Technology Transfer: Instruments and Market-based Incentives

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Presentation Outline

I. Economics of Tech Transfer
II. Contextual Challenges
III. Framework
IV. Instruments
V. Main Takeaways
I. Economic Theory: Knowledge

Knowledge is the driving force key to the growth and employment creation inherent in the process of economic development

Where does knowledge come from?

• “Falls from heaven”, capital accumulation (Solow, 1957)
• Supply side - New Growth Theory, role of institutions in investing in knowledge creation and accumulation (Griliches, 1979; Romer, 1986; Lucas, 1988)
• Demand side – enterprises as conduit for spill overs of knowledge (Audretsch et al., 2012)

Does this spillover occur automatically?

• Penetrating the “Knowledge filter” (Aldridge & Audretsch, 2010)
I. Economics of Tech Transfer: Market Failures

Information Asymmetry

• Valuation of discovery
• Uncertainty about appropriation

Incentive misalignment

• Short-term/incremental improvements versus academic achievements
• Legal and regulatory framework and the incentives for collaboration

Access to specialized resources and support mechanisms

• Information: matching, valuation, market intelligence
• Finances: bridging the “valley of death”
• Skills: commercialization specialized skills

(Zuniga & Correa, 2013)
I. Economics of Tech Transfer: Systems Failure

- **Network failures**: lack of linkages between firms and institutions in the ecosystem, resulting in loss of opportunities for learning/complementarities.
- **Institutional failures**: Weak governance of the innovation ecosystem; universities and research institutions; intermediary institutions.
- **Framework failures**: regulatory framework; investment climate; competition policy; background conditions (entrepreneurial culture).
II. Contextual Challenges of Tech Transfer in ECA

Generally, “European Academic Paradox”
- Strong science, weak commercialization

Legacy issues: readjusting research orientation
- RDIs traditionally designed to serve SOEs
- Linkages to SMEs were absent

SMEs’ limited capacity to identify tech., organizational, and managerial needs
- Demand for tech transfer (*its nature & channels*) strongly determined by level of economic development in the region
- Low levels of private R&D investment amplifies role of publicly-funded R&D

Commercialization specialized skills and technical capacity
- Importance of tacit knowledge and learning by doing

Entrepreneurial culture & institutional framework
- Incentive structure, risk taking, research governance, IPR regime, access to finance, degree of internationalization
III. Framework: Tech Transfer and Shaping Conditions

Public Research and Education

Entrepreneurial Culture

Institutional & legal framework incentives

Econ Dev. & industry demand

Research capabilities and orientation

Framework & business conditions

Industry Innovation and New Tech. competences

Intermediation support

(adapted from Zuniga & Correa, 2013)
III. Framework: Formal and Informal Channels for Tech and Knowledge Transfer

- Public Research and Education
  - Scientific publications
  - Conferences, seminars, workshops, etc.
  - Education and training, mobility
  - Joint research, centers of excellence
  - Consultancies, contract research, ext. services
  - Tech licensing, royalties
  - Spin offs
  - Use of research infra.

- Industry Innovation and New Tech. competences

(adapted from Zuniga & Correa, 2013)
III. Framework: University TTOs as a Platform for Tech Transfer

<table>
<thead>
<tr>
<th>Primary objectives of the UTTO</th>
<th>Percentage of times appeared in mission statement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensing for royalties</td>
<td>78.72</td>
</tr>
<tr>
<td>IP protection/management</td>
<td>75.18</td>
</tr>
<tr>
<td>Facilitate disclosure process</td>
<td>71.63</td>
</tr>
<tr>
<td>Sponsored research and assisting inventors</td>
<td>56.74</td>
</tr>
<tr>
<td>Public good (disseminate information/technology</td>
<td>54.61</td>
</tr>
<tr>
<td>Industry relationships</td>
<td>42.55</td>
</tr>
<tr>
<td>Economic development (region, state)</td>
<td>26.95</td>
</tr>
<tr>
<td>Entrepreneurship and new venture creation</td>
<td>20.57</td>
</tr>
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</table>

\[ N = 128 \text{ TTOs}. \]

(Markman et al., 2005)
III. Framework: University TTOs as a Platform for Tech Transfer

### Licensing

- Bayh-Dole as one of several key influences behind the increase in university patenting and licensing (Mowery et al., 2001)
- Increased disparity in licensing incomes of US universities with those in other countries (WIPO, 2011)
- In terms of licensing, European TTOs performed comparably to their US counterparts but earned significantly less revenue from licensing activities (Conti & Gaule, 2011)

### Academic Entrepreneurship (AE)

- Startups emanating from US universities reported by AUTM averaged 426 per year from 1998 to 2004
- Many Spin-off activities that occur "through the back door" (Shane, 2004).
- Need to adapt promotion and tenure and remuneration systems for academics

### TTOs versus “Hubs for Entrepreneurship” support

- TT officers may or (more likely) may not have the networks needed to connect academic entrepreneurs to the 'right' resources and contacts
- Conflict of interest: short-term revenue goals versus long-term goals of AE
- TTOs may be impeding compared to a decentralized network approach (Hayter, 2016)
III. Centrality of the Firm: Tech Transfer as Leverage for Upgrading Firm Capability

**FIRM CAPABILITY**
- Access to Skilled Labor & Talent (STEM)
- Linkages to knowledge diaspora - Mentorship
- Access to Tech / R&D
- Access to Global Managerial skills
- Business Dev. Services

**MARKETS**
- Competitive Markets
- Trade Logistics
- Linkages to GVCs
- Access to regional/global markets
- Gov. Procurement

**FINANCE**
- Seed Grants
- Angel Investors Networks
- Venture capital
- Crowdfunding Platforms
- Debt/Credit Facilitation, SME funds, Early stage VC
- Emerging market PE funds
- Seed/startup funds
- Incubators & Accelerators
- Entrepreneurial Universities
- Competitive Trade regime
- Bi/multilateral Trade agreements
- Skilled Work Force
- Functioning IPR regime
- Adequate R&D capacity
- Functioning hard/soft infrastructure
- Active university-industry linkages
- Dynamic Innovation and Entrepreneurship Ecosystems and Enabling Policies

**ENVIRONMENT**
- Pre-Seed/ Seed
- Start-up
- Early growth
- Growth
- Developed/ Established
But most innovation in developing countries is imitation rather than radical.

Source: Cirera et al, 2015
IV. Instruments: A Typology of Innovation Policy Instruments

### IV. Instruments: Vouchers

<table>
<thead>
<tr>
<th>Definition</th>
<th>Evidence of impact</th>
</tr>
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</table>
| Vouchers are small grants allocated to non-innovative SMEs to purchase services from external knowledge providers. The main objective is to induce non-innovator SMEs to start collaborating with knowledge organizations and providers. Vouchers are often entitlement-based rather than competition-based. | • Overall: no input additionality since it doesn’t require matching contribution. Most relevant to small firms in service industry  
• Output additionality: some project additionality and some positive impact on sales and value added in the short-run  
• Behavioral additionality: some follow up projects, evidence of change of attitude towards collaboration  
• Spillover effects: improved firm public profile after collaboration with universities. |  

<table>
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<tr>
<th>Market and system failure addressed</th>
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| The policy justification for the application of grants & matching grants:  
• Capability failure  
• Information asymmetry |  
• Coordination/network failure  
|  

<table>
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<tr>
<th>Target group</th>
<th>Key “must have” for replicability</th>
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| SMEs.  
Knowledge providers: including private sector knowledge providers |  
• Required competence from SMEs: identifying the challenge, providing detailed description of service required  
• Competence from knowledge providers: capability & willingness to work with SMEs  
• Enabling conditions: matching and brokerage, verification system to avoid fraudulent use |  

<table>
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<tr>
<th>Strengths</th>
<th>Potential drawbacks &amp; risks</th>
<th>Do’s</th>
<th>Don’ts</th>
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| Simplicity in design, implementation, & evaluation. Minimal bureaucracy, low cost  
Flexibility for recipient to decide how to use  
Demand orientation, projects are defined according to the actual need of the SME. | Risk of one-off transaction, lack of long-term behavioral change  
Difficulty to reach aimed target group, high risk of non-additionality  
Risks of lock-in with local knowledge providers  
Fraudulent use of the scheme, complicity of SMEs and service providers | • Take stock of supply/demand for knowledge services  
• Design simple application and selection procedures  
• Define range of services covered  
• Design (small) voucher amount  
• Adopt proactive advertising  
• Setup brokerage services  
• Data collection for evaluations | • Overcomplicate application procedures  
• Leave list of services providers open  
• Underestimate role of knowledge providers in bearing application paperwork  
• Overstretch role of the scheme  
• Expect development of large innovation projects |

IV. Instruments: Grants and Matching Grants

### Definition
Grants represent direct allocation of funding from public agencies to innovation actors to finance all or part of an innovation project. Modalities of grants are primarily defined by dimensions such as the selection mechanism, size, duration, eligible activities, payment procedures and delivery mechanisms.

### Market and system failure addressed
The policy justification for the application of grants & matching grants:
- Externalities and spillovers
- Information asymmetry
- Coordination failure
- Capability failure

### Target group
- Individual firms, and among them, SMEs.
- Collaboration between firms or between firms and other organizations

### Strengths
- Selectivity of goals, and directionality of policy.
- Ease of implementation, relative to other instruments.
- Flexibility and Control in the definition of conditions for support.
- Signaling power for accreditation of firms capabilities.

### Potential drawbacks & risks
- Managerially and bureaucratic costs compared to indirect mechanisms
- Require monetary stability
- Susceptible to government failure
- Inability to address broader policy issues.
- Can crowd out private funding

### Evidence of impact
- **Overall**: positive impact of grants schemes on business innovation; especially regarding input and behavioral additionality. Literature rejects full crowding-out effects, while confirming crowding-in effects, especially in emerging countries
- **Output additionality**: additionality of grants schemes is relatively limited compared with that on input additionality, but includes: Growth –employment: 4.6-6.4% %; sales: 11.5-39.6%; 31.4% increase in TFP; 6-10% increase in labor productivity.
- **Behavioral additionality**: increased their probability of innovating by 19.3%. higher probability to initiate new collaborations by about 27%.

### Key “must have” for replicability
- Capability needs to design and implement policy instruments
- Industry and collaborators competence: infrastructure & managerial competencies
- Design and implementation factors: M&E and learning
- Enabling conditions: brokerage, absorptive capacity, such as openness and learning behavior, verification system to avoid fraudulent use

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### Do’s
- Consider alternatives
- Evaluate the extent of market failure and potential additionality of beneficiaries
- Ensure political commitment predictability and policy continuity
- Design agile and simple application processes

### Don’ts
- Don’t simply assume that grant is the right response
- Don’t select the participants on the merit of proposals, as they are likely to find private funding sources independently
- Don’t treat all firms within the same broad target group

V. Main Takeaways

• A strong *Research System* is a precondition for TT policies
  ➢ Centrality of the scientific research Reform agenda

• Tech transfer is more than establishing TTOs
  ➢ Informal knowledge transfer is as important, and not captured in metrics

• Adopt an ecosystem approach
  ➢ *Transactionally*: Intelligent public interventions should address bottlenecks on the supply and the demand sides
  ➢ *Institutionally*: sustainable, long-term funding, targeting strategic specialization areas

• Don’t underestimate the culture
  ➢ Time to build institutions’ capacity and learning by doing
Thank you

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