Bridging the Technology Gap

Short courses for Permanent Missions in Geneva

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Outline

- Introductory remarks: Technology and the “technology gap”
- Global, national and end-user perspectives on technology
- Innovation systems and technology flows

Discussion

11:25 – 11:40 break

- Policy implications: global and national
- Case Studies and Discussion
TECHNOLOGY
AND
THE TECHNOLOGY GAP
Technology = Knowledge
(Knowledge about how to do something)

“Hardware”
Processes
Codified knowledge
Biological material
Human skills, knowledge and experience
The “Technology Gap”

What is it, and why is it important?

Is it getting smaller or bigger?

How is it measured?
Measuring technological development

- Total Factor Productivity
- UNESCO’s Science & Technology statistics
- UNDP’s Technology Achievement Index
- World Economic Forum’s Competitiveness Index
- UNCTAD’s Innovation Capability Index
- OECD's Science, Technology and Industry Scoreboard
- ITU’s ICT Indicators
## UNCTAD’s Innovation Capability Index

**Factors reflected in the UNCTAD Index:**
- R&D personnel/million population;
- U.S. patents granted per million population;
- Scientific publications/million population;
- Literacy rate as % of population;
- Secondary enrolment as % of age group;
- Tertiary enrolment as % of age group

<table>
<thead>
<tr>
<th>Region</th>
<th>1995</th>
<th>2001</th>
</tr>
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<tbody>
<tr>
<td>Developed countries (excl. new EU members)</td>
<td>0.876</td>
<td>0.869</td>
</tr>
<tr>
<td>New EU members</td>
<td>0.655</td>
<td>0.707</td>
</tr>
<tr>
<td>South-East Europe and CIS</td>
<td>0.602</td>
<td>0.584</td>
</tr>
<tr>
<td>South-East and East Asia</td>
<td>0.492</td>
<td>0.518</td>
</tr>
<tr>
<td>West Asia and North Africa</td>
<td>0.348</td>
<td>0.361</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>0.375</td>
<td>0.360</td>
</tr>
<tr>
<td>South Asia</td>
<td>0.223</td>
<td>0.215</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>0.157</td>
<td>0.160</td>
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</tbody>
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Key ICT indicators

Adapted from UNCTAD 2007 Information Economy Report 2007-2008
Mobile phone subscribers

Adapted from UNCTAD 2007 Information Economy Report 2007-2008
Internet use

Adapted from UNCTAD 2007 Information Economy Report 2007-2008
PERSPECTIVES ON TECHNOLOGY
International Perspective

Aim: to facilitate and regulate technology flows

Perspective: International Technology Transfer

- Trade (technology markets)
- Investment (FDI, ODA)
- Intellectual Property Rights (IPR)
- International Standards
- Regulation (safety, security and sustainability)
“End user” perspective

Aim: maintain or improve efficiency and/or effectiveness

Perspective: Technology selection, acquisition and absorption

- Technology selection and acquisition
  - Access to information
  - Existing knowledge needed to select best-fit technology
  - Access to capital

- Absorptive capacity
  - Knowledge, skills and experience to use, maintain, adapt and manage change
  - Linkages: within organizations, with other organizations/institutions

- Innovative capacity (for some end-users)
  - Incremental improvement to acquired technology
  - Imitation: reverse engineering / licensing
  - “Radical” innovation: new product/process development
National Perspectives

Aim: Increase economic growth and improve social welfare

Perspectives:
1. Technology acquisition (international)
2. Technology development and diffusion (national)
# National Perspectives

Aim: to promote economic growth and improve social welfare

<table>
<thead>
<tr>
<th>International:</th>
<th>Domestic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Acquisition</td>
<td>Technology development and diffusion</td>
</tr>
<tr>
<td>FDI</td>
<td>Human resource capacity</td>
</tr>
<tr>
<td>Licensing</td>
<td>Stimulate/support innovative capacity</td>
</tr>
<tr>
<td>Trade</td>
<td>IPR protection</td>
</tr>
<tr>
<td>Skills migration</td>
<td>Competition policy</td>
</tr>
<tr>
<td>R&amp;D collaboration</td>
<td>Public sector R&amp;D</td>
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<tr>
<td></td>
<td>Extension services</td>
</tr>
<tr>
<td></td>
<td>etc.</td>
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</tbody>
</table>

**UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT**
INNOVATION SYSTEMS
AND
TECHNOLOGY FLOWS
Linear (“science push”) model

Inputs

Research

Technology development

Innovation

Socio-economic benefit
“Chain link” model

Non-technical factors (e.g. market research, customer feedback, organizational improvements)

Research → Technology development → Innovation → Socio-economic benefit

Wide range of other socio-economic factors

Adapted from Martin & Tang 2007
National Innovation Systems (NIS)

*various definitions*

- **Network** of public and private institutions whose activities and interactions initiate, import, modify and diffuse new technologies. (Freeman, 1987)

- **Elements and relationships** which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state. (Lundvall, 1992)

- **Set of institutions** whose interactions determine the innovative performance ... of national firms. (Nelson, 1993)

- **National institutions, their incentive structures** and their **competencies**, that determine the rate and direction of **technological learning** in a country. (Patel and Pavitt, 1994)
National Innovation System: schematic

Adapted from Arnold & Bell (2001), cited in UNCTAD (2007)
The “core” of an innovation system

Demand

Consumers (final demand)  Producers (intermediate demand)

Business system
- Companies
- Farms
- Healthcare, etc

Intermediate Organizations
- Research institutes
- Brokers, etc

Education and research system
- Professional education and training
- Higher education and research
- Public sector research
Data from country study: Diffusion of results from public sector R&D

- National conferences: 85%
- Academic journals: 90%
- Ministries/extension services: 60%
- Donors: 70%
- Formal research networks: 30%
- In-house business units: 20%
- Mass media: 15%
- Industry: 20%
- Direct to farmers: 5%
- Trade fairs: 5%
- International conferences: 5%
- NGOs: 5%
- IPR applications: 5%

BDP database 2003
Data from country study: R&D projects in agriculture & health by type/objective

![Bar chart](BDP database 2003)
Data from country study:
Firms’ sources of new knowledge

Overall
Innovating
Non-innovating

% of firms

other firms
trade journals, fairs
public sector science
extension services
internet

BDP database 2003
Policy example: a national ICT strategy

**Framework conditions**
- accessible tariff system
- dissemination of an information culture

**Demand**
- Procurement of ICTs in government and other public sector institutions
- Establish community centres for telecommunications
- Public information strategy

**Business system**
- Import and produce equipment
- Create a software industry

**Education and research systems**
- Dissemination of information culture
- Qualifications and knowledge acquisition

**Intermediate Organizations**

**Infrastructure**
- creation of supporting institutional instruments
- seek and obtain up to date information on IPR issues
- Regulation and certification of products
POLICY IMPLICATIONS
Implications for international policy

- Need to understand 'cause and effect' in technology flows
- Complex and differentiated systems of innovation
- On-going efforts include:
  - CSTD
  - WSIS follow-up and an on-going forum for debate and exchange of experiences
  - UNCTAD
    - Science, Technology and Innovation Policy (STIP) Reviews
    - ICT Policy Reviews
  - UNESCO
    - Science & Technology Policy Reviews for Africa
  - OECD
    - Innovation Policy Reviews
Implications for national policy

- Range of policies to facilitate inward technology transfer
- Policies to build an enabling environment for both absorption and development of technology
  - Develop policy mechanisms to support and stimulate innovation at the domestic level
    - Procurement
    - Regulation
    - Direct support for R&D (e.g. grant funding)
    - Indirect support for R&D (e.g. tax credits)
### Key policy areas in an innovation system

<table>
<thead>
<tr>
<th>Trade</th>
<th>R&amp;D</th>
<th>Energy</th>
<th>Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPRs</td>
<td>Education</td>
<td>Standards</td>
<td>Competition</td>
</tr>
<tr>
<td>Industry</td>
<td>Agriculture</td>
<td>Health</td>
<td>Environment</td>
</tr>
</tbody>
</table>
Science, technology & innovation policy at the heart of development strategy
Case Studies and Discussion

- What can be learnt from the development of ICT policies for other technology policies?
- What is the role of public sector R&D?
- What policy mechanisms have been successful in stimulating innovative activities in more and less developed countries?
- AND ANY OTHER TOPICS OF COMMON INTEREST
Thank you for your participation.