TECHNOLOGY TRANSFER: PRINCIPLES AND THE SITUATION IN THE ARAB STATES

Water-Energy Nexus Operational Toolkit : Technology Transfer

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Outline

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Technology Transfer Principles

Technology Transfer Pathways

- From the public to the private sector
- From a big firm to a smaller one
- Between universities or countries (e.g., from developed to technologically less developed countries)
- The conversion of research output into products on the market
Technology Transfer Principles

Technology Transfer Pathways

- International trade can be used to import technology.
- FDI can be used through which foreign component manufactures may set up subsidies in the host country.
- Joint ventures can be used in which a local and a foreign companies form a business association through which they would share equity, profits, risks, etc.
- Licensing in which a local company is given IP rights for the technology due to the legal contract it has signed with the foreign company.
## Technology Transfer Principles

### Technology Transfer - Classification

<table>
<thead>
<tr>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Occurs when information is transmitted from basic research to applied research, from applied research to development, and from development to production. Such transfers occur in both directions and the form of the information changes as it moves along this dimension.</td>
<td>• Occurs when technology used in one place, organization, or context is transferred and used in another place, organization, or context.</td>
</tr>
</tbody>
</table>

TT can also be either formal or informal with reference to the channels used.
Technology Transfer Principles

Technology Transfer - Background

Technology transfer is an integral part of increasing innovation in an economy to achieve economic development.

Successful TT requires a certain environment which is only possible with the support and cooperation of local governments.

Depending on the nature of the entities involved, and the particulars of the type of TT, the arrangement can take various forms (e.g., public-private partnerships, joint ventures).

TT projects that fail tend to do so due to barriers and gaps related to economic and institutional factors; rarely does the failure have to do with the specific technology being transferred itself.
Technology Transfer Principles

Successful Technology Transfer - Barriers

- System barriers such as the unavailability of the required infrastructure, public incentives or market.
- Lack of a technological development plan on the part of the receiving country.
- Conflict between countries.
- Limited financial options for the developing countries.
Technology Transfer Principles

The innovation process

Source: Chair of the Expert Group on Technology Transfer, 2009.
Technology Transfer Principles

Supply-push and demand-pull policies in energy innovation

## Technology Transfer Principles

### Criteria used for selection and assessment of options for an integrated TT framework

- Potential for large-scale resource efficiency improvement and RE deployment worldwide
- Relevance and flexibility regarding needs of countries at different development stages
- Effectiveness across sectors and consistency with sectoral strategies
- Ability to mobilize and leverage private investment
- Potential to be self-sustaining and replicated
- Cost-effectiveness
- Ease of implementation
- Effective governance structure to inspire trust and cooperation
- Advancement of use of indigenous technologies
- Sustainability
- Ability to monitor, report and verify

Source: Chair of the Expert Group on Technology Transfer, 2009.
## Technology Transfer Principles

### Types of intervention required to address specific local barriers to TT

- Applied R&D
- Technology accelerators
- Business incubator services
- Enterprise creation
- Early stage funding
- Deployment of existing resource efficient technologies
- Skills and capacity building
- Domestic policy and market insights

Technology Transfer and the Arab Countries
Technology Transfer and the Arab Countries

Currently observed trends

- Greater funding for RE and resource efficiency related businesses and products as well as funding for the environment which supports these new technologies.

- Greater amounts of research being done in local institutions on topics related to RE technologies and resource efficiency which focus on the local situation.

- Greater research funds available to researchers outside the country.

- Being members of IRENA and participating in its initiatives.
Intuitive institutional models in Arab countries

<table>
<thead>
<tr>
<th>Type</th>
<th>Countries</th>
<th>Main Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Gulf model</td>
<td>Gulf countries</td>
<td>Decentralized trade-oriented governance&lt;br&gt;Public universities open to foreign teachers/researchers&lt;br&gt;Research based on international collaborations&lt;br&gt;Foundations for research</td>
</tr>
<tr>
<td>The Middle East model</td>
<td>Syria</td>
<td>Centralized type of governance</td>
</tr>
<tr>
<td></td>
<td>Egypt</td>
<td>Research in large public research centers and universities, as well as in international and private universities.</td>
</tr>
<tr>
<td></td>
<td>Iraq</td>
<td>Large public universities</td>
</tr>
<tr>
<td>The Mashreq model</td>
<td>Lebanon</td>
<td>Decentralized governance</td>
</tr>
<tr>
<td></td>
<td>Jordan</td>
<td>Research concentrated in private universities</td>
</tr>
<tr>
<td>The Maghreb model</td>
<td>Algeria</td>
<td>Centralized governance</td>
</tr>
<tr>
<td></td>
<td>Morocco</td>
<td>Large public universities</td>
</tr>
<tr>
<td></td>
<td>Tunisia</td>
<td>Research mainly in universities and public research institutes</td>
</tr>
</tbody>
</table>

Technology Transfer and the Arab Countries

High-technology exports of the Arab countries

Technology Transfer and the Arab Countries

Patent applications by nonresidents in the Arab countries

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Patent applications by residents in the Arab countries

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Patent applications in OECD and non-OECD countries

Technology Transfer and the Arab Countries

Scientific and technical journal articles published per capita by the Arab countries

12 pillars of competitiveness for the GCC countries

1st pillar: Institutions
2nd pillar: Infrastructure
3rd pillar: Macroeconomic environment
5th pillar: Higher education and training
8th pillar: Financial market development
9th pillar: Technological readiness
10th pillar: Market size
12th pillar: Innovation

Source: Schwab, 2016.
Technology Transfer and the Arab Countries

12 pillars of competitiveness for the non-GCC Arab countries

Source: Schwab, 2016.
## Global Innovation Index values for some Arab countries

<table>
<thead>
<tr>
<th>Country</th>
<th>2016</th>
<th>2017</th>
<th>Net Rank Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ranking</td>
<td>Value</td>
<td>Ranking</td>
</tr>
<tr>
<td>UAE</td>
<td>41</td>
<td>39.4</td>
<td>35</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>49</td>
<td>37.8</td>
<td>55</td>
</tr>
<tr>
<td>Qatar</td>
<td>50</td>
<td>37.5</td>
<td>49</td>
</tr>
<tr>
<td>Bahrain</td>
<td>57</td>
<td>35.5</td>
<td>66</td>
</tr>
<tr>
<td>Kuwait</td>
<td>67</td>
<td>33.6</td>
<td>56</td>
</tr>
<tr>
<td>Lebanon</td>
<td>70</td>
<td>32.7</td>
<td>81</td>
</tr>
<tr>
<td>Morocco</td>
<td>72</td>
<td>32.3</td>
<td>72</td>
</tr>
<tr>
<td>Oman</td>
<td>73</td>
<td>32.2</td>
<td>77</td>
</tr>
<tr>
<td>Tunisia</td>
<td>77</td>
<td>30.6</td>
<td>74</td>
</tr>
<tr>
<td>Jordan</td>
<td>82</td>
<td>30.0</td>
<td>83</td>
</tr>
<tr>
<td>Egypt</td>
<td>107</td>
<td>26.0</td>
<td>105</td>
</tr>
<tr>
<td>Algeria</td>
<td>113</td>
<td>24.5</td>
<td>108</td>
</tr>
<tr>
<td>Yemen</td>
<td>128</td>
<td>14.6</td>
<td>127</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>31.28</td>
<td>31.68</td>
<td></td>
</tr>
</tbody>
</table>

Source: Cornell INSEAD WIPO, 2017.
Key messages

• TT provides a means through which the SDGs can be achieved, particularly:
  o Target 6.4 (increasing water-use efficiency across all sectors)
  o Target 7.3 (doubling the global rate of energy efficiency improvement by 2030)

• There are many options for TT: options for financing TT, different mechanisms for the TT implementation, options for governments with respect to setting policies and regulatory frameworks for an environment supportive of TT.
  o Actual options chosen must be unique for each country.

• There are many ways in which the Arab countries can improve so that they are able to implement more effective and sustainable TT. Examples:
  o Programs can be designed to address the complete TT chain.
  o Requiring large businesses to contribute towards local research funds.
  o More transparency can be adopted throughout the TT process.
  o Collaboration must be facilitated between entities in different countries and within the same country which are working in the same area.
THANK YOU