# “The inclusion of Mexico in the global academic and technological development: perspectives from abroad and their challenges, considering national and global factors”

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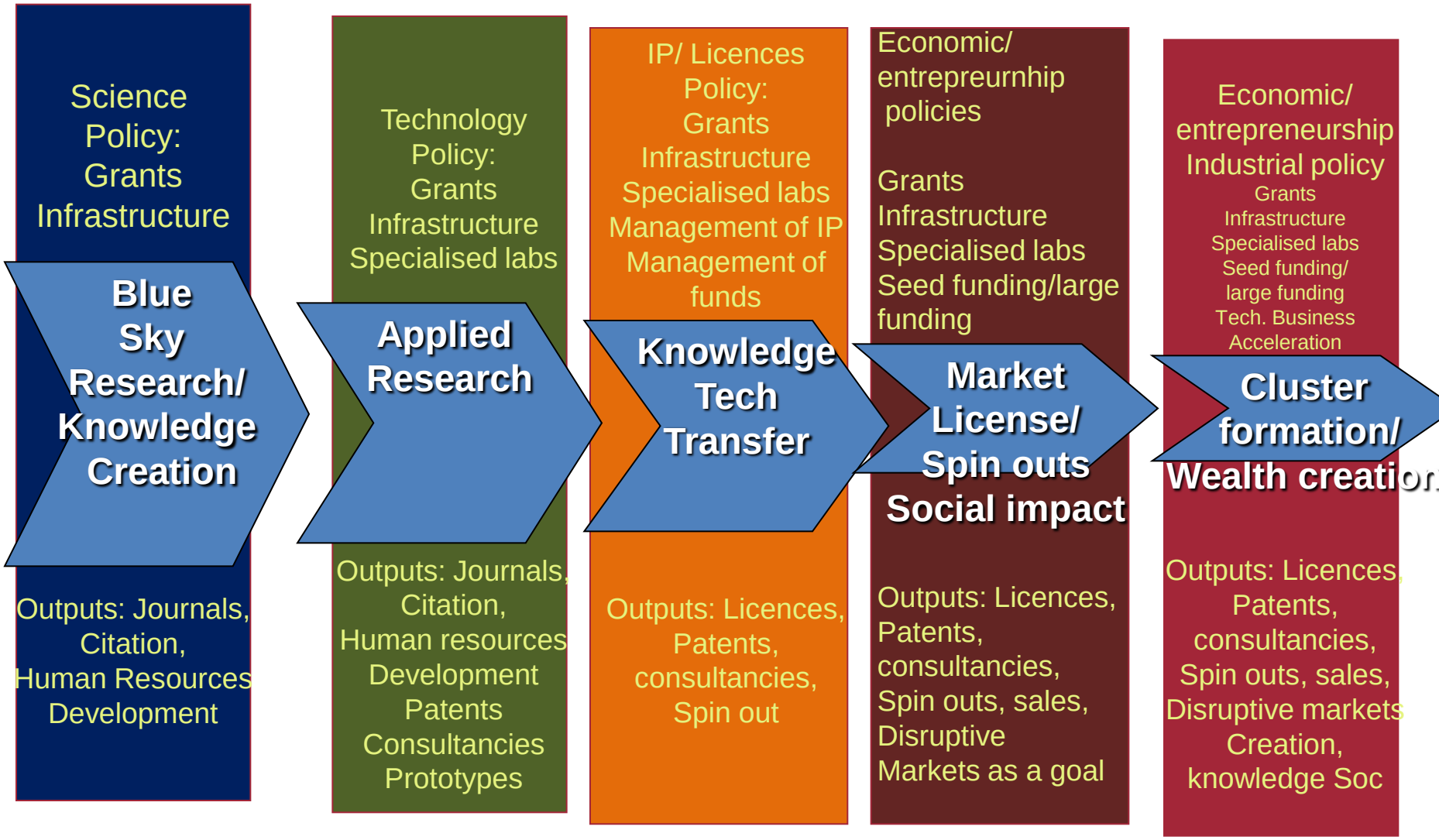
# The “2D” big picture: Academy, R&D, and Human Needs/Markets (by JBRF)



## A evaluation of Mexico in the global academic and technology development

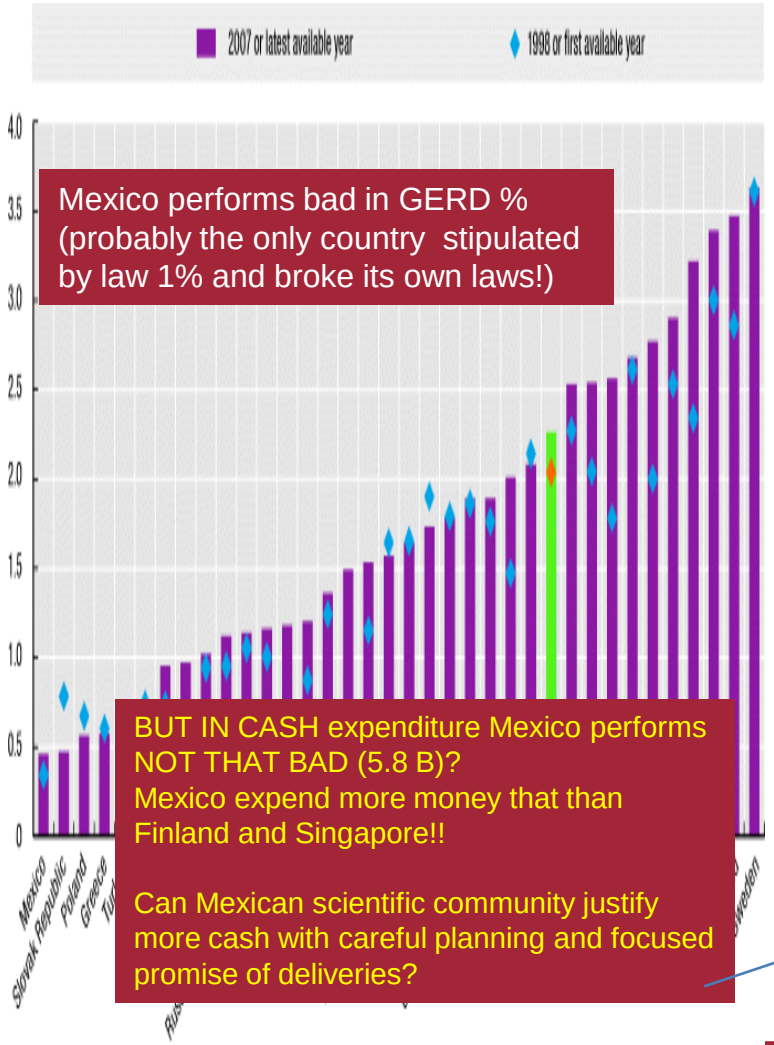
- There is a common “perception” that Mexico needs to improve its scientific performance, quality and international based research
- We need to consider some metrics to evaluate us internationally thus,

also internally

The most common and important metrics are:

- Science policy indicators such as GPD pct. of expenditure in science
- Use of “bibliometrics” such as number of journals, citations, impact factor, h-index….(god know what else....)
- University rankings
- **Departmental / Postgrad programmes evaluation & benchmark against other countries**
- (etc... Probably more that enough for today..)

# Percentage and cash of GDP expenditure for Mexico in science




Mexico performs bad in GERD % (probably the only country stipulated by law 1% and broke its own laws!)

BUT IN CASH expenditure Mexico performs NOT THAT BAD (5.8 B)?
Mexico expend more money that than Finland and Singapore!!

Can Mexican scientific community justify more cash with careful planning and focused promise of deliveries?

Billions of U.S. Dollars

| Global Rank | Country | 2009 GERD PPP Billions, US$ | 2009 R&D as % of GDP | 2010 GERD PPP Billions, US$ | 2010 R&D as % of GDP | 2010-11 GDP Growth | 2011 GDP PPP Billions, US$ | 2011 GERD PPP Billions, US$ | 2011 R&D as % of GDP |
|---|---|---|---|---|---|---|---|---|---|
| 1 | United States | 383.6 | 2.7% | 395.8 | 2.8% | 2.3% | 14,963 | 405.3 | 2.7% |
| 2 | China | 123.7 | 1.4% | 141.4 | 1.4% | 9.0% | 10,747 | 153.7 | 1.4% |
| 3 | Japan | 139.6 | 3.4% | 142.0 | 3.3% | 1.5% | 4,339 | 144.1 | 3.3% |
| 4 | Germany | 68.0 | 2.4% | 68.2 | 2.4% | 2.0% | 2,957 | 69.5 | 2.3% |
| 5 | South Korea | 41.4 | 3.0% | 42.9 | 3.0% | 4.5% | 1,512 | 44.8 | 3.0% |
| 6 | France | 41.1 | 2.0% | 41.5 | 1.9% | 1.6% | 2,176 | 42.2 | 1.9% |
| 7 | United Kingdom | 37.2 | 1.7% | 37.6 | 1.7% | 2.0% | 2,208 | 38.4 | 1.7% |
| 8 | India | 28.1 | 0.8% | 33.3 | 0.9% | 8.4% | 4,193 | 36.1 | 0.9% |
| 9 | Canada | 23.2 | 1.8% | 23.7 | 1.8% | 2.7% | 1,357 | 24.3 | 1.8% |
| 10 | Russia | 21.8 | 1.0% | 22.1 | 1.0% | 4.3% | 2,288 | 23.1 | 1.0% |
| 11 | Brazil | 18.0 | 0.9% | 18.6 | 0.9% | 4.1% | 2,253 | 19.4 | 0.9% |
| 12 | Italy | 18.7 | 1.1% | 18.7 | 1.1% | 1.0% | 1,775 | 19.0 | 1.1% |
| 13 | Taiwan | 17.6 | 2.4% | 18.2 | 2.3% | 4.4% | 839 | 19.0 | 2.3% |
| 14 | Spain | 17.3 | 1.3% | 17.2 | 1.3% | 0.7% | 1,366 | 17.2 | 1.3% |
| 15 | Australia | 15.0 | 1.8% | 15.3 | 1.8% | 3.5% | 907 | 15.9 | 1.7% |
| 16 | Sweden | 11.5 | 3.4% | 11.6 | 3.3% | 2.6% | 366 | 11.9 | 3.3% |
| 17 | Netherlands | 10.5 | 1.6% | 10.6 | 1.6% | 1.7% | 681 | 10.8 | 1.6% |
| 18 | Israel | 8.8 | 4.3% | 9.1 | 4.2% | 3.8% | 223 | 9.4 | 4.2% |
| 19 | Austria | 8.2 | 2.5% | 8.2 | 2.5% | 1.6% | 339 | 8.3 | 2.5% |
| 20 | Switzerland | 7.3 | 2.3% | 7.4 | 2.3% | 1.7% | 327 | 7.5 | 2.3% |
| 21 | Belgium | 6.8 | 1.7% | 6.8 | 1.7% | 1.7% | 402 | 6.9 | 1.7% |
| 22 | Turkey | 6.4 | 0.7% | 6.7 | 0.7% | 3.6% | 983 | 6.9 | 0.7% |
| 23 | Poland | 3.5 | 0.5% | 3.6 | 0.9% | 3.7% | 758 | 6.9 | 0.9% |
| 24 | Mexico | 5.8 | 0.4% | 6.0 | 0.4% | 3.9% | 1,500 | 6.4 | 0.4% |
| 25 | Finland | 6.1 | 3.2% | 6.1 | 3.1% | 2.0% | 200 | 6.3 | 3.1% |
| 26 | Singapore | 5.7 | 2.4% | 6.0 | 2.2% | 4.5% | 287 | 6.3 | 2.2% |

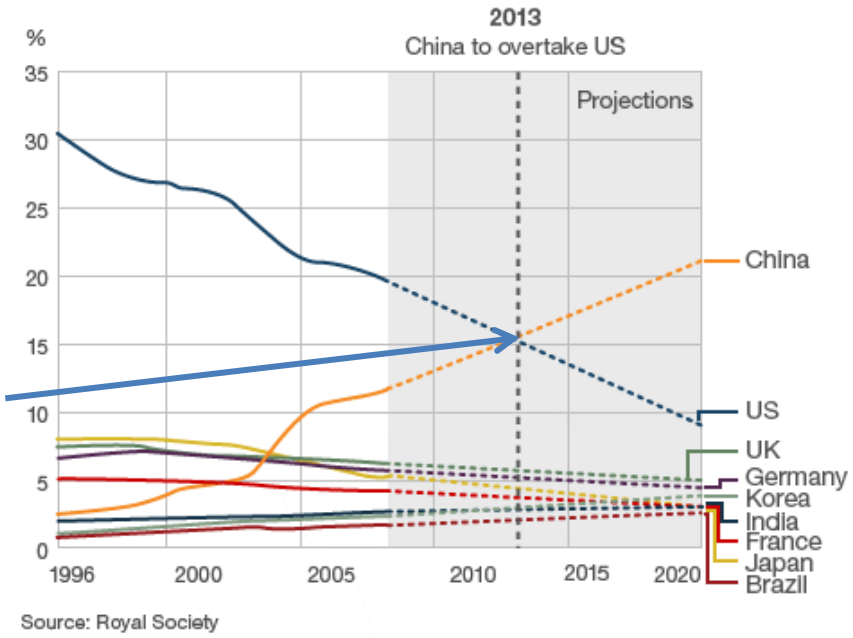
# According the “bibliometrics” which are the global scientific producers leaders?

**Total papers in all fields from 1996 to 2006**

| Country | Total Papers, 1996-2006 |
|---|---|
| **United States** | **2,907,592** |
| Japan | 790,510 |
| Germany | 742,917 |
| England | 660,808 |
| France | 535,629 |
| China | 422,993 |
| Canada | 394,727 |
| Italy | 369,138 |
| Spain | 263,469 |
| Australia | 248,189 |
| India | 211,063 |
| South Korea | 180,329 |
| Taiwan | 124,940 |

| Country | Papers among top one per cent most cited |
|---|---|
| **United States** | **54,516** |
| England | 10,090 |
| Germany | 9,427 |
| France | 5,967 |

**Projected growth in citations in scientific literature**



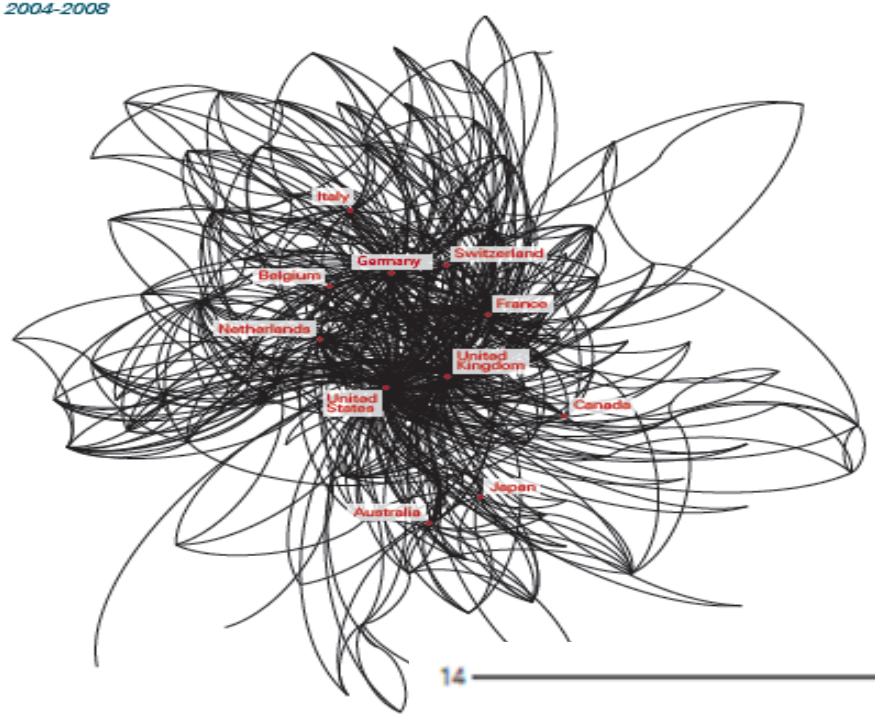

Source: Royal Society

News for Mexican Scientific system to consider: China, the same country which Mexico has been struggle to get the *lead in international Manufacturing Market* is expected to become the **World’s leader in science citations** over passing USA in two years *Nihao ma?*

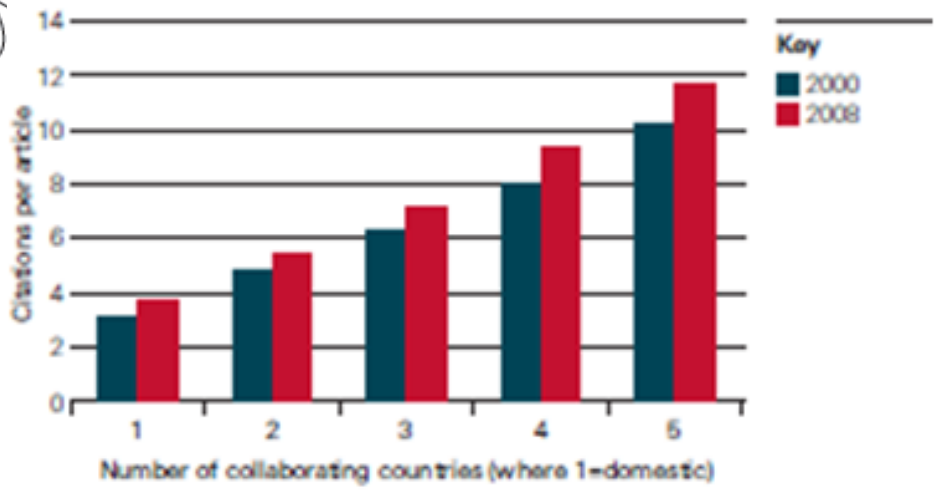
Misleading does not help, “news” around claiming that Mexico is the 7th Science producer... in developing countries...

# How the world collaborate (UK royal society report)?

Fig b. *2004-2008*







# Mexico's overall punch and partners (US, Europe...)

## Field Rankings for Mexico, January 1, 2001-April 30, 2011

**Country Feature, August 2011**

According to *Essential Science Indicators*SM from Thomson Reuters, among the 147 top-performing countries in all fields, Mexico ranked #28 for papers (72,481), #33 for citations (497,367), and #85 (6,86) for citations per paper.

Fields in the table below are sorted by citations. Average citation rates are across all nations for all papers published by field. This analyses reveals that Mexico is below world average in all but one field (Multidisciplinary).

Time period: January 1, 2001-April 30, 2011 (secor

28th papers
33rd Citations
85th citation per paper

Science in Mexico
About the Analyses

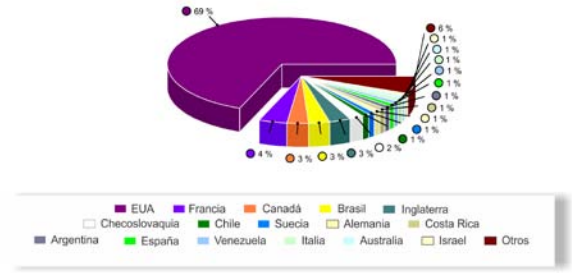
| Rank | Field | Papers | Citations | Cites per paper | Avg. Cit. Rates |
|---|---|---|---|---|---|
| 1 | CLINICAL MEDICINE | 8,351 | 84,316 | 10.10 | 12.44 |
| 2 | PHYSICS | 9,040 | 59,140 | 6.54 | 8.55 |
| 3 | CHEMISTRY | 7,269 | 51,799 | 7.13 | 10.94 |
| 4 | PLANT & ANIMAL SCIENCE | 9,671 | 43,970 | 4.55 | 7.42 |
| 5 | BIOLOGY & BIOCHEMISTRY | 3,761 | 32,668 | 8.69 | 16.37 |
| 6 | ENVIRONMENT/ECOLOGY | 3,505 | 31,771 | 9.06 | 10.92 |
| 7 | SPACE SCIENCE | 2,422 | 29,169 | 12.04 | 14.12 |
| 8 | NEUROSCIENCE & BEHAVIOR | 1,834 | 19,549 | 10.66 | 18.54 |
| 9 | GEOSCIENCES | 2,563 | 19,039 | 7.43 | 9.32 |
| 10 | ENGINEERING | 5,224 | 18,854 | 3.61 | 4.69 |
| 11 | MICROBIOLOGY | 1,727 | 18,164 | 10.52 | 15.06 |
| 12 | MATERIALS SCIENCE | 3,427 | 17,697 | 5.16 | 6.98 |
| 13 | AGRICULTURAL SCIENCES | 3,115 | 15,854 | 5.09 | 6.79 |
| 14 | MOLECULAR BIOLOGY & GENETICS | 1,180 | 13,953 | 11.82 | 24.13 |
| 15 | IMMUNOLOGY | 828 | 10,267 | 12.40 | 20.83 |
| 16 | PHARMACOLOGY & TOXICOLOGY | 1,238 | 9,304 | 7.52 | 11.84 |
| 17 | SOCIAL SCIENCES, GENERAL | 2,227 | 6,726 | 3.02 | 4.51 |
| 18 | MATHEMATICS | 2,204 | 5,122 | 2.32 | 3.35 |
| 19 | PSYCHIATRY/PSYCHOLOGY | 1,084 | 3,999 | 3.69 | 10.84 |
| 20 | COMPUTER SCIENCE | 1,189 | 3,509 | 2.95 | 3.71 |
| 21 | ECONOMICS & BUSINESS | 560 | 1,883 | 3.36 | 6.00 |
| 22 | MULTIDISCIPLINARY | 62 | 614 | 9.90 | 4.87 |
| | ALL FIELDS* | 72,481 | 497,367 | 6.86 | 10.38 |

** Includes data for all papers from ranked and unranked fields.*

Source: *Essential Science Indicators*SM from Thomson Reuters, January 1, 2001-April 30, 2011 (second bimonthly period of 2011).

Individual relationships or country to country agreements?

Figura 6. Distribución de los países involucrados en las colaboraciones científicas de la producción mexicana (1900-1979, *SCI*)
Figure 6. Distribution of the countries involved in the scientific collaboration of Mexican researchers (1900-1979, *SCI*)




USA main partner for long time

Figure 2.8. Those countries (country y) in 2008 which achieved a three-fold increase on their standard domestic publication impact, through collaboration with 'country x'. Minimum of 1,000 papers published by each country in 2008.[196]

| Impact accrued by... (country y) | By collaborating with... (country x) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Australia | Austria | Belgium | Canada | China | Czech Republic | Finland | France | Germany | India | Israel | Italy | Japan | South Korea | Netherlands | Norway | Russia | Spain | Sweden | Switzerland | United Kingdom | United States |
| Argentina | | | | | | | | | | | | | | | | | | | | | 3.2 | |
| Australia | | | | | | | | | | | | | | | | | | 3.2 | | | | |
| Brazil | 4.5 | | | 3.1 | | | | | | | | | 3.7 | | 3.9 | | | | | | | |
| China | | | 3.8 | | | | | 3.6 | 3.5 | 4 | | 5 | | | 3.9 | | 4.1 | 4.8 | 3.5 | 4.2 | 3.1 | 3.2 |
| Czech Republic | | | | | | | | | | | | | | | 3.9 | | | | | 3.1 | 3.2 | |
| India | | | | | | | | 3.8 | | | | 3.7 | | | | | | | | | | |
| Japan | | | | | | | | | | | | | | | | | | 3.3 | | 3.1 | | |
| South Korea | | | | | | | | 3.8 | 3 | | | | | | | | | | | | | |
| Mexico | | | | | | | | | 3.1 | | | 3.4 | | | | | | | | | | |
| Poland | | 3.2 | 3.8 | 3.6 | | | | | | | | 3.3 | | | 4.1 | | | 3.3 | 3 | 3.9 | 3.5 | 3.1 |
| Russia | | | | 4.7 | 3.4 | 3.4 | 3.4 | 3.2 | 3.1 | | 4.8 | 3.7 | 3.6 | 4.5 | 4.4 | 3.6 | | 4.2 | 4 | 4.2 | 4 | 3.6 |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | 3 |
| Spain | 3.5 | | | | | | | | | | | | 3.2 | | | | | | | | | |
| Taiwan | | | | | | | | | 3.2 | | | | | | | | | | | | | |

Europe-Mexico S&T Agreement (2003)

Mexico improves impact collaboration with Germany and Italy

# UNAM is the main contribution in science in Mexico

• Different countries have national evaluations, rankings and additional assesment not only among universities but among all departments

•Mexico has long history in “general” indicators, but there is a lot of work to improve Evaluation of quality in teaching and research in Universities

• Teaching performance has been evaluated by Mexican newspapers reforma and El Universal

• The first and only assessment of scientific production by an Institution in Mexico has been done by UNAM (*Estudio Comparativo de Universidades Mexicanas (ECUM)*).

| | Institución | Artículos | % de participación en el total de artículos (n=7,661) | Total citas en artículos | Artículos que recibieron al menos una cita | % de artículos que recibieron al menos una cita | Media de citas por artículo citado |
|---|---|---|---|---|---|---|---|
| 1 | UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM) | 2696 | 35.19 | 812 | 454 | 16.84 | 1.79 |
| 2 | CENTROS SEP CONACYT | 1114 | 14.54 | 304 | 169 | 15.17 | 1.80 |
| 3 | CENTRO DE INVESTIGACION Y DE ESTUDIOS AVANZADOS DEL IPN (CINVESTAV) | 758 | 9.89 | 270 | 150 | 19.79 | 1.80 |
| 4 | INSTITUTOS NACIONALES DE SALUD | 711 | 9.28 | 368 | 157 | 22.08 | 2.34 |
| 5 | INSTITUTO POLITECNICO NACIONAL (IPN) | 517 | 6.75 | 92 | 59 | 11.41 | 1.56 |
| 6 | UNIVERSIDAD AUTONOMA METROPOLITANA (UAM) | 488 | 6.37 | 81 | 57 | 11.68 | 1.42 |
| 7 | INSTITUTO MEXICANO DEL SEGURO SOCIAL (IMSS) | 362 | 4.73 | 75 | 50 | 13.81 | 1.50 |
| 8 | UNIVERSIDAD DE GUADALAJARA (UDG) | 267 | 3.49 | 56 | 39 | 14.61 | 1.44 |
| 9 | SISTEMA INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY (ITESM) | 230 | 3.00 | 106 | 58 | 25.22 | 1.83 |
| 10 | UNIVERSIDAD AUTONOMA DE NUEVO LEON (UANL) | 218 | 2.85 | 37 | 22 | 10.09 | 1.68 |
| 11 | SECRETARIA DE SALUD (SS) | 189 | 2.47 | 61 | 30 | 15.87 | 2.03 |

# UNAM is the main contribution in science in Mexico (II)

• According *ECUM* (from ISIS web of knowledge in 2008) Mexico scientific production come from internationally collaboration in a 40% (not bad)

•However, the number of publications and citations per paper is still low comparing with top countries

**Artículos y citas en revistas ISI 2008**
**Por conjuntos institucionales**

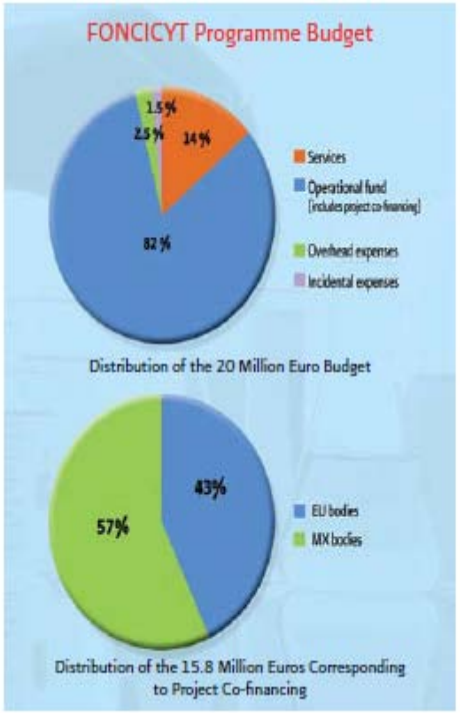
| Conjuntos Institucionales | Artículos | % de participación en el total de artículos (n=7,661) | Total citas en artículos | Artículos que recibieron al menos una cita | % de artículos que recibieron al menos una cita | Media de citas por artículo citado |
|---|---|---|---|---|---|---|
| UNIVERSIDADES SELECCIONADAS | 5504 | 71.84 | 1404 | 808 | 14.68 | 1.74 |
| RESTO DE LAS INSTITUCIONES NACIONALES | 3922 | 51.19 | 1167 | 644 | 16.42 | 1.81 |
| COLABORACIONES EXTRANJERAS | 3118 | 40.70 | 1431 | 705 | 22.61 | 2.03 |

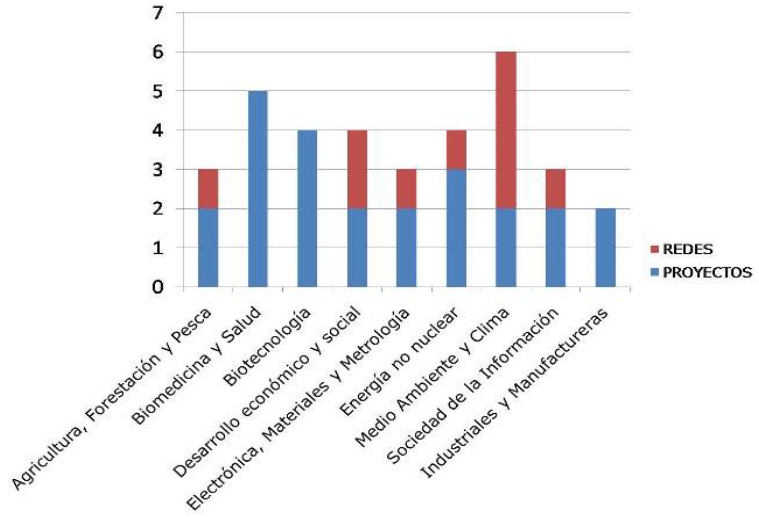
| Conjuntos Institucionales | Artículos | % de participación en el total de artículos (n=7,661) | Total citas en artículos | Artículos que recibieron al menos una cita | % de artículos que recibieron al menos una cita | Media de citas por artículo citado |
|---|---|---|---|---|---|---|
| SOLO UNIVERSIDADES SELECCIONADAS | 3739 | 48.81 | 951 | 542 | 14.50 | 1.75 |
| SOLO RESTO DE LAS INSTITUCIONES NACIONALES | 2157 | 28.16 | 714 | 378 | 17.52 | 1.89 |
| COPARTICIPACION UNIV.SEL /RESTO NAC. | 1765 | 23.04 | 453 | 266 | 15.07 | 1.70 |
| COLABORACIONES EXTRANJERAS | 3118 | 40.70 | 1431 | 705 | 22.61 | 2.03 |

Fuente: ISI Web of Knowledge
Elaboración: Dirección General de Evaluación Institucional, UNAM

# European Union-Mexico collaboration is becoming important

The only global collaboration which call/evaluation (some previous attempts with Texas A&M)




Unfortunately normally Mexico lacks of long term, strong-link programmes like this (for example the science budget of projects for 2008 was delivered recently; so it is difficult to compete Internationally with delays)

Note: FP7 total budget 50 thousand millions euros

# Universities performance has its own rankings

- World rankings are varied, polemic and unequally measure
- However , they provide a good reference of performance
- Also public policies for performance evaluation can be done to individuals universities…..
- The most important Universities rankings are The Academic Ranking of World Universities (ARWU) compiled by a Chinese University, the Times Higher education, QS and others ranks include Ranking of Scientific Papers, etc
- **Most rankings and dominated in the top 10/20 by USA and UK universities**

# Lets take one of the rankings, the QS

| Rank | Title | Country | Score |
|---|---|---|---|
| 1 | University of Cambridge | | 100.0 |
| 2 | Harvard University | | 99.2 |
| 3 | Yale University | | 98.7 |
| 4 | UCL (University College London) | | 98.5 |
| 5= | Massachusetts Institute of Technology (MIT) | | 98.2 |
| 6 | University of Oxford | | 98.2 |
| 7 | Imperial College London | | 97.8 |
| 8 | University of Chicago | | 97.5 |
| 9 | California Institute of Technology (Caltech) | | 96.4 |
| 10 | Princeton University | | 96.0 |

World

Latin America

Mexico

| ank | Title | Country | Score |
|---|---|---|---|
| 1 | Universidad Nacional Autónoma de México (UNAM) | Mexico | 100.0 |
| 2 | Universidade de São Paulo | Brazil | 93.0 |
| 3 | Universidade Estadual de Campinas (Unicamp) | Brazil | 84.5 |
| 4 | Universidad de Buenos Aires | Argentina | 77.3 |
| 5 | Pontificia Universidad Católica de Chile | Chile | 76.4 |
| 6 | Universidad Austral | Argentina | 71.4 |
| 7 | Universidad de Chile | Chile | 70.2 |
| 8 | Universidade Federal do Rio de Janeiro | Brazil | 68.0 |
| 9 | Tecnológico de Monterrey (ITESM) | Mexico | 66.1 |
| 10 | Universidad de Los Andes | Colombia | 46.6 |

| nk | Title | Country | Score |
|---|---|---|---|
| 1 | Universidad Nacional Autónoma de México (UNAM) | Mexico | 100.0 |
| 2 | Tecnológico de Monterrey (ITESM) | Mexico | 66.1 |
| 3 | Universidad Iberoamericana (UIA) | Mexico | 35.5 |

UNAM in QS rankings, how can it be downgraded 122 places in one year??

| 2010 | 2009 | 2008 | 2007 | 2006 |
|---|---|---|---|---|
| 222 | 190 | 150 | 192 | 74 |

# A path to improve: Benchmark to International programmes in Education

• Mexico has a very good initiative in “certification of evaluation” done by COPAES

**Programas de Licenciatura Acreditados por los organismos reconocidos por el Consejo para la Acreditación de la Educación Superior, A. C.**
**Universidades seleccionadas ordenadas por el porcentaje de programas acreditados con respecto al total de programas acreditados en las 58 universidades seleccionadas***

| | Institución | Total de programas | % 58 universidades seleccionadas (n=4,589) | Programas acreditados por COPAES | % 58 universidades seleccionadas (n=1,226) | % total de programas en cada institución |
|---|---|---|---|---|---|---|
| 1 | SISTEMA INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY (ITESM) | 393 | 8.56 | 185 | 15.09 | 47.07 |
| 2 | UNIVERSIDAD DE GUADALAJARA (UDG) | 191 | 4.16 | 79 | 6.44 | 41.36 |
| 3 | UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM) | 155 | 3.38 | 70 | 5.71 | 45.16 |
| 4 | INSTITUTO POLITECNICO NACIONAL (IPN) | 72 | 1.57 | 50 | 4.08 | 69.44 |
| 5 | UNIVERSIDAD AUTONOMA DE BAJA CALIFORNIA (UABC) | 187 | 4.07 | 47 | 3.83 | 25.13 |

• Mexico has started to develop international mobility in undergraduate such as ITESM and UNAM (with Stanford for example)
• In Latin America the flow is bidirectional but in top rated universities very few Students study partially in Mexico
• Examples in mobility are EU erasmus-mundo, Iberoamerica initiatives and MIT-Cambridge (full bidirectional)
• In addition, Mexico could benefit to evaluate the programmes in rankings (UK Rank teaching in 24 points) and international benchmarking (quality/lenguage)

# Benchmarking to International programmes (Master/PhDs)

- In Master and PhDs assess more carefully postgraduate programs by CONACyT (National and International)
- According ECUM less than 40 International programmes are established in Mexico

**Participación en el Programa Nacional de Posgrados de Calidad**
**Primeras veinte instituciones ordenadas por número de programas consolidados***

| | Institución | Consolidados | % total consolidados (n=195) | Total | % del total (n=338) |
|---|---|---|---|---|---|
| 1 | CENTROS SEP CONACYT | 26 | 13.33 | 35 | 10.36 |
| 2 | UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM) | 24 | 12.31 | 38 | 11.24 |
| 3 | UNIVERSIDAD AUTONOMA METROPOLITANA (UAM) | 15 | 7.69 | 22 | 6.51 |
| 4 | UNIVERSIDAD AUTONOMA DE NUEVO LEON (UANL) | 12 | 6.15 | 16 | 4.73 |
| 5 | CENTRO DE INVESTIGACION Y DE ESTUDIOS AVANZADOS DEL IPN (CINVESTAV) | 11 | 5.64 | 25 | 7.40 |
| 5 | INSTITUTO POLITECNICO NACIONAL (IPN) | 11 | 5.64 | 20 | 5.92 |
| 7 | UNIVERSIDAD DE GUADALAJARA (UDG) | 9 | 4.62 | 15 | 4.44 |
| 8 | BENEMERITA UNIVERSIDAD AUTONOMA DE PUEBLA (BUAP) | 7 | 3.59 | 8 | 2.37 |
| 8 | COLEGIO DE POSGRADUADOS (COLPOS) | 7 | 3.59 | 9 | 2.66 |
| 8 | UNIVERSIDAD AUTONOMA DE SAN LUIS POTOSI (UASLP) | 7 | 3.59 | 10 | 2.96 |
| 11 | UNIVERSIDAD DE GUANAJUATO (UGTO) | 5 | 2.56 | 9 | 2.66 |
| 11 | UNIVERSIDAD MICHOACANA DE SAN NICOLAS DE HIDALGO (UMICH) | 5 | 2.56 | 10 | 2.96 |
| 13 | SISTEMA INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY (ITESM) | 4 | 2.05 | 7 | 2.07 |

| | Institución | Competencia internacional | % total competencia internacional (n=39) | Total | % del total (n=338) |
|---|---|---|---|---|---|
| 1 | CENTRO DE INVESTIGACIÓN Y DE ESTUDIOS AVANZADOS DEL IPN (CINVESTAV) | 12 | 30.77 | 25 | 7.40 |
| 2 | UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM) | 11 | 28.21 | 38 | 11.24 |
| 3 | CENTROS SEP CONACYT | 6 | 15.38 | 35 | 10.36 |

- According the report the money for scholarship vary with the quality of programme (this can be a issue)
- Misleading does not help for example the IT Master degree of Fundacion Carlos Slim “validated” by MIT is a very poor quality programme, and even similar to a commercial training, of any MIT or Cambridge Master degree jointly developed such as computational biology, Master in Biotech and Nanoscience enterprise, technology policy.

# International students flow is an asymmetric reality for Mexico

- With so few “international quality” programmes can be see now clear why Mexico sponsor a lot of International Students and received few
- There are in USA and UK more than 2,000 Mexican scholars sponsored by CONACYT
- The SRE promote scholarship of foreign national to study in Mexico. However, in recent very few have been taken
- International students prefers to go USA and Europe with high tuition fee
- A lot stay in other countries
- There are “intellectual diaspora” networks as th *Mexican Talent Network*

*We have several projects in UK with Ford, Surrey satellite Tech*

To discuss: SHOULD MEXICO CHANGE TO A GRADUATE MODEL OF MASTER OF 1 Year and PhD programmes in research of only 3 years in total?

# High impact strategy collobartion:
# MIT-Cambridge Institute ($120M US/6 years)

- Gordon Brown idea to boos UK Innovation with two “big” institutions
- Chancellor of exchequer of UK funded a 6 year programme for £65 M (GBP)
- Oriented to innovation: Mobility, New Master Programmes, joint research, technology innovation, prototyping, technology transfer etc..
- Examples of output:

1) Masters in Nano-science and Biotech enterprise, Technology policy etc..

2) Technology transfer best practices

3) *The silent aircraft, to become the world standard airplane in two generations selected by the world association of aircrafts*

Can we do also strategic collaborations with institution with “high-density” of quality programmes for example UNAM- Cambridge-MIT-Stanford? Why not (although getting 120M US from Hacienda would be difficult!)

# Let's talk about innovation and academic entrepreneurship

☹ *Innovation is a word that a lot of people use and have different meanings..*

- In this discussion we define innovation as:

**THE COMMERCIALIZATION OF AN INVENTION...**

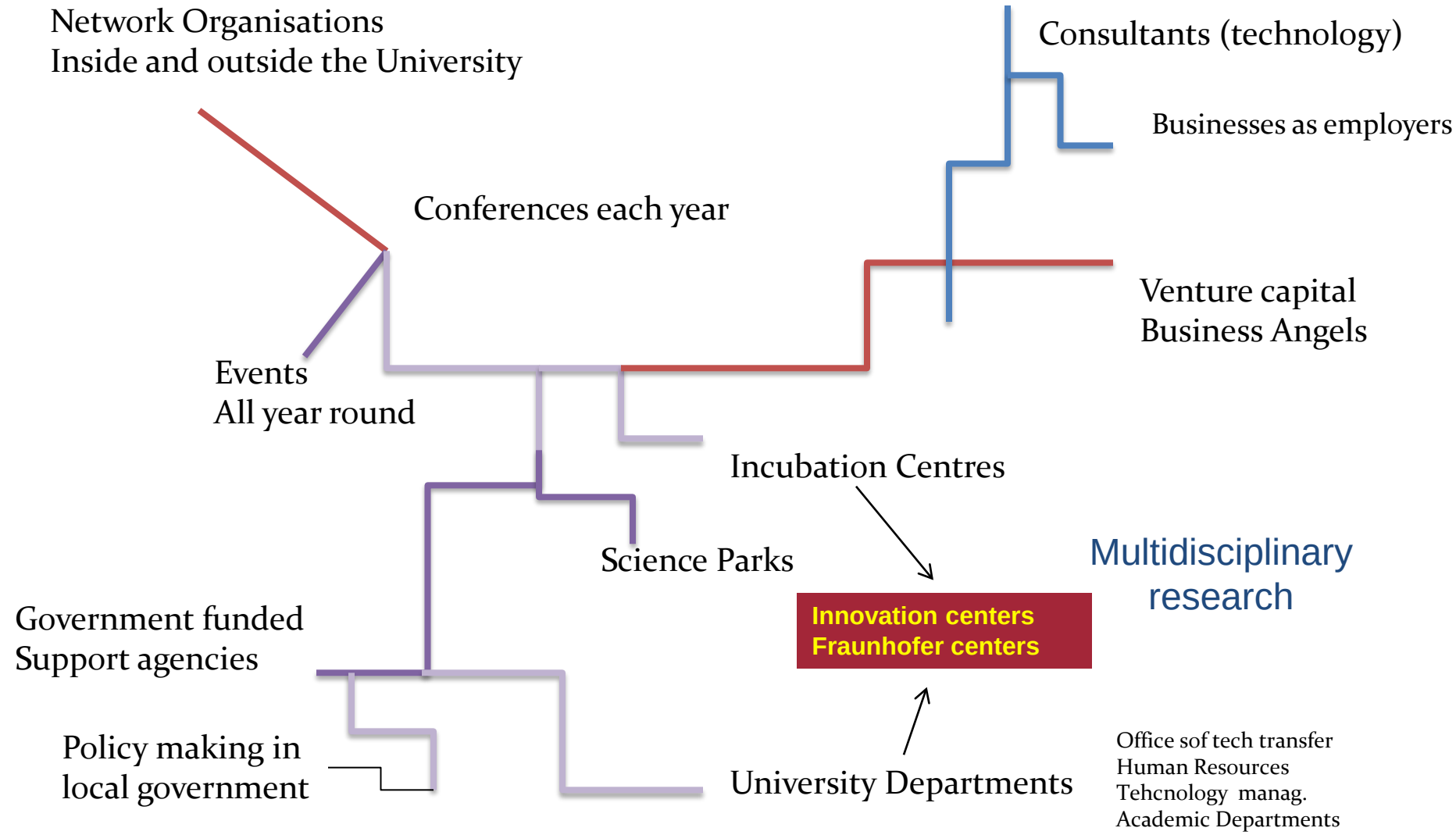
- Preferable developed "disruptive markets", high returns and social impacts

- The larger, high return of investment companies use innovation, although some business may need low degree of innovation...

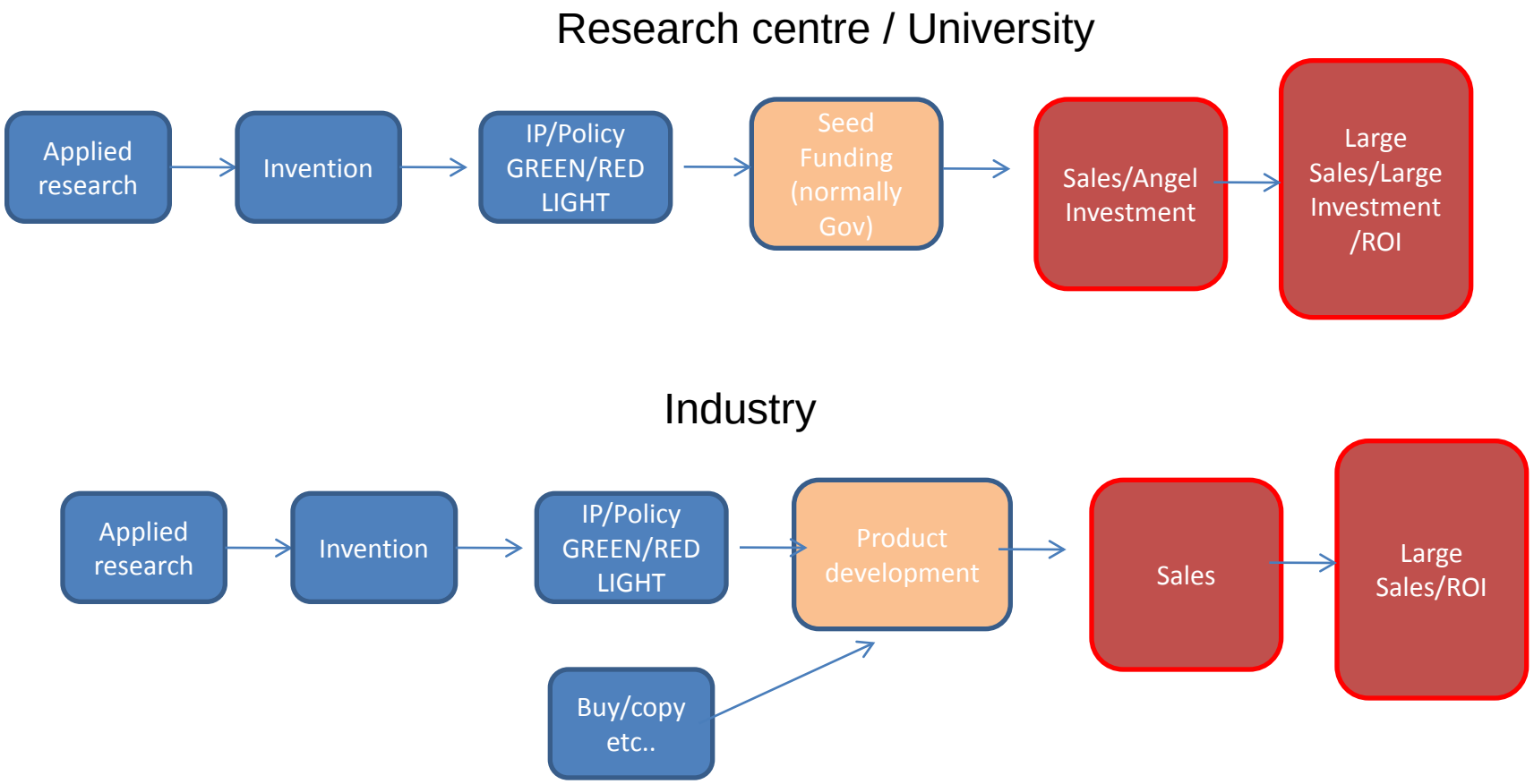
- In the globalisation, research centres and Universities are evolving more and more to do innovation of technology by collaborating with industry through licences or through companies from Universities and alumni name spin-out/spin-offs

- Services, reverse engineering and working with industry hiring people are **define CONSULTANCY SERVICES**

# Technopole route (complex, interconnect, sensible CYCLE)



# How and innovation process work in from invention to market?




We have to be careful in time and investment depending the area for example clinical and software are very different in investment and time

# Misunderstanding and Closing cycles: Mexico additional challenges

- In some of the Goverment grants companies claimed innovation but they just use the cash or develop pseudo-technology programmes
- Misunderstanding in part cycle stop reach the goal

- "make-up results does not help? The Mexican government claims that Mexico generate more engineers than US and Germany and we are the main exporters of mobile phones.. how many of these engineers can work in high-value projects In the blackberries that we produce who gets the return of investment?

Example of a project that could have a different end, Satellites: UNAMSAT /SATEX and STTL Sussex UK. Both projects started in 90's:

- UNAMSAT A/B highly sucessful!!
- Surrey University also did small satellites in the time!

The Mexican Space agency is an opportunity to do a innovation integrator centre for example, thin layer to have policies and real impact in the industry. However I think the Space agency will not help to develop S&T will be support by other means of our S&T and Innovation efforts
(and of course the new director will be selected openly so any one can apply!)... (I am looking for votes....!!)

# Some key elements to considered to implement and assess in the Mexican Innovation/Entreuperneur system

- Cultural change to develop and allow human resources to do high-value innovation projects
- Development of effective office of technology transfer in research centres (cluster to received high-values projects)
- Flexible and continuum seed and large funding (one of the main challenges for my point of view)
- Innovation policies assesmenent and adaption (see repot on OCDE)

## Does a University Professor must be an entrepeuner and work for its founded company

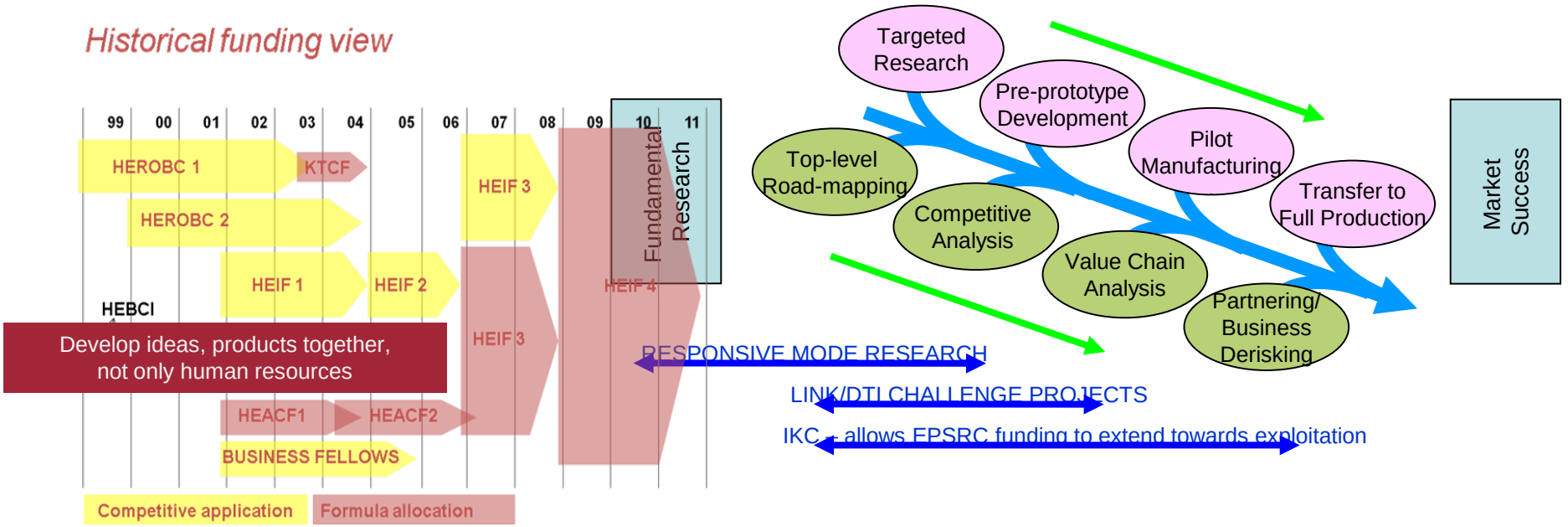
- There is a lot of different approaches in the world. However is clear that the main inventor may be involved in the whole process
- In the case of Cambridge for example a professor can be ***founder, owner, work in the company and get returns***

***For example:***

- The Professor of Physics, Cavendish lab (same position of Maxwell, Rutherford, Thomson..).- Professor Friend discovered and patent the *organic LEDs* and help to develop display technologies in TV, mobiles.. Also he discovered the "plastic transistor" that is being develop for flexible display and plastic electronics.
- The Professor of Computer Lab.- Andy Hopper, who has developed 12 companies, one with 50% of the market in home internet modems based in ADSL
- The Professor of Biotechnology- Chris Lowe, has founded 9 Biotech successful companies with high social impact in health care

**Should inventors/professor in Mexican centres to be allowed to do similar things?? Is this a conflict of interest? (Clear for other countries is a successful method and conflicts an be solved)**

# Real impact collaboration with industry: Innovation-Centers




•In USA and Europe, engineer or innovation centers have different GOALS and deliveries not only journal papers, for example they develope technology roadmaps, prototyping and hopefully licences

• Some are main funded by Government and some mainly by Industry (UK/US and Germany respectively)

•Alignment and goals are very important to define assessment, evaluation and control is increasing world-wide

• Mainly focus in innovation and not in services/consultancy , most of them are integrators of large projects with different institutions

•

# Important of international technology Business Models!!

- MICROPROCESSORS ARM
- provides developers with intellectual property (IP) solutions for specialised Si chips *fab-less* company: chips are designed in Cambridge and licensed to Intel, Texas Instrument, Sony, Apple etc to be produced elsewhere Worldwide ARM controls 80% of mobile phone chip market
- 40% of digital camera chip market, also a leader in MP3 player chips, iPod includes 3 ARM's "IP cores", iPhone includes ARM's "IP cores"



Cambridge Silicon Radio
Found in 1999 by a group of colleagues at Cambridge Consultants Ltd;
Floated on London Stock Exchange in 2004
The company produces integrated circuits and software solution for :
- WiFi applications and cell phones
- Bluetooth
- Wireless connectivity in general

Cambridge Silicon Radio is the world leader in the production and sale of Bluetooth chips

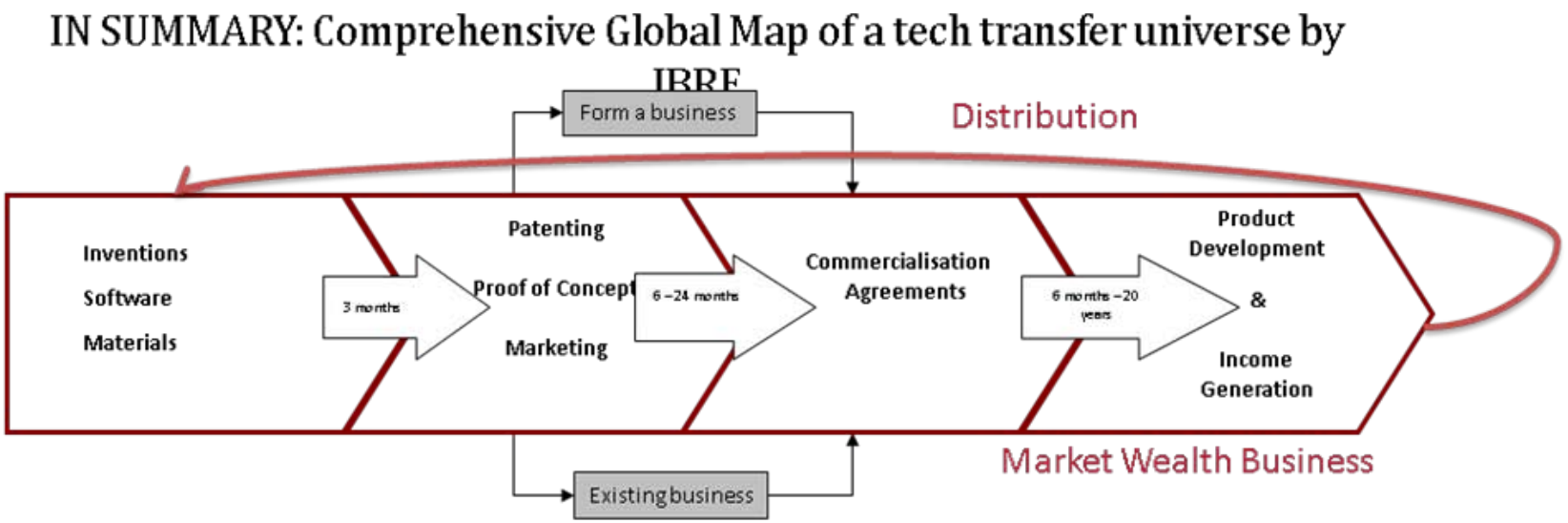

Two Spin-off's of the Cavendish Laboratory (Physics Dept.) , World leaders in plastic electronics and organic displays

PL design plastic electronic component for:
- Flexible, portable display, RF ID tags, smart packaging and shelving

CDT world leader in plastic light emitters for: Mobile phone displays and case
- Large Screen displays Both companies rely on low cost printing of plastic electronic devices



# Office of commercialisation (IP) in Universities/centres




- Strong Academy
- Labs and information
- Research funds
- Directed research
- Open Innovation
- Industrial visits
- International Mobility

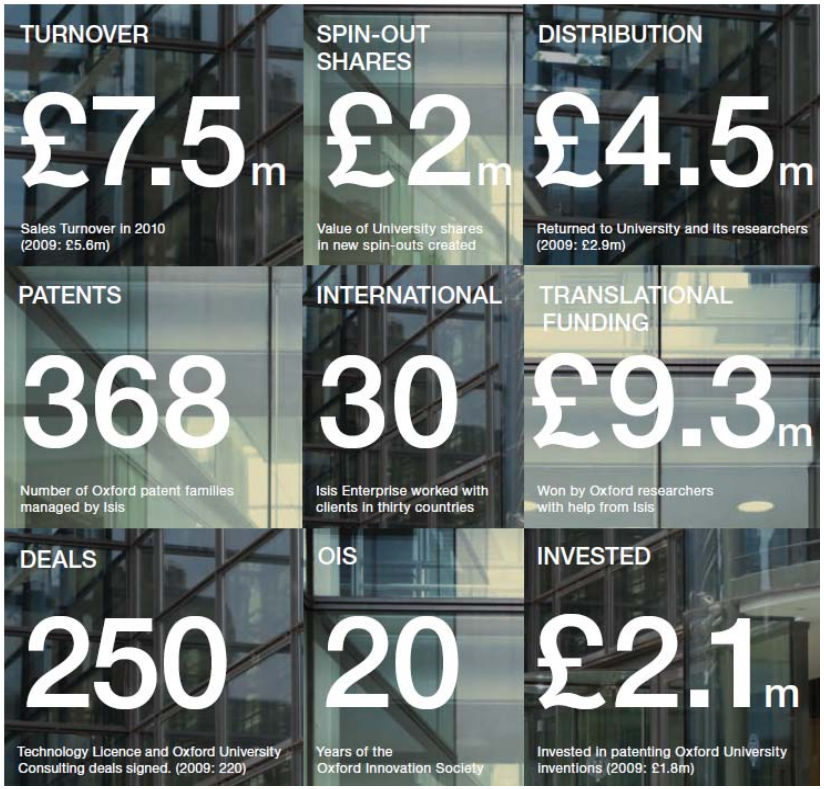
- Topic scouts
- Surgeries
- OTT support
- Manage of Patents portfolio
- Prototyping
- Research feedback
- Kick-off funds

- Licences
- Spin out pitching
- Seed funding
- Licence/patent ratio
- Dealing conflicts
- Angels relationships
- Networking

- Manage Seed funding
- Manage VC relationships
- Valuation
- Exits
- Dealing conflicts
- Dealing with disruption of innovation cycle

Training/Specialization/Regulations/Networking

# Office of commercialisation metrics and outputs




*Flow: Disclosure, applied to patents, Patent grant, Licence, sales, sell company*

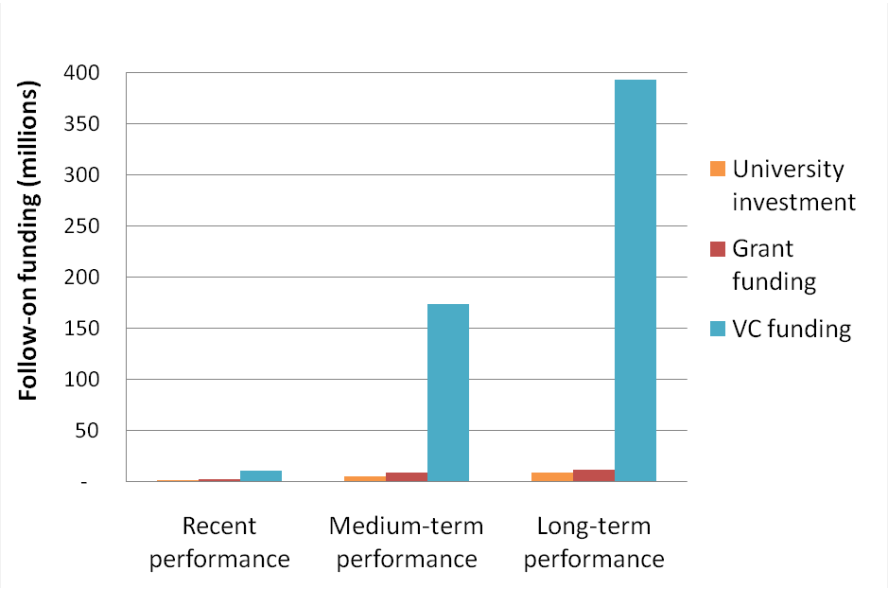
☹ BECAREFUL WHAT YOU PATENT
PATENTS MAKE US POOR

☺LICENSE/SELL OF UNIQUE (DEFENDIBLE) PRODUCTS MAKE US RICH!

# The University of Cambridge Discovery Fund

## Supporting the 800th Anniversary Campaign – Our Freedom to Discover

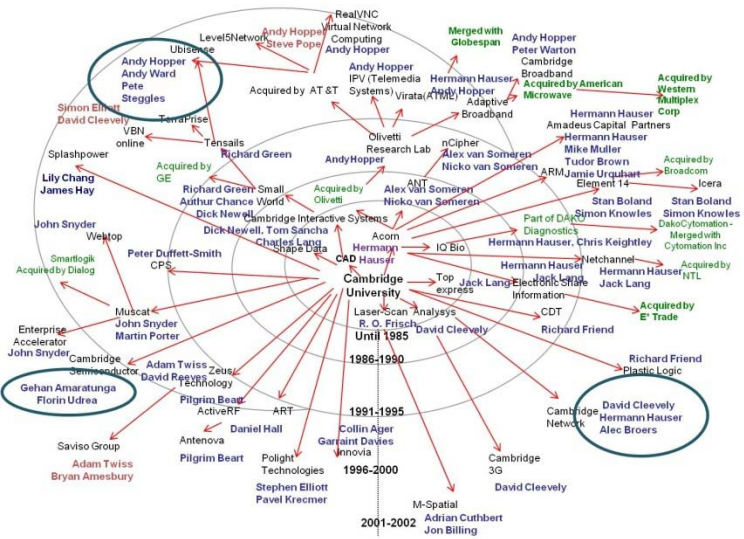
| Country | ISR&D 2006[2](millions $ PPP) | Intensity (ISR&D by % of GDP) | % funded by | |
|---|---|---|---|---|
| | | | private sector (industry) | government |
| United States | 312535.40[3] | 2.68[4] | 63.7[4] | 31[4] |
| Japan | 118026.3 | 3.13 | 74.8 | 18.1 |
| China | 93992.00 | 1.23 | 65.7 | 26.6 |
| Germany | 59115.00 | 2.49 | 67.1 | 30.4 |
| France | 38985.00[4] | 2.16[4] | 50.8 | 39 |
| United Kingdom | 33231.20 | 1.88[6] | 43.80 | 31.40 |
| Korea | 28288.30 | 2.85 | 75 | 23.1 |
| Canada | 21047.60[4] | 1.99[4] | 47.1[4] | 34.1[4] |
| Italy | 17505.50 | 1.11[6] | 43.00 | 50.80 |
| Russia | 16669.70 | 1.15 | 31.4 | 60.6 |
| Taipei(China) | 14951.00 | 2.56 | 64.4 | 33.9 |
| Spain | 11801.90 | 1.07 | 48 | 41 |
| Sweden | 10440.90[7] | 3.95[6] | 65 | 23.5 |
| EU-25 | 210167.90 | 1.81[6] | 53.7 | 35 |
| OECD | 729430.80[4] | 2.26[4] | 61.9 | 30.2 |




- Venture capital industry take “your company” And make in grow (value it better) to sale it after for 20 or more times of the value they invest (not the best system but how it works..)

*“Trying to get sales (or advance cash) as soon as possible is the best way to avoid angel/VC funding (Dr Hauser, one of the main VC investors in Europe)*

# Example of Cambridge Silicon Fen cluster: Critical Mass of R&D International Companies




- Companies understand that to maintain competitiveness they must be increasingly innovative and interdisciplinary
- Relying solely on internal resources for new product development can be a recipe for disaster
- Philips, Intel, Xerox have pioneered a new **Open Innovation** approach based on inflows and outflows of knowledge to and from external organisations. This is becoming widespread
- The level of scientific and technical know-how floating around Cambridge has attracted large corporations from all over the world
- Several corporate R&D centres have been created
- Cambridge as become an **Open Innovation hub**

**Geographically small, only infrastructure needed**

- **PLUS 1,500 technology companies**

Develop ideas, products together, not only human resources

# Innovation Policy in Mexico

• CONACYT has good programmes in technology development:

AVANCE, Fondo de Innovacion Tecnologica, FINOVA, estimulos de innovacion...y SE (fondos de innovacion)

(although they request 50% of some of other investment)

AERIS – Networks of research/ US and UK has organically growth this in all calls

SNI is good but review...

JUST IN TIME culture

• FUMEC has a good program in technical international sales....

• Good news: Funding for technology is increasing in Mexico but a lot of best practices/models must be tuned!
• A fund of funds is developed by SE, Nafinsa/CONACyT

For example:
Gerbera,
Alta Venture,
*Angel Ventures, Green Momentum (well there are intermediate but this is good)*
Avanza Capital,
(AMEXCAP has a plublication on this)

We need to scale this to play the internation game in innovation and promote results a lot (marketing, marketing and more marketing)

# Science and politicians, Industrial Policy....

• It is important to work with Politicians (***YES YOU READ WELL WITH POLITICIANS***) and show them the way/interest

• Does industrial policiy must be stronger in innovation? For example
Does Mexico should promote only 3 or 4 main areas ONLY???

• An example of aggressive Industrial Policy CHINA and RUSSIAN governments are importing European Technologies to dominate future markets:

Example:

Plastic logic has been bought by 1B US to take to Russian the plastic Electronics patent technologies: idea to generate a Trillion dollar market
In plastic chips??

• Promexico and SE in Mexico are doing road mapping for areas
•Such as aerospace, automotive, multimedia, energy...

# Final comments

• Barriers will increase with the economic crisis...but recent history proves that good innovation can survive

• Innovation is a part one of the main drivers of economy, however services and manufacturing must be maintained (and not as other countries)

• In academy several improvements in assessment could be done internally to be more strength international cooperation, barriers include infrastructure, language, mobility and scientific interests, and cash available

• UNAM is the leader institution in Mexico and there is a good chance to Become ranked among top 40 Universities in the world in the next years

• High value- product innovation and academic entrepreneurship cycle has several Challenges in Mexico but it is improve fast, but cultural change, OTT scheme and more funding available are very important challenges

It is good to know the history but I prefer to look for a future on Mexico where we solve humans needs and the economy of Mexico is driven in part by real innovation

Consultants (technology)

Network Organisations
Inside and outside the University

esses as employers

re capital
ess Angels

**MUCHAS GRACIAS**

**Preguntas, reclamos, discusiones, etc..**
**Son bienvenidos**

Science Parks

Multidisciplinary research

CIKC

Government funded
Support agencies

Policy making in
local government

University Departments

Cambridge Enterprise
CfEL
IfM
Academic Departments