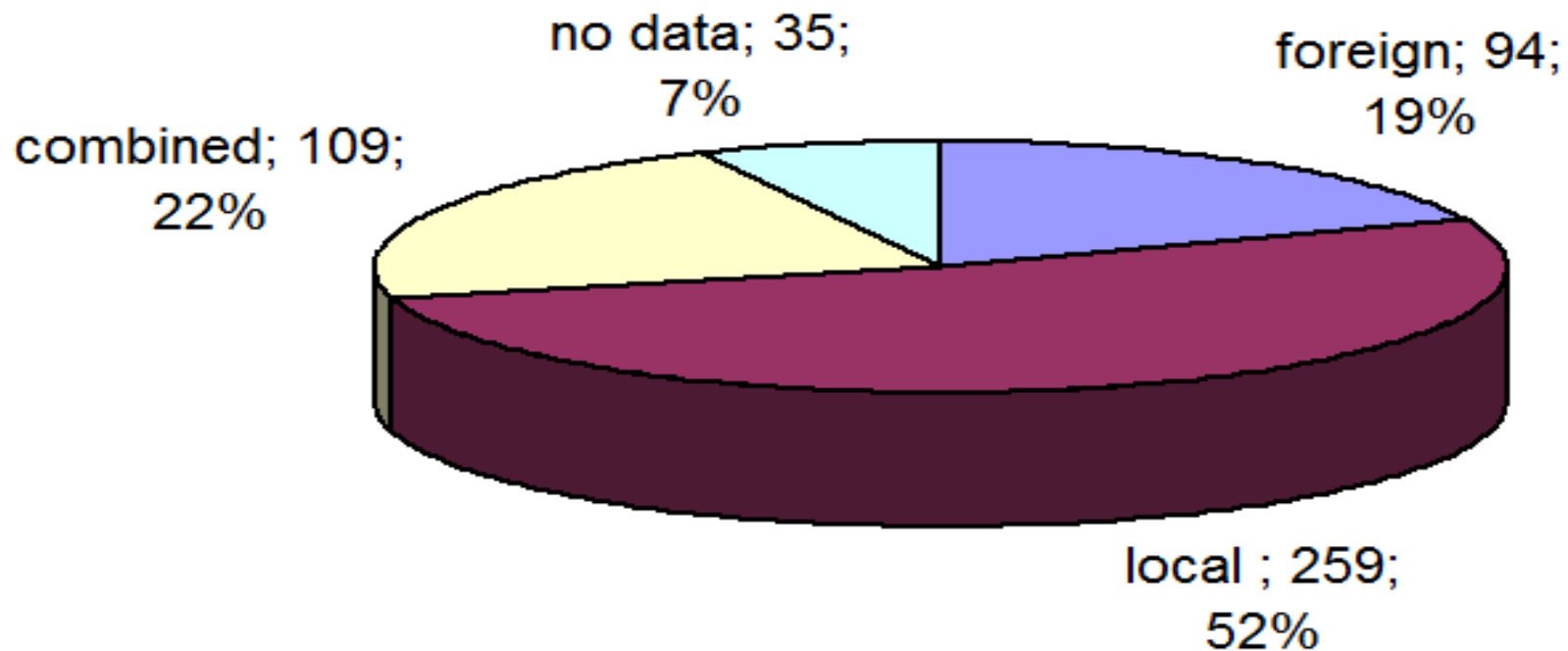
- = CDM project, Large scale, one location
- = CDM project, Large scale, several locations
- = CDM project, Small scale, one location
- = CDM project, Small scale, several locations

Source: UNFCCC
<http://cdm.unfccc.int/>

CDM goals

- Enable **developed countries** to meet their emission reduction commitments in a flexible and cost-effective manner
 - Assists **developing countries** in meeting their sustainable development objectives. They benefit in the form of
 - **investment**
 - **transfer of better & clean technologies**
 - **local sustainable development**
-

CDM statistics: *Technology origin in our sample*
(497 projects)



Technology providers' in CDM projects

| <i>Annex I countries</i> | | <i>Non-Annex / CDM project recipient countries</i> | |
|--------------------------|----|--|-----|
| Australia | 1 | Brazil | 59 |
| Austria | 1 | Chile | 11 |
| Belgium | 5 | China | 13 |
| Canada | 4 | Colombia | 1 |
| Italy | 5 | Ecuador | 2 |
| Japan | 13 | El Salvador | 1 |
| Europe | 1 | Honduras | 1 |
| Denmark | 19 | India | 145 |
| France | 11 | Indonesia | 2 |
| Germany | 21 | Israel | 1 |
| Czech Republic | 2 | Malaysia | 8 |
| Ireland | 41 | Mexico | 27 |
| Netherlands | 10 | Nicaragua | 1 |
| New Zealand | 2 | Pakistan | 1 |
| Russia | 1 | Singapore | 1 |
| Spain | 12 | South Africa | 2 |
| UK | 6 | South Korea | 1 |
| USA | 20 | Taiwan | 5 |
| TOTAL 175 | | TOTAL 282 | |

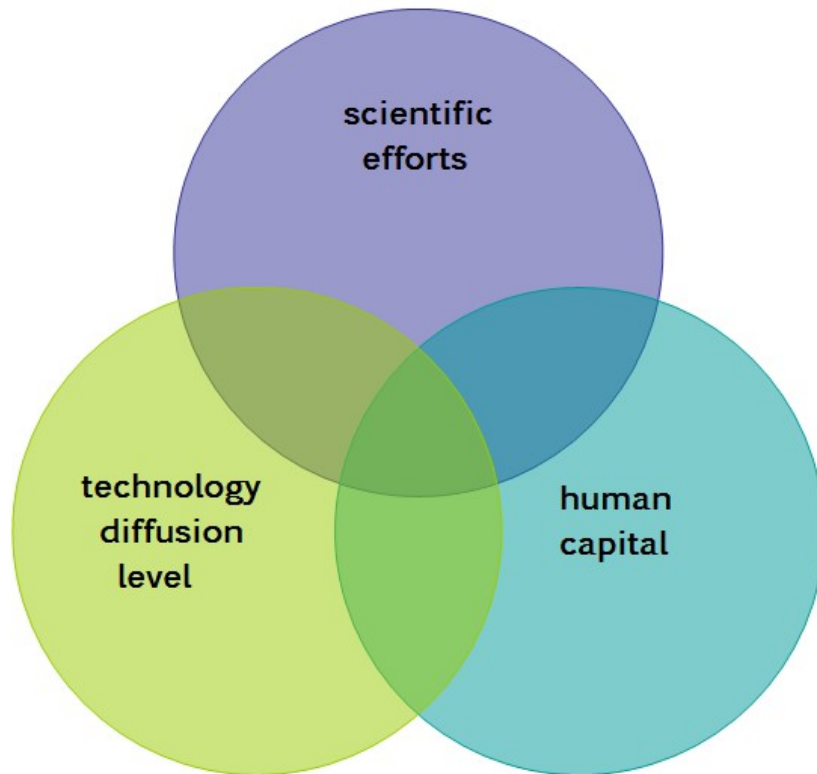
Question:

Does the **technological and knowledge base of a host country** determine the technology sourcing patterns in the CDM projects?

Other studies on CDM and technology transfer

| <i>Authors</i> | <i>Factors studied</i> | <i>Sample size</i> |
|-----------------------------------|---|--------------------|
| <u>De Coninck</u> et al., 2007 | Technology origin country, capacity building, investment costs | 63 |
| <u>Haites</u> et al., 2007 | Country size, GDP, technology type | 860 |
| <u>Pueyo Velasco</u> , 2007 | Carbon intensity, energy resource endowments, FDI flow, climate policy institutions | 938 |
| <u>Seres</u> , 2008 | Technology needs, technological barriers, capital investment | 2293 |
| <u>Dechezlepretre</u> et al. 2008 | Technological capabilities (<u>ArCo</u> index), presence of the buyer, affiliation, size | 644 |

Knowledge base



- # publications in CFT
- # patents in CFT
- renewable energy production
- Export of CFT
- # Graduates in CFT fields(?)

CDM knowledge base: Data

| <i>Constructs for CDM technologies knowledge base</i> | <i>Data and measurements</i> | <i>Source of data</i> |
|---|---|---|
| Diffusion level of climate friendly technologies | <ul style="list-style-type: none">• Share of energy from hydro, wind, solar, geothermal, biomass in total primary energy supply• Share of climate friendly technologies in the flow of total export of goods | International Energy Agency UN Commodity Trade Statistics Database |
| Scientific effort in climate friendly technologies | <ul style="list-style-type: none">• Share of scientific articles in climate friendly technologies in total pool of scientific articles• Number of patents in climate friendly technologies by inventor | Science Citation Index expanded US PTO database |

Technology origin VS knowledge base

top 15 countries

| | Share of project with local technology | Share of projects with combined technology | Share RE in TPES | Share of combustible biomass and waste | # RE_publ/ mln ppl |
|-------------------|--|--|------------------|--|--------------------|
| India | 92% | 6% | 2% | 29% | 1,8 |
| Brazil | 58% | 34% | 14% | 27% | 3,0 |
| Mexico | 38% | 58% | 5% | 5% | 3,3 |
| China | 39% | 4% | 2% | 13% | 1,8 |
| Chile | 79% | 0% | 7% | 16% | 4,7 |
| Malaysia | 8% | 58% | 1% | 5% | 4,9 |
| Honduras | 60% | 0% | 4% | 42% | 0,3 |
| Ecuador | 25% | 0% | 6% | 5% | 0,3 |
| Indonesia | 38% | 0% | 4% | 28% | 0,2 |
| Philippines | 13% | 75% | 21% | 24% | 0,4 |
| Republic of Korea | 14% | 14% | 0% | 1% | 14,1 |
| Argentina | 0% | 0% | 5% | 4% | 4,3 |
| Colombia | 33% | 0% | 12% | 14% | 0,7 |
| Guatemala | 20% | 0% | 3% | 53% | 0,2 |
| South Africa | 20% | 60% | 0% | 11% | 4,1 |

Technology origin VS knowledge base

top 15 countries

| | Share of project with local technology | Share of projects with combined technology | Share RE in TPES | Share of combustible biomass and waste | # RE_publ/mln ppl | |
|-------------------|--|--|------------------|--|-------------------|---|
| India | 92% | 6% | 2% | 29% | 1,8 | ✗ |
| Brazil | 58% | 34% | 14% | 27% | 3,0 | ✗ |
| Mexico | 38% | 58% | 5% | 5% | 3,3 | |
| China | 39% | 4% | 2% | 13% | 1,8 | |
| Chile | 79% | 0% | 7% | 16% | 4,7 | ✗ |
| Malaysia | 8% | 58% | 1% | 5% | 4,9 | ✗ |
| Honduras | 60% | 0% | 4% | 42% | 0,3 | ✗ |
| Ecuador | 25% | 0% | 6% | 5% | 0,3 | |
| Indonesia | 38% | 0% | 4% | 28% | 0,2 | |
| Philippines | 13% | 75% | 21% | 24% | 0,4 | |
| Republic of Korea | 14% | 14% | 0% | 1% | 14,1 | ✗ |
| Argentina | 0% | 0% | 5% | 4% | 4,3 | ✗ |
| Colombia | 33% | 0% | 12% | 14% | 0,7 | |
| Guatemala | 20% | 0% | 3% | 53% | 0,2 | |
| South Africa | 20% | 60% | 0% | 11% | 4,1 | ✗ |

Technology origin VS knowledge base

top 15 countries

| | Share of project with local technology | Share of projects with combined technology | Share RE in TPES | Share of combustible biomass and waste | # RE_publ/ mln ppl | |
|-------------------|--|--|------------------|--|--------------------|---|
| India | 92% | 6% | 2% | 29% | 1,8 | |
| Brazil | 58% | 34% | 14% | 27% | 3,0 | |
| Mexico | 38% | 58% | 5% | 5% | 3,3 | × |
| China | 39% | 4% | 2% | 13% | 1,8 | × |
| Chile | 79% | 0% | 7% | 16% | 4,7 | × |
| Malaysia | 8% | 58% | 1% | 5% | 4,9 | |
| Honduras | 60% | 0% | 4% | 42% | 0,3 | |
| Ecuador | 25% | 0% | 6% | 5% | 0,3 | × |
| Indonesia | 38% | 0% | 4% | 28% | 0,2 | |
| Philippines | 13% | 75% | 21% | 24% | 0,4 | × |
| Republic of Korea | 14% | 14% | 0% | 1% | 14,1 | |
| Argentina | 0% | 0% | 5% | 4% | 4,3 | |
| Colombia | 33% | 0% | 12% | 14% | 0,7 | |
| Guatemala | 20% | 0% | 3% | 53% | 0,2 | × |
| South Africa | 20% | 60% | 0% | 11% | 4,1 | |

Results: Effect of independent variables on choice between different technology origins

Publications

Patents

Export

Renewable
energy

| | | <i>Local over Combined</i> | <i>Local over Imported</i> | <i>Combined over Local</i> | <i>Combined over Imported</i> | <i>Imported Over Local</i> | <i>Imported over Combined</i> |
|----------------------------------|--------------------|------------------------------------|------------------------------------|------------------------------------|---------------------------------------|------------------------------------|---------------------------------------|
| CFT_PUBL <i>SD=0.28</i> | B | 1.561** | 1.722* | -1.561** | 0.162 | -1.722* | -0.162 |
| | e ^b | 4.761 | 5.598 | 0.21 | 1.176 | 0.179 | 0.851 |
| | e ^{bStdX} | 1.538 | 1.609 | 0.65 | 1.046 | 0.622 | 0.956 |
| <u>PAT_dum</u> <i>SD=0.31</i> | B | -2.917*** | -2.287** | 2.917*** | 0.63 | 2.287** | -0.63 |
| | e ^b | 0.054 | 0.102 | 18.488 | 1.877 | 9.848 | 0.533 |
| | e ^{bStdX} | 0.406 | 0.493 | 2.462 | 1.215 | 2.027 | 0.823 |
| CFT_EXP <i>SD=0.82</i> | B | 0.667** | 1.031*** | -0.667** | 0.365 | -1.031*** | -0.365 |
| | e ^b | 1.948 | 2.805 | 0.513 | 1.44 | 0.357 | 0.694 |
| | e ^{bStdX} | 1.734 | 2.344 | 0.577 | 1.352 | 0.427 | 0.74 |
| RE_SHARE <i>SD=5.68</i> | B | 0.009 | 0.05624* | -0.00886 | 0.04738 | -0.05624* | -0.0474 |
| | e ^b | 1.009 | 1.0578 | 0.9912 | 1.0485 | 0.9453 | 0.9537 |
| | e ^{bStdX} | 1.052 | 1.3763 | 0.9509 | 1.3087 | 0.7266 | 0.7641 |

b = raw coefficient

e^b = exp(b) = factor change in odds for unit increase in X

e^{bStdX} = exp(b*SD of X) = change in odds for SD increase in X

Results: Comparison of preferences in technology sourcing across countries

| | <i>1st pref</i> | <i>2nd pref</i> | <i>3rd pref</i> |
|----------------------|----------------------------|----------------------------|----------------------------|
| Publications: | Local | Combined | Foreign |
| Patents: | Combined | Foreign | Local |
| Exports: | Local | Combined | Foreign |
| Ren Energy: | Local | Combined? | Foreign |

Conclusion

RQ: Does the **technological and knowledge base of the host country** determine the technology sourcing patterns in the CDM projects?

Answer:

- *Experience related knowledge* – “yes” with clear preference for local technologies
 - *Scientific knowledge* – rather “yes” with preference for local and combined
-

Implications

- Change in paradigm of North-South technology transfer under Climate change mitigation agenda:
Developing countries not as passive receivers of the technology but as producers, sellers and innovators
 - Consideration of local knowledge in capacity building and technology transfer (different across countries)
 - For national governments - building the technological knowledge base in developing countries as a strategic goal
 - Developing countries need support to build effective innovation system **not** just narrow technology transfer
(ref. E3G)
-

Thank you!
