...a new era of international affairs?

...and about human development through science?

...which new factors for development and growth at local and global scales?

...which impact for public policies?

Manuel Heitor
Center for Innovation, Technology and Policy Research, IN+/IST
Portugal
A Primeira Missa no Brasil, Victor Meireles, 1860
Museu Nacional de Belas Artes (Rio de Janeiro, RJ)
a few recent initiatives...
UNESCO’s initiative, together with CNPq, CPLP, Camoes, IP and other partners to develop an interactive platform for the science, Technology and innovation systems of countries with Portuguese as official language to promote scientific collaboration and for a better assessment and update of their national regional and global performance.
Brazil: Co-publication patterns (1973-2011)

Source: GO→SPIN-UNESCO (2012)
Mozambique: Co-publication patterns (1973-2011)

Source: GO→SPIN-UNESCO (2012)
The **idea**: new (distributed) Centre institutionally linked to CPLP (The International Organization of all Portuguese-Speaking Countries), providing the steering of doctoral and post-doctoral programmes designed to reducing brain drain and fostering sustainable scientific international cooperation.

**The context**: recently approved by UNESCO, 2012

**Operation**: The secretariat of the new UNESCO Centre will be located in Lisbon. Its is expected that the Centre activity will rely mostly on the scientific and technological capacities of Brazil and Portugal, and that it will impact scientific development and capacity building in Angola and Mozambique as well as in Cape-Vert, Guinea (Bissau), S. Tome and Principe, and East-Timor.

**The Progress**: 40 PhD grants approved in 2012, funded by FCT (Portugal)
...but, a “long-lasting” trend: “Early drop-out” and/or “brain drain” from developing and emerging regions”
% of international Students

### Mobility patterns of foreign and international students (2010)

*Regional and cross-border mobility, balance on mobility and use of the official language of the host country in countries of origin*

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of national tertiary students enrolled abroad</th>
<th>Number of foreign students per national student abroad</th>
<th>Percentage of foreign students coming from neighbouring countries</th>
<th>Percentage of students from countries with the same official language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.3</td>
<td>20.6</td>
<td>33.6</td>
<td>20.3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.7</td>
<td>15.1</td>
<td>14.0</td>
<td>35.8</td>
</tr>
<tr>
<td>United States</td>
<td>0.3</td>
<td>12.0</td>
<td>7.0</td>
<td>28.6</td>
</tr>
<tr>
<td>Portugal</td>
<td>5.6</td>
<td>0.9</td>
<td>5.7</td>
<td>68.5</td>
</tr>
<tr>
<td><strong>OECD total</strong></td>
<td><strong>2.0</strong></td>
<td><strong>2.9</strong></td>
<td><strong>20.7</strong></td>
<td><strong>26.1</strong></td>
</tr>
<tr>
<td><strong>EU21 total</strong></td>
<td><strong>3.6</strong></td>
<td><strong>2.7</strong></td>
<td><strong>23.4</strong></td>
<td><strong>27.3</strong></td>
</tr>
<tr>
<td>Brazil</td>
<td>0.5</td>
<td>0.4</td>
<td>23.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.8</td>
<td>0.1</td>
<td>88.1</td>
<td>41.5</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>0.8</td>
<td>2.3</td>
<td>60.6</td>
<td>37.5</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>5.0</td>
<td>0.7</td>
<td>9.9</td>
<td>12.5</td>
</tr>
<tr>
<td>South Africa</td>
<td>1.3</td>
<td>5.1</td>
<td>55.4</td>
<td>60.6</td>
</tr>
</tbody>
</table>
Justifying student outbond flows...

1. Constrained-domestic schooling: students leave the education system because of lack of study opportunities and overall poverty levels.

2. Migration-for-employment: students leave to obtain higher wages abroad after they complete their studies
1. Constrained-domestic schooling: Large differences in societal engagement!

Ratio of total students enrolled at Tertiary Education by 20-29 year-old population (2004)

Source: OECD and Eurostat (w/ approximations of population)
East Asia/Pacific region has more enrolled tertiary students than N. America/Europe. Numbers are lowest in C. Asia, sub-Saharan Africa and Arab countries.
2. Migration-for-employment:
Trends in students enrolled outside their country of citizenship

This figure shows the growth of foreign tertiary student enrolment, by regional grouping, over the past nine years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Worldwide</th>
<th>In OECD</th>
<th>G20</th>
<th>Europe</th>
<th>North America</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>500,000</td>
<td>400,000</td>
<td>300,000</td>
<td>200,000</td>
<td>100,000</td>
</tr>
<tr>
<td>2001</td>
<td>550,000</td>
<td>450,000</td>
<td>350,000</td>
<td>250,000</td>
<td>125,000</td>
</tr>
<tr>
<td>2002</td>
<td>600,000</td>
<td>500,000</td>
<td>400,000</td>
<td>300,000</td>
<td>150,000</td>
</tr>
<tr>
<td>2003</td>
<td>650,000</td>
<td>550,000</td>
<td>450,000</td>
<td>350,000</td>
<td>175,000</td>
</tr>
<tr>
<td>2004</td>
<td>700,000</td>
<td>600,000</td>
<td>500,000</td>
<td>400,000</td>
<td>200,000</td>
</tr>
<tr>
<td>2005</td>
<td>750,000</td>
<td>650,000</td>
<td>550,000</td>
<td>450,000</td>
<td>225,000</td>
</tr>
<tr>
<td>2006</td>
<td>800,000</td>
<td>700,000</td>
<td>600,000</td>
<td>500,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2007</td>
<td>850,000</td>
<td>750,000</td>
<td>650,000</td>
<td>550,000</td>
<td>275,000</td>
</tr>
<tr>
<td>2008</td>
<td>900,000</td>
<td>800,000</td>
<td>700,000</td>
<td>600,000</td>
<td>300,000</td>
</tr>
<tr>
<td>2009</td>
<td>950,000</td>
<td>850,000</td>
<td>750,000</td>
<td>650,000</td>
<td>325,000</td>
</tr>
</tbody>
</table>

Regional origins of international students

Students studying abroad come from Asia (52%), followed by Europe (23%) and Africa (11.5%).

The USA, UK, Australia, Germany, France, Canada, Russia, and Japan had the largest numbers of global students in 2010.

- United States¹ 16.6%
- United Kingdom¹ 13%
- Australia¹, ³ 6.6%
- Germany 6.4%
- France 6.3%
- Canada² 4.7%
- Japan 3.4%
- Russian Federation 3.9%
- Other OECD countries 6.4%
- Other non-OECD countries 15.5%

[1] Data relate to international students defined on the basis of their country of residence.
[3] Student stocks are derived from different sources; therefore, results should be interpreted with some caution.

Trends in share of all international students: 2000-2009

This figure shows the share of all foreign tertiary students taken by each of the major study destinations, and how that share has changed. Most notably, almost a quarter of all foreign students went to the United States in 2000, but this has since fallen to less than a fifth.
Stay rate of international students (2009)

This figure shows the percentage of international students who decide to change their student status and legally remain in their country of study. In many cases, countries with higher rates have immigration policies that encourage the temporary or permanent immigration of international students.

...but, lack of data and systematic analysis for international flows of skilled labor force and researchers!
...and a great challenge for **public policy** (and science and innovation policies):

**Portugal:**

a case study of policies oriented towards attracting skilled human resources!
Some data: New PhDs by 10,000 labor force

Fontes: NSF/NIH/USED/USDA/NEH/NASA, 2008 Survey of Earned Doctorates; Eurostat; GPEARI/MCTES
Doctoral degrees concluded in Portugal and abroad for 1970-2010, and percentage of those obtained from the four oldest universities in Portugal (Porto, Coimbra, Lisbon and Technical of Lisbon)
Ratio of PhDs obtained abroad in relation to PhDs obtained in Portugal, by quinquenium, 1970-2010

- Ratio of PhDs obtained abroad vs obtained in Portugal
- FCT Direct PhD fellowships - periods spent in Portugal and abroad
Science policy in Portugal: time evolution...
### Portugal: total PhDs (1970-2009)

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorates working in R&amp;D activities in Portugal (2009)</td>
<td>12,277</td>
</tr>
<tr>
<td>Doctorates working in non-related R&amp;D activities in Portugal, or in other situations</td>
<td>988</td>
</tr>
<tr>
<td>Doctorates working abroad (2009)</td>
<td>521</td>
</tr>
<tr>
<td>Doctorates with non-identified professional situation</td>
<td>361</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorates working in R&amp;D activities in Portugal (2009) Portuguese nationality</td>
<td>3,491</td>
</tr>
<tr>
<td>Doctorates working in R&amp;D activities in Portugal (2009) Foreign nationality</td>
<td>313</td>
</tr>
<tr>
<td>Doctorates working in non-related R&amp;D activities in Portugal, or in other situations</td>
<td>555</td>
</tr>
<tr>
<td>Doctorates working abroad (2009)</td>
<td>148</td>
</tr>
<tr>
<td>Doctorates with non-identified professional situation</td>
<td>293</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorates working in R&amp;D activities in Portugal (2009) Foreign nationality</td>
<td>1,523</td>
</tr>
<tr>
<td>Doctorates with foreign nationality working in non-related R&amp;D activities in Portugal (2009)</td>
<td>313</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorates who obtained or registered their degree in Portugal and are working abroad</td>
<td>669</td>
</tr>
</tbody>
</table>
Main findings:

• Public investment in science associated to policies facilitating the co-evolution of human capital formation and institutional capacity building can lead to a situation of brain gain.

• In the specific case of Portugal, it took almost four decades to achieve reasonable international levels of investment in science and technology and to overcome a situation of continuous lagging behind the international scene.

• This is shown to be associated with patterns of relatively sluggish or fluctuating investments in R&D for many years, reaching unprecedented levels of development only after 2008.

• Other regions worldwide may accelerate this process, if adequate policy measures are systematically taken to facilitate the co-evolution identified in this paper.

• In the case of Portugal, the number of researchers grew with relatively low levels of R&D funding per researcher, but at a level attractive enough to foster brain-gain.
...diasporas:

other great challenges for public policy
(and science and innovation policies)
Profiting from the “Diasporas” abroad...

Switzerland:
• Swissnex - Switzerland’s Knowledge Network
• GIAN - The Geneva International Academic Network

Germany:
• GAIN – German Academic International Network

Canada:
• ISTP Canada – Intl. S & T Partnerships Canada Inc.

Portugal:
• PAPS; ParsUK (Doctoral and post-doctoral networks)

…building “Knowledge Networks” between research students and scientists abroad and national R&D institutions and industry
...but, how to frame related public policies in emerging countries (and science and innovation policies)?

“endogenous development with knowledge”, avoiding brain drain from developing and emerging regions AND attracting skilled human resources for those regions!
Is there room for a **common vision** of the future of S,T&I?

Such a future would require to:

- Multiply **global R&D and HE networks**
- Better understanding of “**policy mix**”:
  - Exploration **and** exploitation
  - Extended BERD **across** small, medium and large companies
  - The key role of **local** productive arrangements for global markets
- Develop **international R&D organisations** and programmes
- Invent jointly **new economic drivers**
- Diversify and combine **funding sources**
- Promote the transatlantic **debate for new research agendas**
A potential idea for policy action and policy research:

Looking at government-industry-higher education relationships in a new era of international affairs
Formal mechanisms for Industry-Science Relationships: *the tip of an iceberg*

<table>
<thead>
<tr>
<th>Government policy</th>
<th>Support schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Framework conditions</strong></td>
<td><strong>Support schemes</strong></td>
</tr>
<tr>
<td>Specific regulations (e.g. IPRs)</td>
<td>Financial incentives to co-operative research (e.g. Framework Programme in the EU)</td>
</tr>
<tr>
<td>Education policy</td>
<td>Co-operative Research Centres (e.g. CRCs in Australia)</td>
</tr>
<tr>
<td>Labour market policy</td>
<td>Public seed capital funds (e.g. I-Source in France)</td>
</tr>
<tr>
<td>Public procurement</td>
<td>Publicly funded intermediaries (e.g. Fraunhofer in Germany)</td>
</tr>
<tr>
<td>Financial policies</td>
<td>Thematic research networks (e.g. RNRT in France)</td>
</tr>
<tr>
<td>Regional and urban planning policies</td>
<td>Promotion of researchers' mobility (e.g. TCS in the United Kingdom)</td>
</tr>
</tbody>
</table>

- **Joint labs**
- **Spin-offs**
- **Licensing**
- **Research contracts**
- **Mobility of researchers**
- **Co-publications**
- **Conferences, expos & specialised media**
- **Informal contacts within professional networks**
- **Flow of graduates to industry**
THE DYNAMICS OF THE KNOWLEDGE-BASED ECONOMY

Technological Change

- Codified knowledge easier to use and manipulate (IT)
- Codified knowledge easier to divulge (telecommunications)

Globalization and innovation of markets

Intensification of competition and acceleration of the process of diffusion of technology

Reduction in costs of communication, promoting the globalization of production and of financial markets
Can it foster new factors for development and growth at local and global scales?

Government-industry-higher education relationships in a new era of international affairs:

Internationalizing Higher Education
Students enrolled outside their home country: long term growth

Data on foreign enrolment worldwide comes from both the OECD and the UNESCO Institute for Statistics (UIS). UIS provided the data on all countries for 1975-95 and most of the non-OECD countries for 2000, 2005 and 2009. The OECD provided the data on OECD countries and the other non-OECD economies in 2000 and 2009. Both sources use similar definitions, thus making their combination possible. Missing data were imputed with the closest data reports to ensure that breaks in data coverage do not result in breaks in time series.

StatLink ➝ http://dx.doi.org/10.1787/888932461617
...a new hypothesis:

The “organized” internationalization of universities should be understood as a key element in a new era of international affairs, as driven by political and economic objectives, but:

• It considers activities that are fundamentally different from the traditional role of universities, involving, most of the times, capacity building and institution building.

• It act as a new narrative in university-government-industry relationships and claims for the need of national policies to go beyond “national systems of innovation”.

• It does not seem to be a hostage of traditional forms of services’ international commerce, deriving its uniqueness from the very nature of the academic communities.
Sino-Danish Center for Education and Research (Beijing)

The Sino-Danish Center will be located at GUCAS’ Yanqihu Campus. The Sino-Danish Center will be fully operational in March 2013. It will accommodate 100 researchers from both countries. Moreover, the Center will offer high quality master programmes to 300 master students as well as PhD training programmes to 75 PhD students.
British University of Dubai (BUiD)

Established in 2004 to facilitate access to world-class education, training and research in the Middle East. It is the Middle East region’s first, research-based, postgraduate university.

It is organized around specialized Institutes, each linked to a leading UK partner university. Each Institute offers a discipline based on their excellence in research and teaching:

- **University of Edinburgh**
  - Faculty of Engineering and IT (MSc Informatics (Knowledge and Data Management) and MSc in IT Management)

- **Cardiff University**
  - Faculty of Engineering and IT (MSc in the Sustainable Design of the Built Environment and MSc in Intelligent Buildings Design and Automation)

- **King’s College London**
  - Faculty of Business (MSc in Construction Law and Dispute Resolution)
Songdo Global Univ. Campus, South Korea

Aims to have 10 different foreign universities operate on a single campus. It is under construction on land reclaimed from the Yellow Sea in the Incheon Free Economic Zone.

Participating foreign universities have each received a $1 million planning grant to study the feasibility of opening a campus in Songdo, and generous subsidies to support a campus in its first five years of operation.

The State University of New York at Stony Brook was the first – and so far only – university to move in. Stony Brook's Songdo location began operating in March 2012 with an enrollment of 35 students in four master's and Ph.D. programs in two fields - computer science and technology.

George Mason University's Board of Visitors has authorized the university to move forward in establishing a campus in October 2012. This will be the Virginia university's second attempt to establish an overseas branch: its first, in the United Arab Emirates, ended in failure.

The university devoted three years to developing a degree-granting campus in the Ras Al-Khaimah province only to withdraw in 2009 due to slow enrollment growth, funding difficulties, and disagreements with the U.A.E. government body that was financing the campus.

Other universities that are moving ahead with planned campuses in Songdo are Ghent University, in Belgium, and the University of Utah (conducted a feasibility study).
MIT – Portugal joint venture
Carla Pepe

**Position:** Technical Assistant - Director of Engineering & Technology at Rolls Royce, UK

MIT Portugal: Graduate of Leaders for Technical Industries PhD

**PhD thesis:** A framework to analyze and improve engineering processes

**Background**
MSc in Engineering Design, IST, Technical University of Lisbon

**Internship** as part of her PhD work at Rolls Royce

**Hired by Rolls Royce** as Design System Technologist and Lean Sigma Black Belt Trainee

**Research**
Lean design in product development, complex design processes
Daniela Couto

**Position:** CEO and co-founder of Cell2b, biotechnology start up

MIT Portugal: Graduate of Bioengineering Systems PhD
PhD Thesis: Emergence of Tissue Engineering and Disruption of Product Development in Healthcare

**Background**
MSc in Biomedical Engineering, University of Minho

**Stay at MIT:** 18 months

**Research:** Technological Innovation, Tissue engineering and regenerative medicine
Carlos Silva

Position: Assistant Professor at IST, Technical University of Lisbon
MIT Portugal: Director of Executive Masters in Sustainable Energy Systems
Teaches in the Sustainable Energy Systems PhD

Background
Industry: Siemens CT – R&D department in Münich
PhD in Mechanical Engineering, Operations Research, Technical University of Lisbon

Research
Sustainable Energy Systems: energy planning (GreenIslands Project, Azores) and energy efficiency.

Stay at MIT (Program Teach the teachers): 2 months

Entrepreneurial activity: Co-founder of Watt-IS – energy efficiency spinn-off

National coordinator for international joint doctoral programs
- Select + PhD Program Erasmus-Mundus
- EIT-KIC InnoEnergy PhD – Sustainable Energy Systems for Renewables
The “Green Islands” test bed
Renewables Integration

Hourly dynamics of supply and demand in energy systems planning tools

Grid management for large renewable penetration

Fig. 1. Electricity demand variation in São Miguel

Fig. 2. Integrated modeling framework

Fig. 3. Electricity production scenario using TIMES

Fig. 4. Electricity production scenario using the developed framework

Fig. 2. Voltages drops after short circuit simulation

Fault Ride Through capability:

Simulation results:

Fig. 1. Short circuit simulation with the loss of large wind power generation

Fig. 3. Short circuit simulation without the loss of wind power generation

Fig. 4. Voltages drops after short circuit simulation
Electric Vehicles

Economic and environmental impact of EV in Electric Systems

Impact of V2G in grid operation

Fig. 1. Technical management and market operation framework for EV integration into electric power systems.

Fig. 2. Markov chain to simulate the drivers' behaviour.

Fig. 3. Load diagram for a scenario with 50% of EV.

Fig. 4. Losses absolute (bars), referred to the left vertical axis, and their value relative to the overall energy consumption (crosses), referred to the right vertical axis.
Buildings Retrofit

Multi-objective optimization of retrofit strategies

Energy Efficient Retrofit in Lisbon

Nuno Clímaco

2 of the 6 typology monitored buildings

• Results
  (Point II. and IV.)
  Not just energy savings (40%) but also the improvement of coupled comfort, air quality and health dynamics.
Buildings Design

Decentralized Energy Production for sustainable built environment

Design of Carbon Neutral Buildings

Maria Kapsalaki
Energy as a Service - DSM

Locally automated control of residential energy use

Demand response in residential sector

Daniel Livengood

Joana Abreu
The local context embeds a set of social and technical challenges that stimulates systems thinking and promotes new learning practices...
MIT – Portugal: main challenges

• Continuous improvements in the patterns of teaching and learning:
  - Introduce forms of “design thinking”.
  - Promote “systems thinking”.
  - Establish routines of entrepreneurial culture.
  - Strengthen “test beds” for collaborative research:
    - “Green Island”, at Azores, leading to new approaches for islands worldwide.
    - New therapies in regenerative medicine, involving hospitals.
    - Urban metabolism, fostering comparative urban studies at international level.
    - “Foz Tua”: revising regional development in a remote and isolated area.
• Promote modern industrial strategies and policies:
  - New industrialization patterns.
  - New therapies, leading to bio-industries.
An evolving experiment: institutional partnerships

1950: Institute of Aeronautic Technologies (ITA, Brazil) - MIT

1963: Harvard Business School IESE Business School (University of Navarra)


1998: The Singapore - MIT Alliance

1999: The Cambridge - MIT Institute (CMI)

2000: Malaysia - MIT Biotechnology Partnership Programme

2002: CMU, Carnegie Mellon - Athens Information Networking Institute

2005: MIT - Zaragoza – International Logistics Program


2006: MIT - Portugal Program – Engineering Systems

    CMU - Portugal Program – Information and Communication Technologies Institute

    UT Austin – Portugal Program – CoLab on Emerging Technologies

    Harvard Medical School – Portugal – translational research and Information
## International Consortia: *typologies*

<table>
<thead>
<tr>
<th>Main focus</th>
<th>Sample example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of campuses abroad</td>
<td>Sino-Danish Center for Education &amp; Research, Beijing</td>
</tr>
<tr>
<td></td>
<td>European University Centre at Peking University</td>
</tr>
<tr>
<td></td>
<td>Songdo Global University, South Korea</td>
</tr>
<tr>
<td>Collaboration in the creation of a new university and</td>
<td>Singapore University of Technology and Design (SUTD, with MIT)</td>
</tr>
<tr>
<td>campus</td>
<td>Masdar Institute of Science and Technology (with MIT)</td>
</tr>
<tr>
<td></td>
<td>Skolkovo Institute of Science and Technology (Skolkovo Tech with MIT)</td>
</tr>
<tr>
<td>Research collaboration and offering of degrees in</td>
<td>British University of Dubai</td>
</tr>
<tr>
<td>association</td>
<td>Utrecht Network</td>
</tr>
<tr>
<td></td>
<td>Portugal-US universities (MIT; Harvard Med. School, Carnegie Mellon; Univ. Texas Austin)</td>
</tr>
<tr>
<td>Collaboration and mobility in R&amp;D programs</td>
<td>IARU Alliance</td>
</tr>
<tr>
<td></td>
<td>Worldwide Universities Network</td>
</tr>
<tr>
<td></td>
<td>Matariki Network of Universities</td>
</tr>
<tr>
<td></td>
<td>British Universities Iraq Consortium</td>
</tr>
<tr>
<td>Bilateral agreements among institutions – joint degrees</td>
<td>Cluster</td>
</tr>
<tr>
<td></td>
<td>Universitas 21</td>
</tr>
<tr>
<td></td>
<td>IDEA League</td>
</tr>
<tr>
<td>Collaboration oriented towards technology commercialization</td>
<td>University Technology Enterprise Network, UTEN - Portugal</td>
</tr>
<tr>
<td></td>
<td>Skolkovo Institute of Science and Technology (Skolkovo Tech with MIT)</td>
</tr>
</tbody>
</table>
# Intl. Consortia: *necessary conditions*

<table>
<thead>
<tr>
<th>Major objectives and policy instruments</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Train, attract and co-hire researchers, fostering their exchange and the training of a teaching body | • Sustain excellence and internationalization in doctoral programmes  
• Foster and systematize the hiring of researchers with PhDs |
| **Institutions**                        |               |
| Reinforce and promote the role of scientific institutions in society, and their links with the private sector (promoting R&D in business enterprises) | • Reinforce institutional evaluation mechanisms, in order to improve systemic and organizational efficiencies  
• Adopt policies that foster the creation of critical mass, including policies oriented towards fostering R&D consortia. Promote the training of a new generation of technicians and other human resources to support R&D activities |
| **Test beds and thematic R&D networks** |               |
| Facilitate the integration of researchers and scientific institutions in international networks focused on “test beds”, as living laboratories for the production and dissemination of knowledge with local relevance and facilitating ideas for markets worldwide | • Reinforce international partnerships and foster participation in international knowledge-based networks as a way to improve scientific quality and the employability of researchers  
• Foster S&T thematic networks in terms of test beds and living laboratories that can boost companies’ capacity to export and access emerging markets. |
Argument -1:

a new narrative in the relation between universities, governments and industry is emerging based on three interrelated themes:

• Beyond “national systems of innovation”

• The complexity of an increasingly dynamic and globally distributed geography of innovation

• The emerging perception of the “academic divide” at world level
Trends in the share of R&D expenditure under foreign control business sector

1. Consists of the Czech Republic, Finland, Hungary, Ireland, Poland, the Netherlands and Sweden.

The new paradigms in international academic cooperation consider the affiliation of private companies to academic and research programs, which can be used to foster the access of those companies to new markets and skills, contributing to economic development.
It was incorporated with the primary objective of strengthening Canada's science and technology, business-to-business relations and ultimately overall economic, trade and political relations.

It provides networking opportunities and funding to support Canadian participation in collaborative research projects with counterparts globally, starting with China and India.

Emphasis is placed on research projects with the potential for commercial application.
UTEN: University Technology Enterprise Network

- A network of +/- 30 technology transfer offices, across Portuguese Universities and R&D Centres, together with the University of Texas at Austin;
- Aimed to create and foster a "body of knowledge" in international technology transfer and commercialization;
- 3 main activities:
  - People: "On-job" training of experts, with international internships
  - Networking: series of specialized workshops
  - Commercialization: identification of new ventures and access to new markets
Promoting global Systems of Innovation and Competence Building:

...with diversified partnerships

Networks of Scientific Cooperation

Post-Grad Training

Individual Mobility

Potential Markets

Invention/analytical design

Thematic Mobilization Programmes

Research Agendas

Knowledge diffusion

NTBF’s
Argument -2:

The university, even in mass higher-education systems and under new international contexts, continues to fulfil two basic functions that depend on it being a relatively stable institution:

1. It remains the most important incubator of the next generation of people:
   - Researchers, and this do require effective “University-Science” relationships
   - the need to secure and explore “University-Industry” relationships: Among the most precious and valuable roles of the universities, is the supply and training of talented young people.

2. generating and promoting “cultural norms”, in both substantive and procedural terms

No other institution is so well equipped to undertake these tasks in modern societies!
Slow dancing @ Harvard’s Widener Library

...a Work of Art by David Michalek, April 2012
The Painters´ Academy (1615), Pietro Francesco Alberti (1584-1638)
the issue is:... HOW people learn?
“design studios” are important to provide adequate forms of interaction of users with adequate research environments.
The emergence of “human centered systems”: the local context embeds a set of social capabilities that define the context under which knowledge and knowledge networks evolve…
The new paradigms in international academic cooperation **do not appear to match** the usual model for exporting services and although they provide new forms of expansion for institutions in developed countries, they clearly challenge their own traditional competences and agendas.

...they act as a **new generation of STEM** related programs worldwide!
Summary:
New paradigms in international academic cooperation seem to emerge, including:

• Diversified forms of capacity building;
• Modernization of education and learning across partners;
• The coaching and steering of research programs and collaborative research in developing countries;
• The development of “test beds” for interdisciplinary studies;
• New industrial strategies and policies.

The new paradigms require the collective action of institutions and a system approach to tertiary education.
Towards a new narrative to foster the internationalization of universities...

1. PEOPLE: improved funding and equity for enlarged participation rates and learning;

2. KNOWLEDGE & IDEAS: strengthening knowledge exploration and exploitation through inclusive knowledge networks;

3. LINKAGES & BOUNDARIES: strengthening linkages at local and global levels, together with institutional integrity.

...a policy mix facilitating systems linkages to strengthen societal trust for growth
“No esperen nada del siglo XXI, pues es el siglo XXI que espera todo de ustedes. ...”

Gabriel Garcia Marquez, UNESCO/BID, Paris, 1999