Second LAEBA Annual Meeting
Buenos Aires, Argentina – November 28-29, 2005

Innovation Policy for Development: An overview

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Sponsored by
Inter-American Development Bank
Integration and Trade Sector
Institute for the Integration of Latin American and the Caribbean (INTAL)
Plan of talk

• Introduction: broadening the notion of innovation; innovation and growth in historical perspective
• The economic rationale for Government support of innovation and R&D
• Expanding on spillovers in development economies
• Key Issues: Outward- vs. locally oriented innovations; General Purpose Technologies (GPTs)
• Promise and limitations of innovation policies: The case of Israel
• Drawing guiding principles for innovation policies; main levers: skills, incentives, information, finance.
Introduction

the view of R&D/Innovation policy as panacea

Riding the wave of The “Knowledge Economy”:

• In the EU the Lisbon agenda: 3% \( R&D/GDP \)

• Race in emerging economies to develop innovation policies, set up Gov support to R&D (e.g. eastern Europe, Central Asia, etc)

• Presumed success stories turned into “role models”: Finland, Israel, Taiwan, Bangalore (India).

• Bandwagon effect in the globalization of R&D; rush to attract and set up Venture Capital funds.

Is all this really relevant for development?
Constructive skepticism…
Intro 2: Broadening the notion of innovation

• Typically associate innovations with new/better products (e.g. CDs vs. magnetic tapes, GPS, cardiac stents), nowadays particularly with improvements in Information & Communications Technologies (ICT).

• But in fact much broader notion, including all sorts of “process innovations” and organizational changes, e.g.
  - Rearranging the sequence/timing of tasks,
  - Better transportation modes,
  - Altering the composition of inputs & skills,
Intro 3:  
Innovation and growth in historical perspective

1. The cumulative effect of *widely distributed* small improvements has been as significant for growth as the impact of discrete, “higher order” innovations.

2. Innovations entail *interdependencies*, necessitating and triggering further complementary investments and innovations in order to reap their full benefits.

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*Innovation policies for development should include much more than just supporting formal R&D projects, more than just in “high tech” sectors.*
The Economic Rationale for Government Support of Innovation and R&D

R&D

Endogenous growth theory: economic forces shaping R&D hence TFP

ΔK

Arrow (1962): Social >> private returns
1. Spillovers: Partial appropriability
2. Information asymmetries: funding gap

TFP

Solow (1957): TFP key to growth

Growth

Too little innovation => need Government intervention (e.g. subsidize R&D)
Expanding on Spillovers

- Spillovers: The basics
- Broadening the Scope of Spillovers:
  (i) Post-innovation competition
  (ii) “Demonstration effects” in diffusion
  (iii) “Demonstration Effects” again: rent-creation vs. rent-seeking norms
  (iv) Who really benefits from spillovers in a global economy?
Spillovers: the basics

1. Innovations generate positive externalities (e.g. new ideas, new $K$) that benefit other would-be inventors;

2. Innovations confer benefits to purchasers of new products (consumers and producers) that often exceed sustainable increases in price;

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*social returns from innovations $>>$ private returns*

Spillovers channels:

- local interactions, information diffusion, mobility,
- International trade, FDI
Broadening the Scope of Spillovers

(i) Post-innovation competition

- Markets in developing countries tend to be highly concentrated and stagnant;
- A single innovator may break the mold and trigger a process of “spiraling innovations”;
- Hence “spillovers”: initial innovation brings about further innovation.
- Policy implications: encourage *first-time* innovators in static markets; prevent dominant firms from denying foothold.
(ii) “Demonstration effects” in diffusion

• Early adopters positively impact later adopters: network externalities, informational effects, emulation, etc.
• Thus early adopters/innovators: source of spillovers;
• Finding: diffusion of new techs *slower* in less developed countries;
• Policy implications: support early adopters, particularly of technologies that can enhance productivity in wide range of sectors.
“Demonstration Effects” again: rent-creation vs. rent-seeking norms

- J. Mokyr: precondition for Industrial Revolution (thus for growth), the shift from rent-seeking to rent-creation behavior and institutions, encouraged by the Enlightenment.

- Shift yet to occur in many developing countries: is it more attractive for entrepreneurs to search for innovative ways to further extract rents, or to develop new technologies?

- Policy implications: change cost-benefit of rent-seeking versus rent-creation, help market pioneers. Need the local “Thomas Edison”, the local “Steven Jobs” to emulate.
(iv) Who really benefits from spillovers in the global economy?

• **In large economies with small \((Ex+Im)/GDP\)** (e.g. USA), spillovers benefit mainly the local economy:
  - Large: high \(Prob.\) that other local agents will benefit,
  - Low \((Ex+Im)/GDP\): small risk of spillovers slipping out.

• **In “small” open economies:**
  - Fewer potential local recipients ("small": size of relevant sectors, not population or GDP);
  - spillovers may easily spill out, benefiting foreign firms and consumers rather than local economy;
  - But may be recipient of trade-mediated spillovers (e.g. Coe & Helpman) \(\Rightarrow\) need “absorptive capacity”
(iv) cont.: Local vs. Global Spillovers - some policy implications

Just promoting local innovation may not result in faster growth. Innovation policies should aim not just at increasing R&D, but do so in a way that,

• incentivizes spillovers inflows rather than outflows;
• develops “absorptive capacity”;

None of it can be taken for granted in small open economies, certainly not in developing countries.
Innovation and Development
*zooming in*

1. Outward-oriented innovations vs. serving local markets

2. Innovation in the context of General Purpose Technologies (GPTs)
Outward-oriented innovations vs. serving local markets

• (Wrong) perception that globalization implies there are no “local needs” or “local markets”, hence local innovators should only serve global demand.
• True, markets are global, linking up with them is important, but so is locally-oriented innovation.
• Recognition of inherent heterogeneity of preferences/“needs”, and of vast opportunities to increase consumer surplus and profits by catering to this heterogeneity - “mass customization.”
The need for locally-oriented innovation in developing economies

Typical examples:

• **Health care**: very different incidence of diseases; need for e.g. cheap prevention rather than high end technology, etc.

• In **ICT**: simpler software packages (not more features), less demanding on hardware, more backwards compatibility;

• If population spread over large, unwired areas: satellite-based broad band internet.
Why the failure to innovate for local markets?

Potential large surplus

Local spillovers

Global demand

fixed cost: R&D

Local demand

Q

P
Innovation and Development in the context of “General Purpose Technologies” (GPTs)

GPTs as “engines of growth”, e.g. the steam engine, electricity, ICTs:

• GPTs drive growth by spreading over a wide range of sectors, prompting them to innovate as well (i.e. “innovational complementarities”).

• Progress in the adopting sectors feeds back into the GPT sector => further advances in the GPT itself, feeding a positive, self-sustained loop.
GPTs continued


• The GPT sector: small, cannot pull on its own the whole economy (no “locomotive”): if the rest of the economy fails to adopt the GPT, or fails to make complementary innovations, growth will not materialize.

Policy: focus not just on the prevailing GPT (ICT now), but on the potential “Walmarts”…
Promise and limitations of innovation policies:
The case of Israel
Background and Features of Policies

Background (1970’s):

Israel had little resources, but highly skilled manpower, scientific prowess – how to mobilize them for growth? **Strategic Decision:** Jump-start and breed a “science-based” sector by providing broad financial support, and making up for market failures.

**Hallmark of policies:**

- **“Neutrality”:** respond to market demand/signals, do not “pick winners.”
- **Dynamic/Innovative:** create new and varied support programs according to evolving needs; avoid “self-perpetuating” programs.
Main R&D-Support Programs in Israel

- **Matching grants to commercial R&D projects** - criteria: innovativeness, tech and commercial feasibility, risk, spillovers; paybacks if success; some strings attached.

- **“Magnet” Program for support of generic, pre-competitive R&D consortia**: corporations + academia; longer term, higher support. Examples: Nano Functional Materials, Streaming Media Messaging, Digital Printing.

- **Technological “Incubators” Program**: from innovative ideas to start-ups.

- **“Yozma” Program 1993-97**: Jump-started the Venture Capital Industry – success, hence discontinued
Indicators of Innovation and R&D performance in Israel: 1990-2000

- ICT production grew 4.6 times (16% per year); share of GDP grew from 5% to 14%;
- Exports grew 6.2 times (to $15 billion), 1/3 of total exports;
- The ICT sector contributed 30% of the growth of GDP;
- 2nd largest VC market after the US;
- US Patents per capita: fourth (after US, Japan, Taiwan);
- Major innovations: ICQ, disk-on-key, camera/pill for gastro imaging, shopping.com, etc.;
- 2004: R&D/GDP = 4.6% (world highest, but...), ~ 4,000 high tech companies.
And yet, sustained growth elusive...

- Wide *disparity* between fast growing High Tech sector and the rest of the economy; stagnant productivity of non-tradable, non-ICT sectors – a “dual economy”:
- In 1996-2004 the ICT sector grew at 10.5% per year, the rest of the economy at just 2.3%; in many sectors TFP declined: Business Sector average: -0.8!
Why?
Innovate here, benefit elsewhere…

1. In spite of neutrality, support mostly product rather than process innovations that could be applied locally; hence little R&D in e.g. services, chemicals, etc.

2. Innovations made in Israel mainly for exports, some spillovers internal, but benefits (e.g. TFP growth) realized mostly abroad.

*no “Wal-Mart effect” in Israel*
Innovate here, benefit elsewhere – cont.

3. **R&D labs of multinationals**: absorb local talent, but where do the benefits of the new K go? (e.g. Intel Israel designed the Centrino chip for laptops – so what?)

4. **VC-backed star-ups**: must exit, mostly by selling off to US-based corporations – again, who benefits? (very few large Israeli-based corporations)

*Israel: powerhouse in generating innovations, but not quite in benefiting from them. And this is a successful case!*
Some lessons from the Israeli experience

1. Cannot have sustained growth by relying just on one fast-growing sector (ICT), while the rest of the economy stagnates:

   *Need to encourage and channel innovativeness also to non-High Tech sectors*

2. Cannot have growth while widening gap across socio-economic segments of the population:

   *Need policies of inclusion, of reaching out to left-behind segments, of expanding the pool of human capital.*
Some (cautious) Corollaries

Drawing guiding principles for development-targeted innovation policies;

Main levers of policies:

- skills,
- incentives,
- information,
- finance.
Guiding principles for Policy

1. Innovation should be *widely distributed* across sectors (not just “high tech”), and type of innovations (not just formal R&D projects).

2. **Bottom up** policies, not top down: provide enabling conditions and incentives => growth-enhancing innovation should spring from widening cohorts of would-be entrepreneurs.

3. Alter the payoffs between innovations aim at *rent creation* versus ingenuity in rent extraction.
Policy levers: (i) Skills

Wide spectrum of skills needed for innovation-based growth strategy, acquired via formal education, training, learning by doing.

Two-pronged strategy:

• Supply universal, baseline education – literacy, basic math, English. Revise and upgrade often. Rely on ICT: shortcut.

• Ensure responsiveness (endogeneity) of institutions supplying vocational and advanced skills (Rosenberg: “Universities as Endogenous Institutions”).
Policy levers: (ii) Incentives

Crucial attractor: Expectation of large rewards to innovation, given risks, costs.

• Traditional factor: appropriability, IP.
• Would-be innovators should have a stake in the firm, good prospects of promotion, outward mobility.
• Low “barriers to innovation” within markets (officially sanctioned regulations, tacit collusion)

Policies promoting,

\textit{inclusion} (of potential innovators), \textit{openness} (of markets).
Policy levers: (iii) Access to Information

- Necessary condition for innovation: access to $K$, info about technology, about markets (substitutes, market size, prices).
- Innovation as "recombination of ideas", hence wide knowledge base.
- **Policy:**
  - Internet access, computer and search skills
  - Openness and competition in media,
  - knowledge intermediaries,
  - transparency in businesses.
Policy levers: (iv) Availability of Finance

- Chronic problem in developing countries, much more acute for innovation, given information asymmetries, lack of collateral, lack of screening expertise.
- Need “angel investors”, internal finance, VCs, etc. Not much available in LDCs.

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- Preeminent government role: provide funding for innovation, many channels possible, e.g. matching grants, conditional loans, etc.
- Lots of international experience – tap it!
To conclude…

Need genuinely innovative research on “Innovation and Development”

- Cannot just translate Arrow (1962) to Swahili…
- Cannot just extrapolate from experience in a handful of successful countries, cannot just borrow their tools and policies

The truth is, we know little, big payoff to economic research in this area!