CONSEJO NACIONAL DE INNOVACIÓN PARA LA COMPETITIVIDAD

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Technology Commercialisation Workshop

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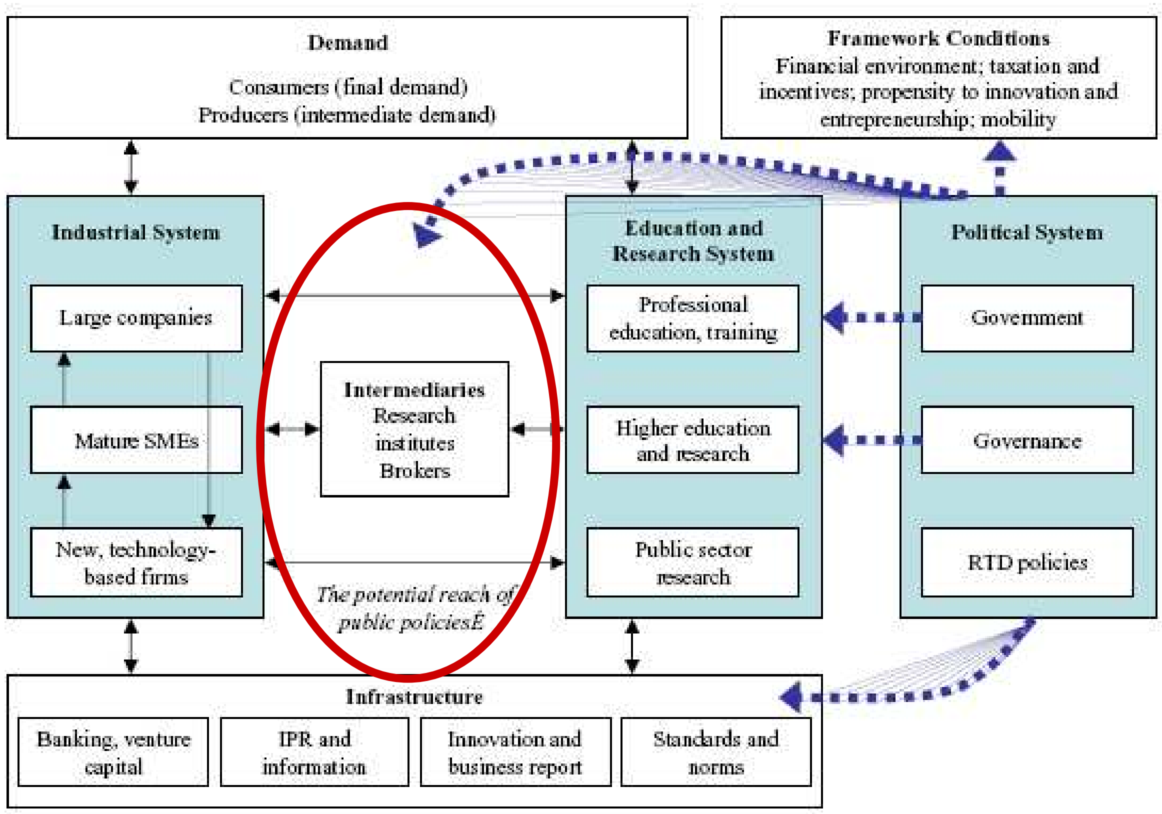
Diagnostic of industry – science relationships in Chile

A National Innovation System Model



Source: Arnold, E., 2007: *Governing the Knowledge Infrastructure in an Innovation Systems World*, SPRU, University of Sussex. UK.

Technology commercialisation in the UK and US

Commercialisation activity in the UK and US: 2003-2004

	US universities AUTM survey	UK HEIs, HE BCI Survey
Number of institutions	165	164
Research expenditure Industrial (£000s)	1,551,410	186,771
Research expenditure Public (£000s)	14,102,984	2,400,052
Total research expenditure (£000s)	21,296,961	3,633,283
New patents granted	3,450	463
Patents per £10 million research expenditure	1.6	1.3
IP income from licensing, other and spin-off sales (£000s)	632,061	38,234
Licence income as percentage of total research expenditure	3.0%	1.1%
Spin-off companies formed	348	167
Research £ expenditure per spin-off (£000s)	61,198	21,756

Source of US data: AUTM Financial Year 2003 report
Source of UK data: HESA FSR 2003-04 and HE-BCI survey 2003-04

Some figures of the US University System

OFFICE OF TECHNOLOGY LICENSING
STANFORD UNIVERSITY

- 1969 - 1980 Total Royalties of USD 4 millions
- 1981 - 1990 Total Royalties of USD 40 millions
- 1991 - 2000 Total Royalties of USD 400 millions
- However, essentially all of the USD 400 millions came from inventions disclosed in the 1970s

HARVARD UNIVERSITY
THE OFFICE OF TECHNOLOGY DEVELOPMENT

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The Landscape:

Invention Disclosures and Research Expenditure FY 2006

	Total Research Expenditures (A)	Invention Disclosures Received (B)	B / A per $1MM
U. California System	$3,035,949,000	1,308	0.43
Johns Hopkins	$1,757,268,191	363	0.21
MIT	$1,212,800,000	523	0.43
Stanford	$699,211,807	518	0.74
U Pennsylvania	$640,224,563	306	0.48
Harvard	$630,100,000	180	0.29
Cornell	$605,341,000	237	0.39
Columbia*	$600,000,000	272	0.45
Caltech	$411,126,907	533	1.30
New York University	$210,804,000	101	0.48

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Source: AUTM; *Columbia University Science & Technology Ventures Annual Report 2005

Diagnostic of industry – science relationships (ISRs) in Chile

- In Chile the creation of ISRs is impeded by the same factors as in other countries, such as a lack of demand by firms, an academic research culture which does not emphasise economic relevance, low mobility of researchers, among others.

- However, these problems are more acute in Chile than in most OECD countries for the following reasons:

  1. **Capability failures (*).** There is a shortage of the type of human resources necessary for vibrant ISRs:
     - On the supply side, neither the institutional culture of universities nor their curricula encourages engineers to complete their studies with a PhD or Master's degree in areas relevant for technological innovation.
     - On the demand side, job prospects in industry for graduates in scientific disciplines is limited by the lack of awareness among company managers and owners of the importance of innovation for long-run productivity improvements.

Source: (*) OECD, 2007: *OECD Reviews of Innovation Policy CHILE*

Diagnostic of industry – science relationships (ISRs) in Chile

2. **Institutional failures.** The institutional frameworks commonly used to promote ISRs are underdeveloped:
   - This is particularly the case for public-private partnerships; the government has quite recently started to promote them through a pilot programme (*).
   - There does not seem to be a specific mechanism for stimulating and organising a dialogue between companies and educational institutions, both high schools and universities, regarding current and prospective needs of specialised human capital (*).
   - Also, Chile does not have a specific mechanism for stimulating and organising the knowledge bridge between companies and universities, regarding current and prospective needs of technological innovation.

3. **Other failures.**
   - There is a low demand for R&D from industry.
   - Also, public spending in R&D is concentrated in basic research.

Source: (*) OECD, 2007: *OECD Reviews of Innovation Policy CHILE*

Benefits and obstacles to industry-science relationships

Industrial System

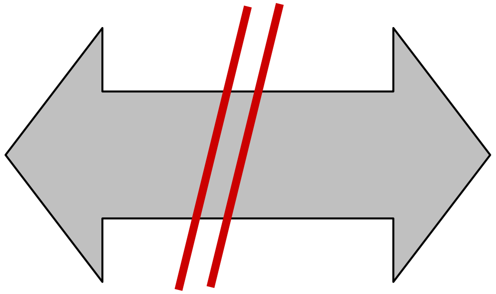
- Speed-up the acquisition of new knowledge
- Increase the innovation capacity
- Upgrade innovative network
- Access human resources in S&T

Obstacles:

- **Low propensity to innovate and weak absorptive capacity**
- **Lack of qualified S&T personnel**
- **Short time horizon of investment in innovation**

Obstacles between the two systems:

- **Non-conducive framework conditions (e.g. barriers to entrepreneurship)**
- **Ineffective intermediaries**
- **Deficient legal and regulatory, and institutional framework**



Education and Research System

- Secure and diversify the funding base
- Provide ideas and guidance for research priorities
- Improve research tools and capabilities
- Improve job prospects for students

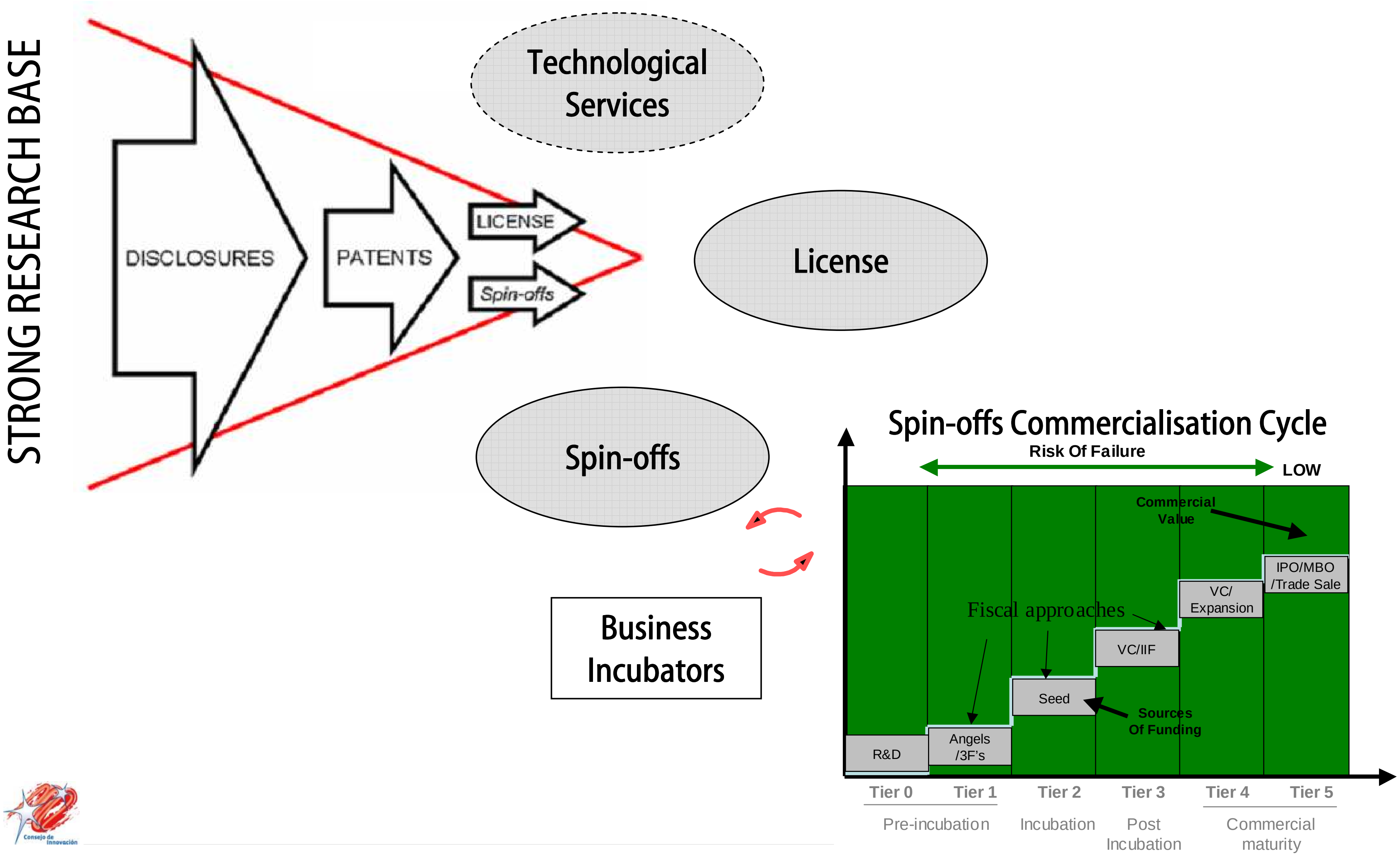
Obstacles:

- **Inappropriate researchers' incentive**
- **Over-specialisation in non business relevant fields of research**
- **Regulatory obstacles to researcher´s mobility and academic entrepreneurship**

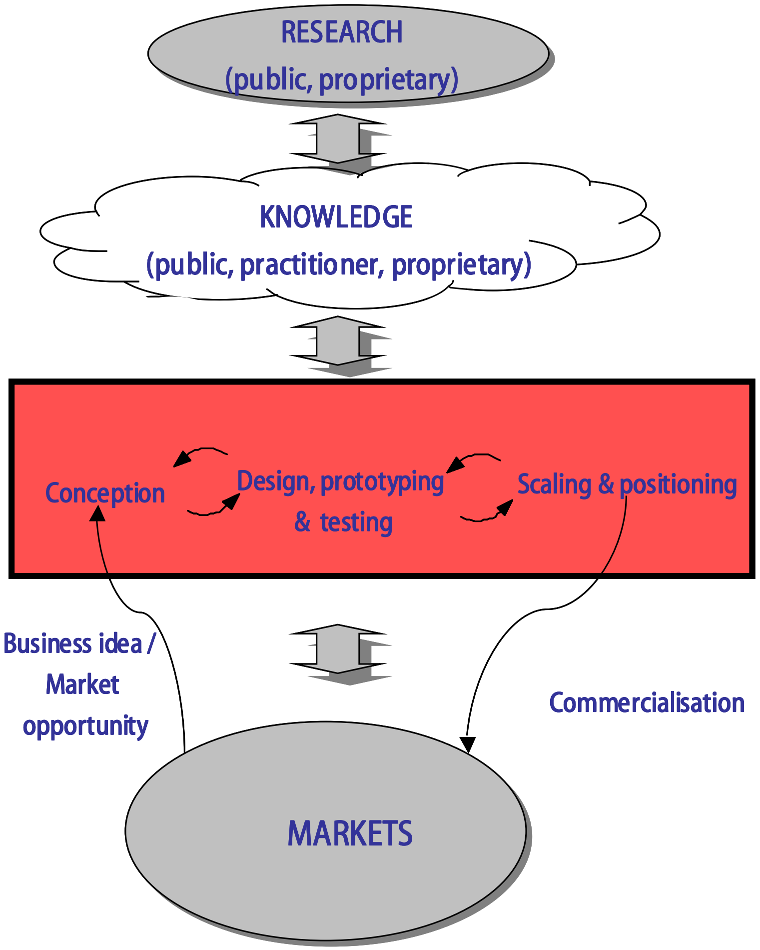
Source: OECD, 2007: *OECD Reviews of Innovation Policy CHILE*

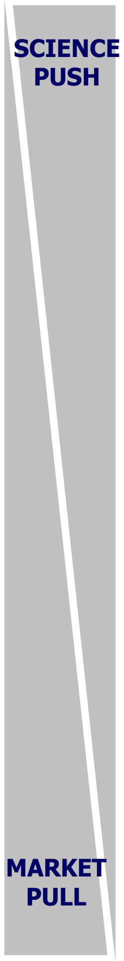
Proposal for the development of world class Technology Commercialisation Units in Chile

Value chain of knowledge transformation



Technology Commercialisation Units for Chile (differs from US)





SCIENCE PUSH

- Disclosure identification
- Business strategy
- IP protection

MARKET/DEMAND PULL

- Business intelligence
- Identify and channel R&D needs from industry
- Sponsored R&D contracts negotiation

- Licensing agreement negotiation
- Spin-off structuring & negotiation, Coordination with incubators & funding system (seed capital, business angels, venture capitalists)
- Monitoring licensing agreements and companies' stakes
- Control and enforcement of:
  - Incentives structure
  - IP rights
  - Code of ethics
  - Value of ownership

Source: Based on Stephen J. Kline & Nathan Rosenberg Model

Creation of world class Technology Commercialisation Units(TCU) in Chile

Goal

" Creation of specialised TCU for dissemination and commercialisation of technology in order to create bridges between scientific and technological capacity and the productive and service sectors"

Scale

Depending on the quality and quantity of research the institution must evaluate the possibility of a consortium with other institutions

Key Success Factors

There must be a special focus in four factors:

1. Defining management policies for intellectual property at universities and institutes
2. Defining management policies of conflicts of interests
3. Developing a neat business model
4. Having highly qualified and specialised personnel

Consejo de Innovación

① IP management policies

- IP is the central element that allows the commercialisation of technology
- IP policies should:
  - Generate IP rights for the TCU, University, Faculty/Department and research team
  - Include incentive mechanisms for technology commercialisation
  - Include ways of ensuring that publications are aligned with IP protection

Source: Fundación Chile, 2004: *Formulación de un Modelo de Entidades de Transferencia Tecnológica*

② Conflict of Interests management policies

- IP ownership belongs to University (Bayh-Dole Act in the US), except for the case of sponsored research that have to be negotiated up-front with companies
- Net benefits from IP go to: research center, research team (30-50%), university overhead and TCU (15%)
- In general, conflicts arise between companies that have R&D contracts with the university and researchers
- International literature describes potential conflicts between the creation of new companies (or participation in existing companies) by researchers and R&D contracts execution
- Universities should:
  - Develop an explicit statement about what is considered as a conflict of interest (Code of Ethics)
  - Nominate ex-ante a competent authority to act as a judge if necessary

Source: Fundación Chile, 2004: *Formulación de un Modelo de Entidades de Transferencia Tecnológica*

③ Sustainable Business Model

- Deal flow / Consortium
  - Depending on the expected deal flow universities should consider associations with other universities

- Joint ventures / World class advise
  - Given the stage of development of Chilean commercialisation units, the business model should consider world class coaching/advise from the beginning
  - The business model should incorporate international networking/alliances (global venture capital, business and market intelligence, tech antenna, etc)

Source: Fundación Chile, 2004: *Formulación de un Modelo de Entidades de Transferencia Tecnológica*

③ Sustainable Business Model

- Structure
  - Director, 2 programme managers and 2 analysts: USD 380.000 per year in fixed salaries
  - Management costs: USD 50.000 per year
  - Professional services (legal, due diligence, others): USD 200.000 per year
  - Overall cost > USD 650.000 per year (depending on deal flow, incentives, etc)

- Funding
  - Significant base funding for the implementation stage (3 to 5 years)
  - Long run sustainability (sources of income)

④ Highly qualified and specialised personnel

- Director:
  - PhD in Eng or Biotech with technology business experience
  - Alternatively, MBA or PhD in Economics with technology management experience
  - Fluent in English / Leadership, negotiating and networking skills

- 2 Programme Managers:
  - 1 PhD in Life Sciences or Biotech with 10 years technology and product development experience
  - 1 PhD in Engineering with 10 years technology and product development experience
  - Fluent in English

- 2 Analysts:
  - Economist or Engineers with MSc with 5 years experience in technology project evaluation

Source: Fundación Chile, 2004: *Formulación de un Modelo de Entidades de Transferencia Tecnológica*

Policy implications for Chile

Linking metrics to funding decisions (performance-based funding)

- The process of linking metrics to funding mechanisms can be divided in 3 steps:

1. The development of indicators and measurement system
    - Development of metrics
    - Clear specification guidelines for collecting data
    - Development of survey instruments

2. Data analysis and scoring mechanisms
    - Translation of collected indicators into scoring and ranking systems reflecting performance in tech transfer.

3. Development of a funding allocation system
    - Resulting data can be added to other information offered to a decision making panel
    - Resulting data can be translated into a funding allocation using a formula

Source: Molas-Gallart, J., A. Salter, P. Patel, A. Scott, & X. Duran, 2002: *Measuring Third Stream Activities. Final Report to the Russell Group of Universities*. SPRU, University of Sussex. UK.

Possible indicators to be included

Component	Indicator	Collection costs
1. Technology commercialisation	• N° of patents applications • N° of patents awarded • N° of licences granted (including option agreements) • Royalty income (including option fees)	• Moderate
2. Entrepreneurial activities	• N° of spin-offs created in the last 5 years • N° of current employees in spin-offs created in the last 5 years • Turnover/profits from spin-offs and commercial arms • Development funds and loan facilities provided by universities to support start-ups	• Moderate
3. Contract research with non-academic clients	• Value of contract research carried out by the university • N° of contracted research deals (excluding follow-on deals) signed by universities with non-academic organisatio	• Medium
4. Flow of academic staff, scientists and technicians	• N° of faculty members taking a temporary position in non-academic organisations • N° of employees from non-academic organisations taking temporary teaching and/or research positions in universities	• Medium

Source: Molas-Gallart, J., A. Salter, P. Patel, A. Scott, & X. Duran, 2002: *Measuring Third Stream Activities. Final Report to the Russell Group of Universities*. SPRU, University of Sussex. UK.

Funding allocation formula in the Higher Education Innovation Fund of UK

Component	Purpose	Weight
1. Potential and capacity building	A forward-looking component to reflect potential and allow for capacity building. This is based on academic staff numbers.	45 per cent of funding
2. External income	A component to reward performance to date, using external (business) income as a proxy to reflect the value which demand-side partners place on interaction with an institution.	45 per cent of funding
3. Activities not best measured by income	An activity-based component, rewarding current and desirable performance on measures other than income.	10 per cent of funding

Source: HEFCE, 2005: *Higher Education Innovation Fund Round 3*. HEFCE. UK.

Discussion and next steps

Proposal for next steps

Component	Key issues	Responsible
1. Formal commitment between Government , Universities and CNIC (September 2008)	• Signature of a formal agreement to develop world class technology commercialisation units in Chile • Agree an international expert team to coach the entire process	• Government • Universities • CNIC
2. Development/ Enhancement of a Technology Commercialisation Strategy (August 2008 -)	• IP management policies • Conflict of interests management policies • Sustainable business model • Highly qualified personnel • World class advise	• Each University • Consortium of Universities
3. Development of indicators and measurement system (September 2008 - January 2009)	• Agree and develop an initial list of indicators • Associated data collection manual • First measure of tech commercialisation activities	
4. Development of policy mechanism	• Develop a performance-based funding instrument (linking metrics to funding decisions) • Ensure specific budget for this purpose	• Government

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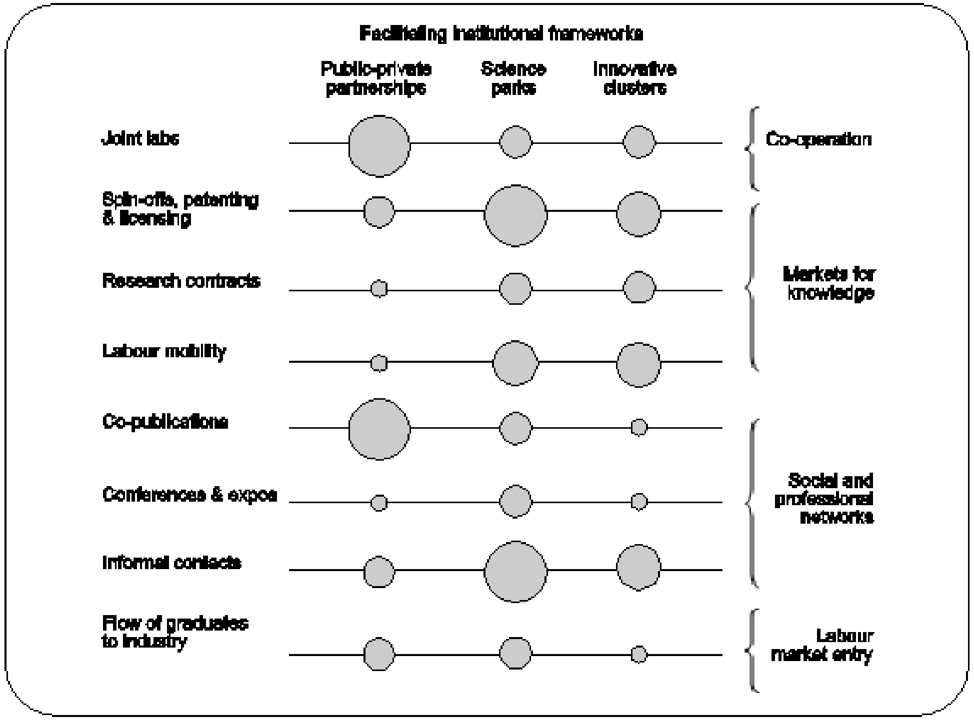
Channels of industry – science relationships



Source: OECD, 2007: *OECD Reviews of Innovation Policy CHILE*