



**MAINSTREAMING SCIENCE, TECHNOLOGY &
INNOVATION INTO DEVELOPMENT STRATEGY**
- Korea's Experience and IDB's Strategy -

HYUNGHWAN JOO
Senior Advisor
Inter-American Development Bank

August 23-24 – San Salvador, El Salvador



Outline

- **Main Trends in Science & Technology**
- **Policy Challenges for LAC**
- **Building NIS: Korea's Experience**
- **IDB's Strategy**



*Developing countries will likely remain mired in poverty unless they can do what developed countries have done to achieve sustainable growth : **incorporate science, technology and innovation into their economic strategies.***

**UN Millennium Project
Taskforce on Science & Technology and Innovation, 2005**



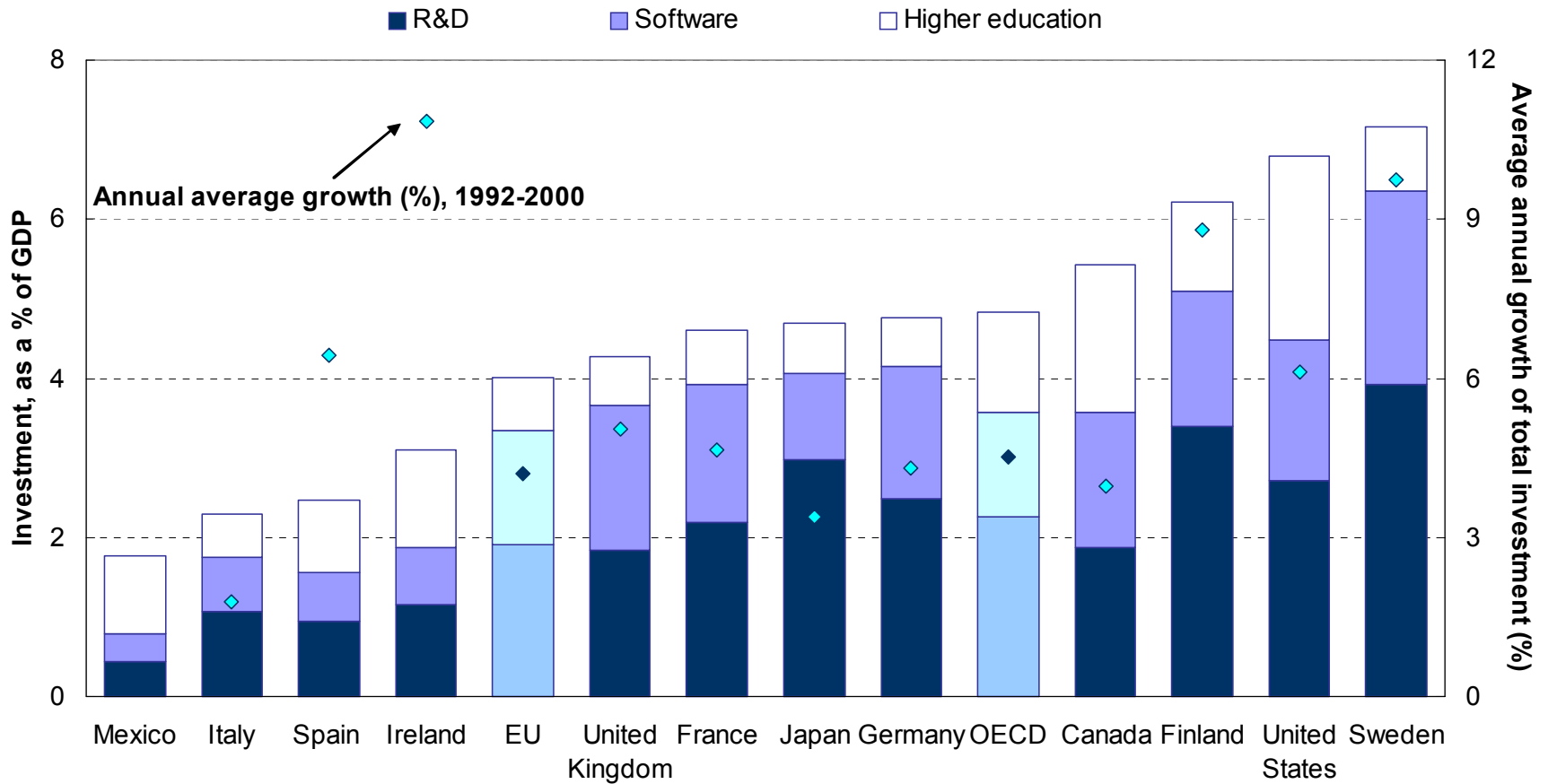
Main Trends (OECD)

- **Investment in knowledge has risen across OECD**
 - In developed countries, **more than half of total investment** is devoted to : R&D, education, software, design, marketing...
 - Innovation accounted for 50% of US productivity growth in 90s
 - Innovation is a key driver of sustainable development, wealth creation and competitiveness
 - ROI: 50% or higher, over the long run. Higher for developing countries
ROI on education and training : 7~ 8% per year
- **(Input) Growing R&D intensity (R&D/GDP)**
Dominance of Business (in R&D funding/personnel)
(Output) Rising patenting/S&T articles/Competitiveness



Investment in knowledge has risen across the OECD...

As a % of GDP, 2000





Main Trends (LAC)

- **Low investment in knowledge, particularly in R&D**
 - Countries in LAC spend **0.6%** of GDP on R&D
Total R&D (**\$12 b.**) < Korea (\$16 b., **2.6%**), US (\$282 b., **2.7%**)
 - R&D intensity has either **decreased or leveled off**
(except for Brazil, T&T, Mexico)
- **Predominance of Public Sector : low share of private funding in total R&D spending**
 - Public to Private ratio: 3 : **7** (OECD), 7 : **3** (LAC)
 - The share of business R&D funding has declined
(except for Brazil, Uruguay)



Main Trends (LAC)

- **Disconnect b/w university & PRIs and industry**
 - The public research is biased toward basic research
 - **Curiosity-driven** rather than market-driven or problem-oriented
 - Lack of “innovation culture” in firms / no channel for articulation
 - **Shortage of researchers**
 - Researchers per 1000 persons: **6~10** (OECD) vs. **0.7** (LAC)
 - **Low IT penetration rate**
 - Low PC penetration, limited broadband connectivity, high access cost
- ⇒ **Rising but still low patenting**
Growing technology gap
Low competitiveness



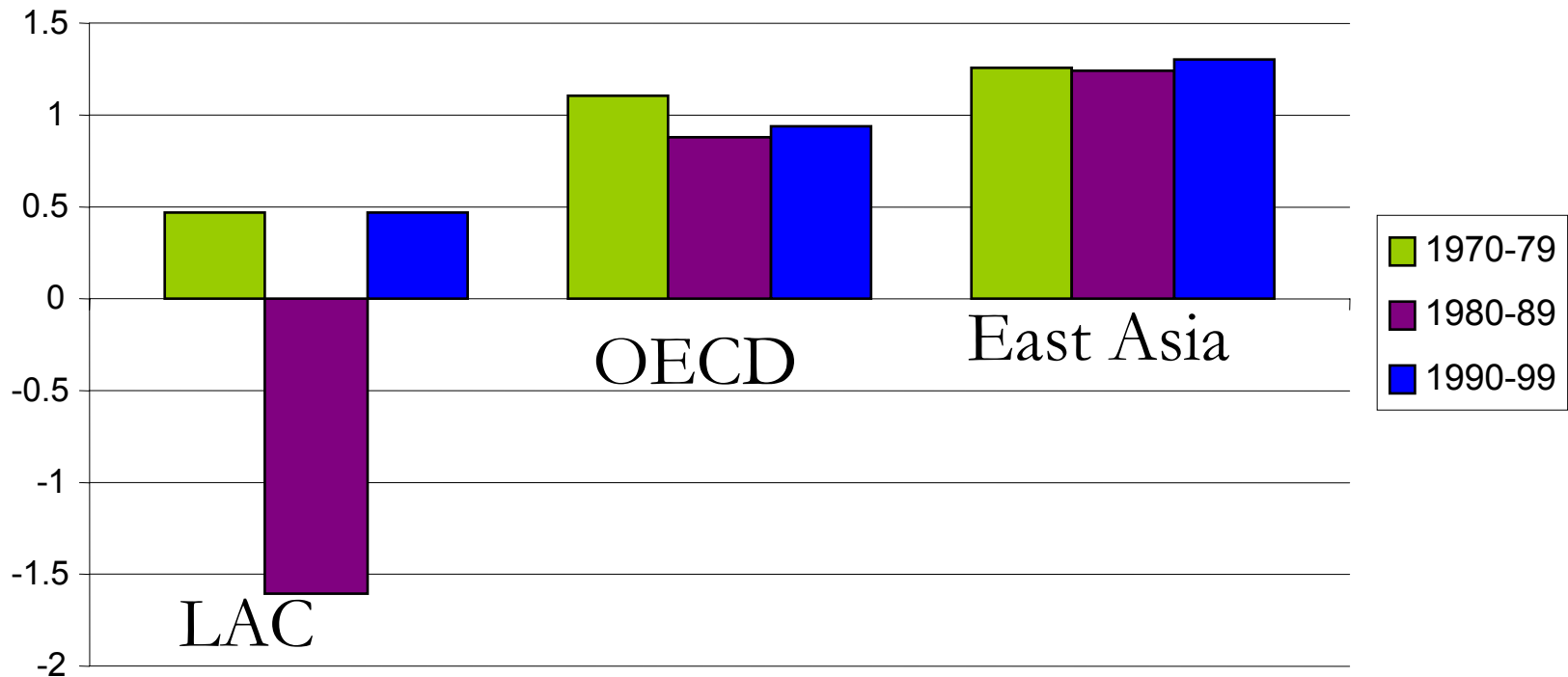
Comparative Snapshot: Key Data

	OECD countries	LAC
R&D as % of GDP	2 ~ 3 %	0.6% (Brazil 1.0%)
Private Sector in R&D	60 ~ 75 %	30 %
Researchers per 1000	6 ~ 10	0.7 (Argentina 1.6)
Internet Users	50 ~ 70%	15%



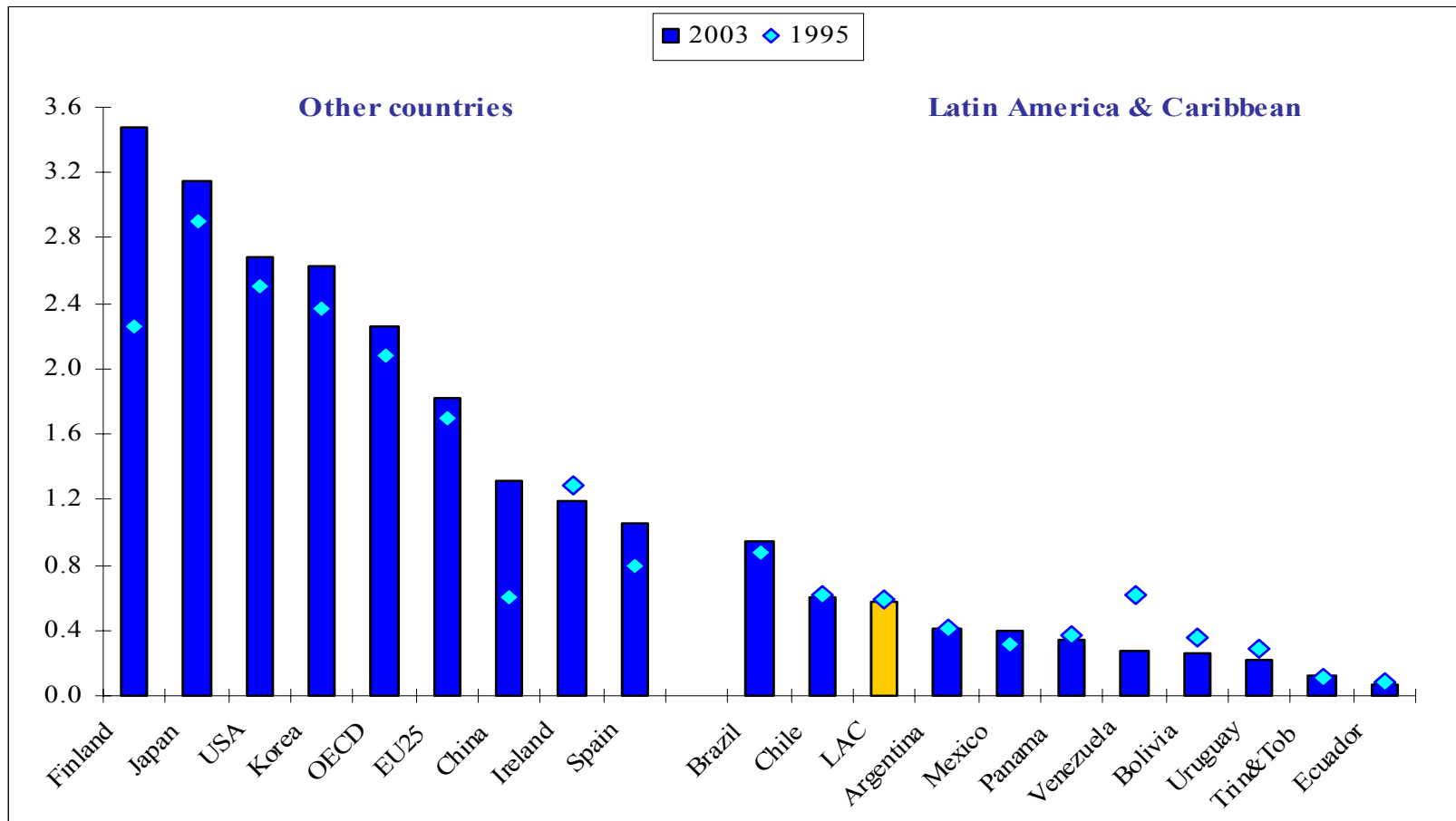
TFP Has Not Been a Source of Growth for LAC Countries...

Annual TFP Growth





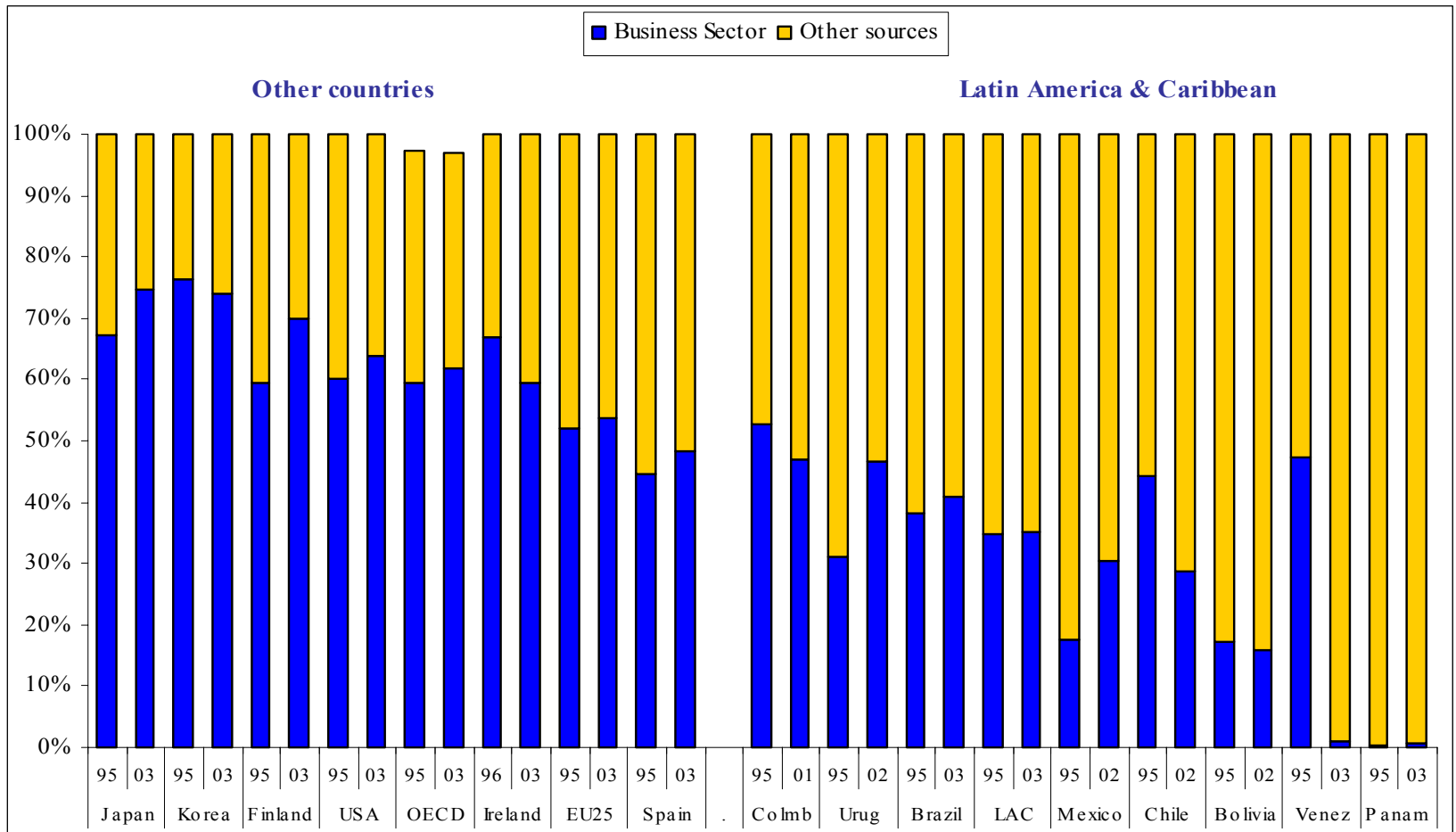
(Input) Low R&D investment has persisted... (R&D expenditure as a percent of GDP)





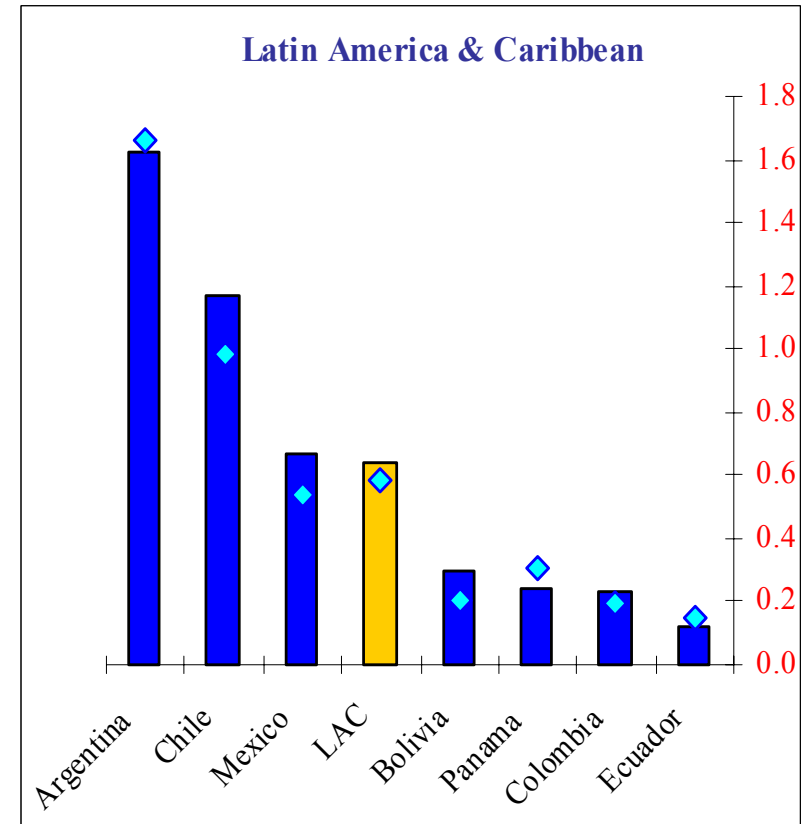
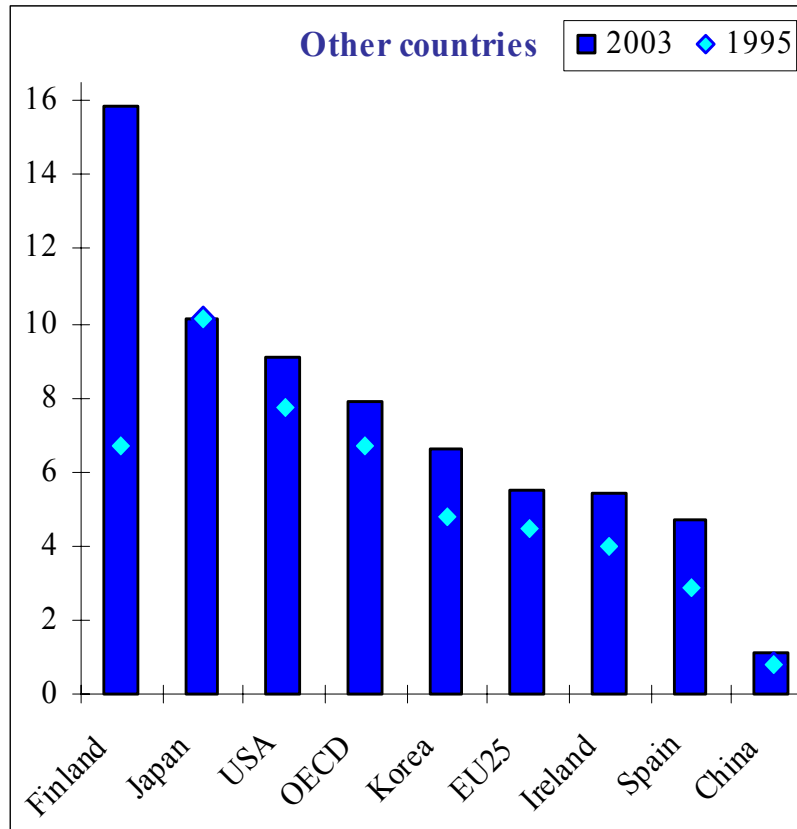
(Input) R&D mostly financed by the public sector...

(R&D expenditure by source of financing)



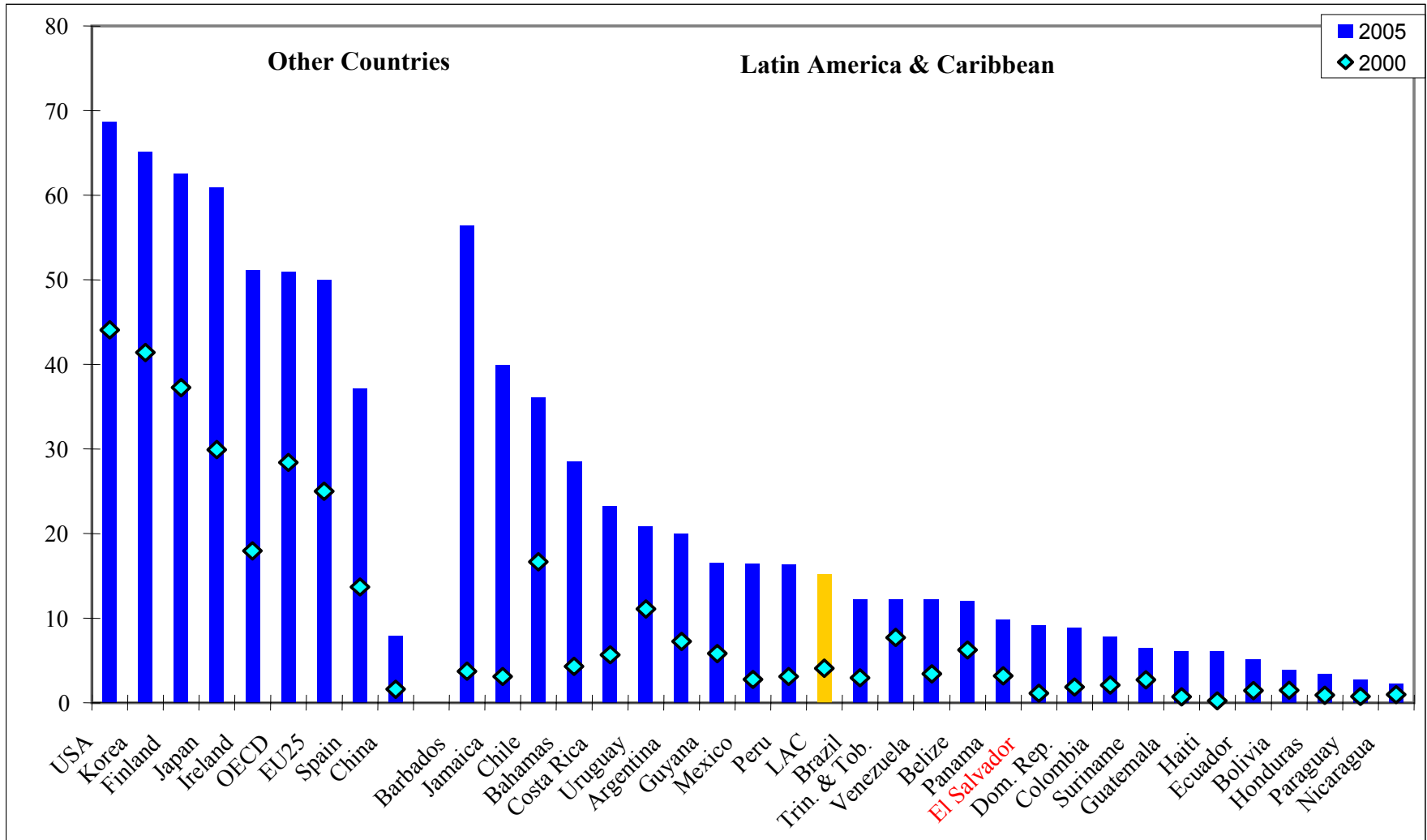


(Input) Too few researchers for growing demand... (Researchers per 1000 labor force)



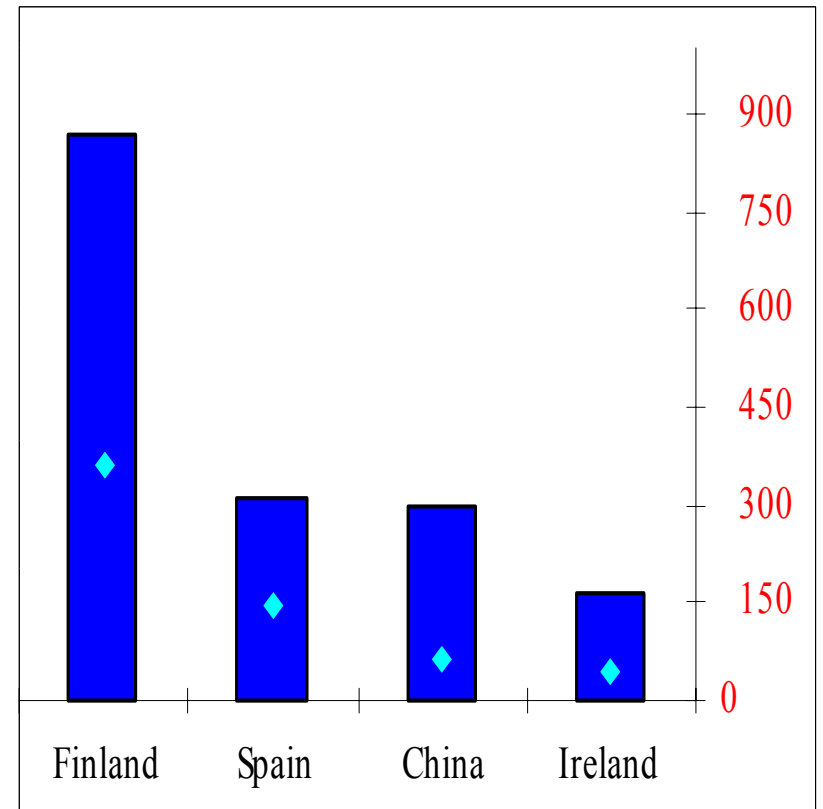
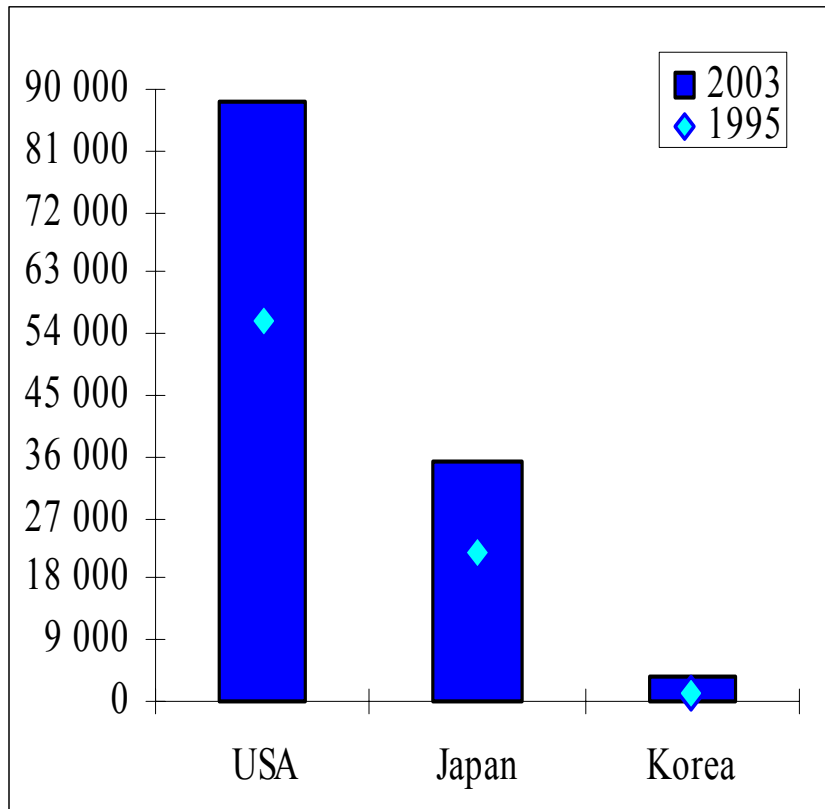


(Input) ICT penetration rate is growing but still low... (Internet users per 100 inhabitants)



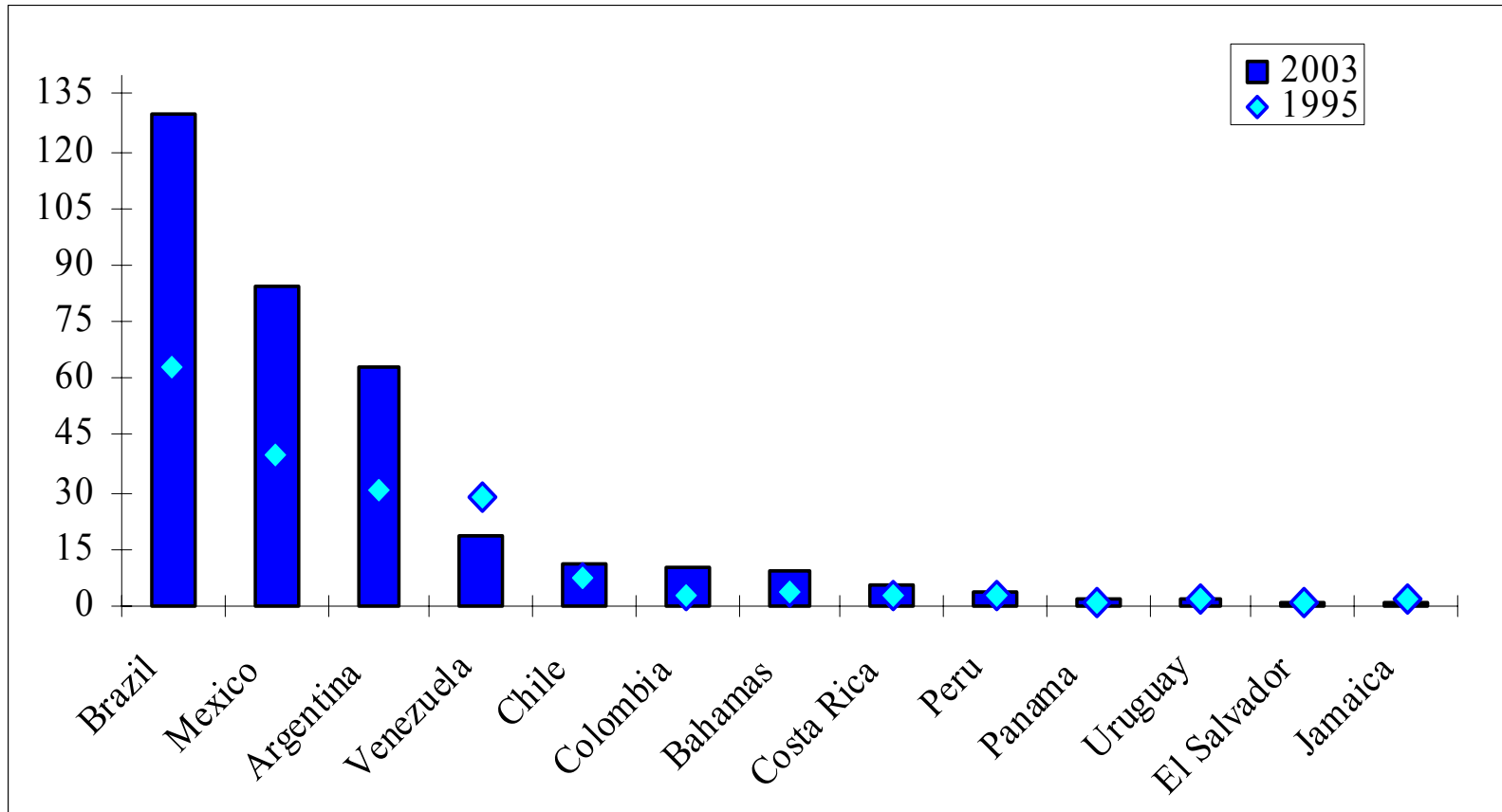


(Output) A huge parenting gap between OECD and LAC... (Patents Granted by US patent Office)





***(Output)* Patents Granted by US PTO to LAC countries are increasing but still too low...**





(Output) Global Competitiveness (2005-2006, WEF)

Country	Score	Rank out of LAC Countries	Rank out of 117 Countries
Chile	4.84	1	27
Argentina	4.09	2	54
Costa Rica	4.08	3	56
Brazil	4.08	4	57
Colombia	4.07	5	58
Mexico	4.07	6	59
El Salvador	4.05	7	60
Jamaica	4.03	8	63
Panama	4.00	9	65
Trinidad and Tobago	3.99	10	66
Uruguay	3.95	11	70
Peru	3.83	12	77
Venezuela	3.71	13	84
Ecuador	3.59	14	87
Dominican Republic	3.56	15	91
Guatemala	3.50	16	95
Nicaragua	3.48	17	96
Honduras	3.47	18	97
Bolivia	3.39	19	101
Paraguay	3.36	20	102
Guyana	3.27	21	108



Policy Challenges (LAC)

Beyond funding and performance, institutions and governance are increasingly important for innovation

- **Mainstreaming innovation policy**
 - Treat innovation as a strategic issue in development planning
 - Links to strategic economic and social directions
- **Institutional development**
 - S&T/ Innovation policy and regulatory frameworks
 - Database on S&T system
 - Improve framework conditions
(Competition(service), FDI, Financing(Venture Capital), IPRs)



Policy Challenges (LAC)

● **Public-Private linkage**

- Stimulate R&D investment by industry
 - Policy mix (grants, loans, guarantees / **tax incentives...**)
- Use **strategic PP partnerships** for research
- Enhance the governance of public research
 - **Greater stakeholders involvement in priority setting**
 - **Evaluation** with implications for funding

● **Human resources development**

- **Access & quality** (**secondary / tertiary** + vocational training)
 - **Focus on building 21st century skills (IT, science & math)**
- **Enhance mobility** b/w public and private institutions
 - Attract foreign talent and return migration of expatriates

● **IT infrastructure**



Paths to Innovation & Competitiveness

- **There is no “one size fits all” model**
 - Country strategies depend on initial conditions & resources
 - Strategies include building institutions, FDI, participation in value chains and applying innovation to traditional goods
- **Look beyond regional model : cross modeling**
 - IT development: Korean, Scandinavian, Irish, Indian, US models
- **Develop indigenous capability & absorptive capacity of enterprises and labor force**
 - build with acquisition, adaptation, improvement, innovation
 - Distinguish among objectives at different stages – this is a **multi-generation process**
- **Create competitive advantage**
 - Chile - salmon, Korea - electronics, Ireland - software



Building NIS : Korea's Experience

From 1980 to 2005, Korea's

- **Total R&D expenditure** increased by 60 fold:
US\$ 0.4 billion (4m.(63)) \Rightarrow **US\$ 24 billion**
- **R&D as % of GDP: 0.77%** (0.25% (63)) \Rightarrow **2.99%**
Government / Private ratio: 64:36 (97:3(63)) \Rightarrow **24:76**
- **Researchers: 18,434** \Rightarrow **234,702** (**7.5** per 1000 employed)



Building NIS: Korea's Experience

Korea's NIS changed from

- **Catch-up model** through reverse engineering and imitation
- **Stand alone & closed** innovation system
- **Input & supply-oriented** innovation system

To

- **Creative mode** based on locally developed tech.
- **Networked & open-mode** innovation system
- **Outcome & demand-oriented** innovation system



How ? Some Lessons

1. Create a S&T Policy Coordinator

- Put in place consolidated legal / institutional framework(1967)
 - ❑ Enactment of Science and Technology Promotion Act
 - ❑ **Creation of Ministry of Science and Technology / NSTC**
- Key: improved **coordination over S&T related policies**
 - ❑ **Power** to plan, coordinate, evaluate S&T policies + **Allocate R&D budget** + Vice chair for NSTC
 - ❑ Minister level and upgrade deputy PM level later
 - ⇒ MOST as the central agency for inter-ministerial coordination of S&T policy and R&D activities
- **Commitment** to promotion of S&T from the presidency
 - ❑ Overcome resistance from existing ministries / Quarterly NSTC chaired by President / First minister served 12 years



How ? Some Lessons

2. Develop a vision

- **Develop a strategic vision for S&T** and integrate it into the 『 Five-year Economic Development Plan 』
 - ❑ “Long Term S&T Development Plan (1967~1986)”
 - ❑ Set Goal, Strategies, Priority areas, Target for R&D (0.47~2.5%), Funding source
- **Link S&T and education (manpower training) to an overall industrial development strategy**
 - ❑ Select core technologies as next growth engine and concentrate nat'l R&D budget on them
- **Encourage participation of key ministries (MOF, MOE, MIC...)** in S&T policy making process from the beginning
 - ❑ Cross-fertilization of key personnel among related ministries



How ? Some Lessons

3. Buy in

- Establish **a network** (advisory council) **among stakeholders** to sustain policy dialogue
 - ❑ Industry, academia / PRIs, and government
- **Start at the central level** and expand by fields / regions
- **Identify technology / manpower needs from the industry and channel them** to university / PRIs / related ministries
 - ❑ Technology foresight, industrial policy directions...
- **Hold an inter-ministerial / public-private joint meeting** regularly chaired by President
 - ❑ Share vision, monitor progress and discuss next steps



How ? Some Lessons

4. Focus and concentration

- Identify priority areas where comparative advantage exists & most spillovers are expected and focus on these niche areas
 - ❑ Evaluate skill requirements, technology demand & firm capacity
- At early stages, ability to identify, absorb & adapt existing technology by licensing, FDI....

Cultivate skilled workers reflecting industrial development

- ❑ Better linkage with industrial demand
(Balance b/w liberal arts and science & engineering majors)
- Adapt / Streamline support systems
 - ❑ PPPs, tax incentives, public procurement, provision of guarantees / public / private venture capital, industrial clusters...



How ? Some Lessons

5. Framework for private-public partnership

- **Establish an umbrella industrial R&D institution** (KIST) and spin-off it into specialized sectoral institutions (ETRI, CRI...) (in accordance with evolving industry demand & policy goals)
- **Foster strategic P/P research programs** responding to socio-economic demand, **with strong industry participation** (semiconductor: 4 mega D-RAM, cell phone: CDMA...)
- Industry presence on the boards of PRIs
 - Preferential funding for proposals involving industry
 - Preferential tax incentives for R&D program through PPP
 - Joint use of research equipments and manpower exchange
 - Licensing and spin offs of IPRs by PRIs



How ? Some Lessons

6. Join internet revolution decisively

- **Develop and implement comprehensive strategies** to promote IT infrastructure and improve IT regulatory framework
 - ❑ **Secure access** as well as connectivity
 - ❑ Provide **cheaper & faster** broadband access
 - Develop basic IT **skills** for all citizens
 - Deliver **contents** (e.g., internet based citizen service...)
 - * **e-government as a tool to develop IT software industry** as well as to enhance transparency, efficiency & participation
- **Twin track approach**: ICT as a new growth industry + Applying IT-based innovation to traditional industries
 - ❑ Develop mechanism (e.g., Tech. dev't fund) for expanding credit, equity, guarantee for start-ups & simplify start-up process



IT industrial Development (Korea)

- At the initial stage, Gov't played a leading role as **an enabler or a facilitator**
- **(Supply push)** Expand wire/wireless telephone, Build up broadband network, invest in human resources & development of critical technologies such as TDX, CDMA (through PPP...)
 - effective **policy framework** for master plans, laws, funding mechanisms, organizational support
 - ❑ Informatization Promotion Act(1995), Cyber Korea 21(1999)
 - ❑ Informatization Promotion Fund
 - ❑ Ministry of Information and Communication and NCA
 - Slogan to spread IT culture (Although our industrialization lagged, our digitalization will not.)



IT Industrial Development (Korea)

- **(Demand pull)** Liberalization and competition in telecom/broadband market encourage telecoms to main low tariffs via a reduction in cost
 - Provide low cost PC, free broadband access to all primary & secondary schools, internet training for 10 million people
 - e-government projects
- **Strategic and focused**
 - Which area to target: HW or SW
 - If SW, which niche market to target: on-line game, e-gov't, computer animation...
 - A precise **roadmap** with proper sequencing and pacing of core measures is key



IDB's Strategy : New framework for S&T

- **Commitment of IDB leadership to strengthening Bank activities in the S&T and innovation area**

- **New Organizational Setup**
 - Establishment of the new Sub-Department in charge of S&T, ICT and education
 - High level S&T advisory Group to the President (in progress)

- **New Financing Tool : Korea Technology Fund**
 - Created by a contribution of US\$ 50 million from Korea
 - Increase the flow of technical assistance



IDB's Response: Strategic Directions

- **Mainstreaming S&TI into country dev't strategies**
 - Through **country dialogues & innovation policy assessment**, identify policy priorities & funding requirements
 - **Employ convening power** to stimulate dialogue among country policy makers and share best practices
(Establishment of **a Regional Policy Dialogue on S&T**)
- **Emphasis on:**
 - <Areas>
 - Improvement of institutional and regulatory conditions
 - Support to R&D / innovation investment projects by the private sector (notably in **SMEs** / in the context of **innovation clusters**)



IDB's Response: Strategic Directions

- **Foster innovation collaboration** b/w universities, PRIs & business through **strategic programs** responding to social needs (e.g., health, energy, housing & environment...)
- **Adoption and diffusion of technologies**, particularly **ICT**

<Approach>

- **Differentiated** approach based on needs of a particular country (e.g) **Strengthening NIS** in more developed countries vs. **technological infrastructure** (S&T policy framework, metrology, standard, IPRs...) and **capacity building** in less developed ones
- **Regional** approach
(e.g) sectoral / technological programs, database for researchers / S&T statistics / patent information...
- **Stress poor & small countries**



New Financing Tool: Korea Technology Fund

- Finance activities that promote S&T capacity and innovation through **technical assistance**
 - small-scale pilots and e-application projects
- **Emphasis will be given to**
 - lower income countries & those with weaker S&T capacity
 - **e-applications**, industrial development with strong technology and innovation components, institution building and strengthening, innovation through PPP
- **Non-reimbursable, untied & no project ceiling**



New Financing Tool : Korea Technology Fund

- **Grant recipients**

- **Borrowing member countries**

(Firms, educational institutions, NGOs and governments)

- **Regional and sub-regional organizations**

- **Target activities**

- **Activities that enhance S&T/ innovation capacity building**

(policy assessment(leading to action), feasibility study, institutional development, training(in engineering and IT), and adoption & diffusion of new technologies(e.g., alternative energy))

- **Activities that promote IT infra. & related e-applications**

- **Activities that identify and disseminate best practices**

(financing technological innovations, sustaining rural connectivity...)



Thank you

Hyunghwan JOO

**Senior Advisor for Technology and Innovation &
Korean Technology Fund Program Coordinator
Inter-American Development Bank**

hjoo@iadb.org