R&D Policy in the era of Globalization: Israel and India

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R&D Policy in Israel

Interesting "laboratory case" of seemingly successful government policies towards commercial R&D.

***Background (late 1960's)*:**

Israel had little resources, but highly skilled manpower, scientific and tech prowess – how to turn them into engine of growth?

***Government Strategic Decision*:**

Jump-start and breed High-Tech sector by providing broad financial support, and making up for market failures.

Hallmark of past policies

- **"Neutral":** respond to market signals, not "picking winners."
- **Innovative:** create new and varied support programs according to evolving needs – ***but lately "stuck", not clear vision of how to proceed…***
- **Mobility** of personnel in and out of Gov. programs (e.g. Chief Scientists from industry, then out again)
- **Not "self-perpetuating"**

Time line of R&D Policy in Israel

1969 — Chief Scientist established at the Ministry of Industry and Trade

1985 — R&D Legislation passed

1991 — **"Incubator"** Program

1992 — **"Yozma"** Program for Venture Capital

1993 — **"Magnet"** Program for generic R&D

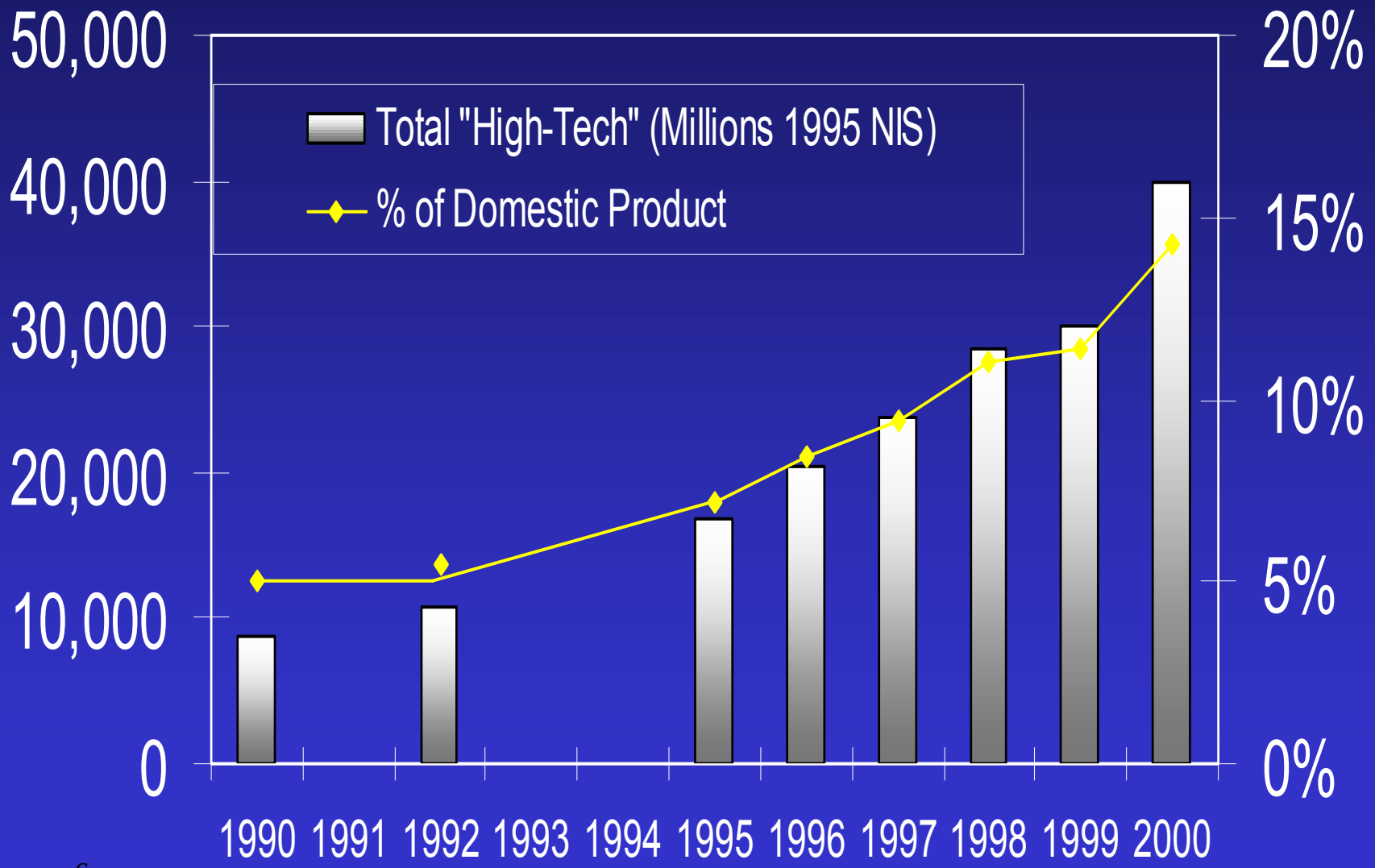
1997 — Chief Scientist budget freeze; excess demand for grants

2003/4 — Update R&D legislation
Budget cuts: neutrality in question

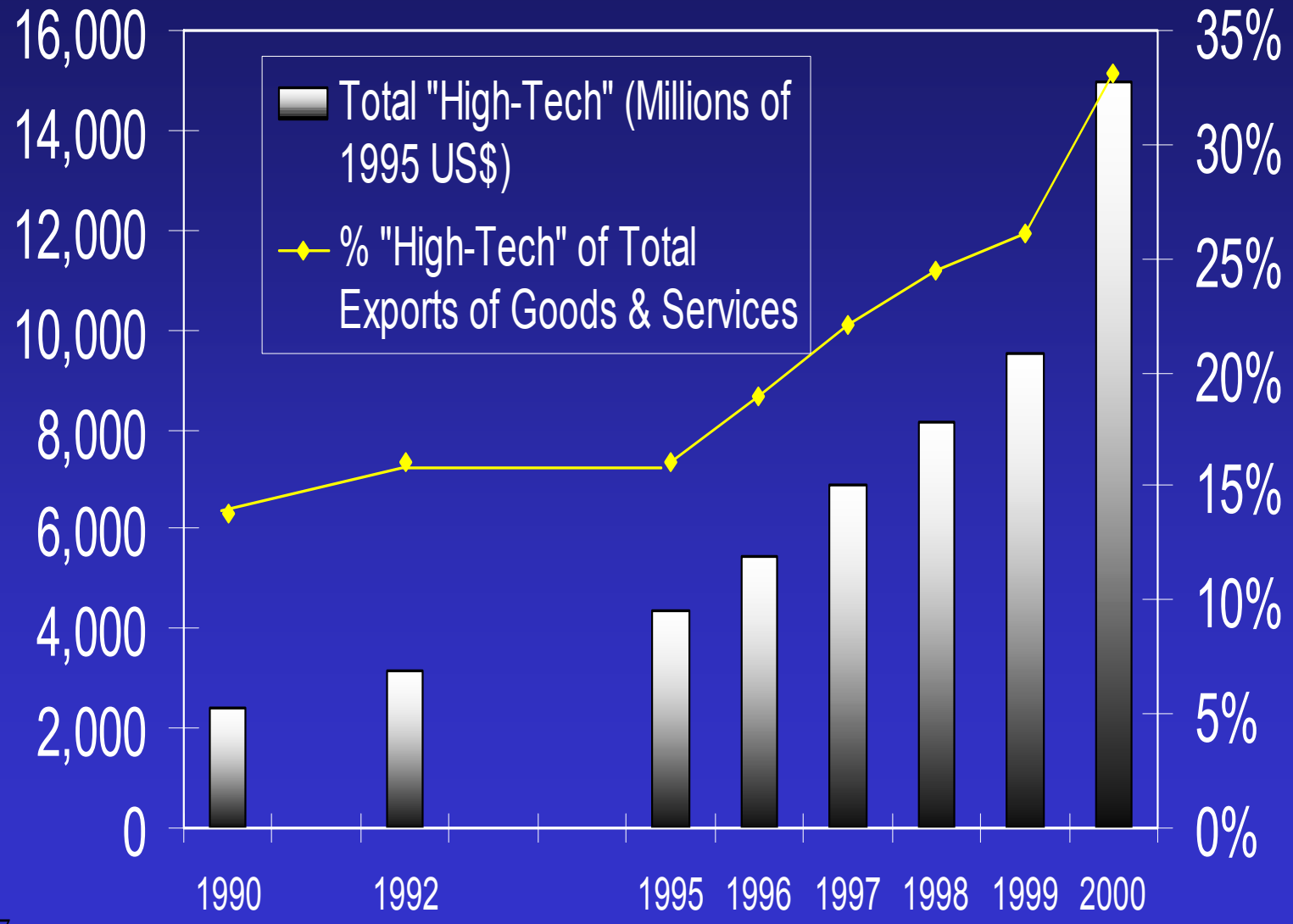
Main OCS Programs

- R&D Grants (main program)
- “Magnet” Program: support generic, pre-competitive R&D
- Technological “Incubators” Program
- ”Yozma” (“initiative”) Program: Jump-start the Venture Capital (VC) Market
- Other: bilateral programs, etc.

Growth of the High Tech Sector (ICT) Israel: 1990-2000



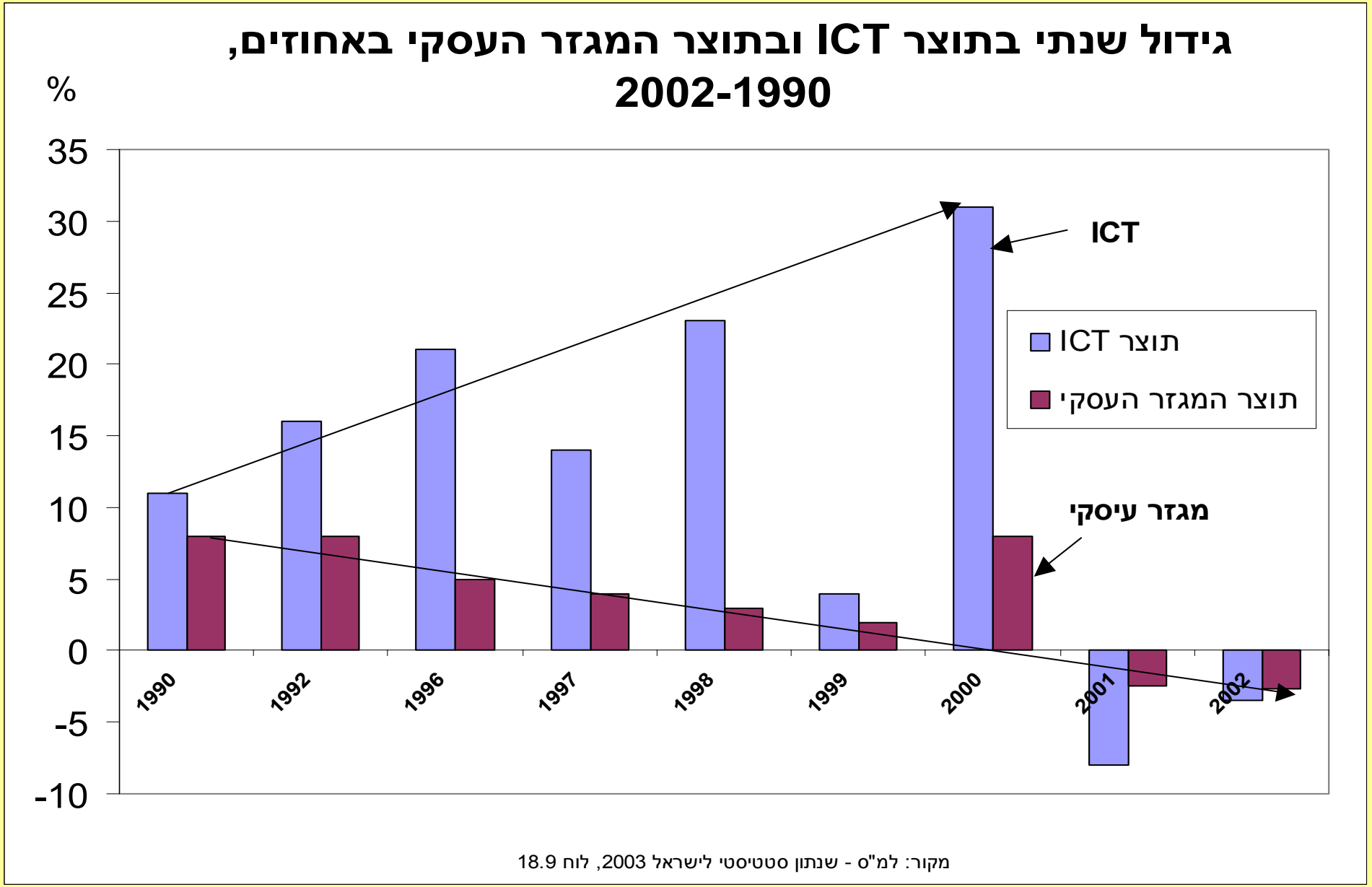
High Tech Exports



The contribution of High Tech to Growth

Period	Contribution of HT to Growth of GDP
1990-92	9.4%
1995-96	35.7%
1999-2000	66.4%
1990-2000	**30.0%**

Annual growth of ICT vs. BS-GDP



מקור: למ"ס - שנתון סטטיסטי לישראל 2003, לוח 18.9

Some open Issues in R&D Policy

1. What target for total R&D? hence how much R&D support?
2. Subsidize demand, or stimulate supply (of scientists and engineers)?
3. What/whom to support in view of excess demand for R&D grants (due to budget cuts)? Keep neutrality?
4. How to support? E.g. what about payback system? Sales of firms/knowledge abroad?

R&D and Innovation in Israel: *Internal Challenges*

- Israel cannot have sustained growth by relying just on one fast-growing sector (ICT), while most of the economy stagnates

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

- Israel cannot have growth while widening gap in the population across socio-economic classes

Need policies of inclusion, of reaching out to left-behind segments, of expanding the pool of human capital.

External challenges
(from globalization)

- Israel can no longer rely on “plain vanilla” comparative advantage in R&D: see the rise of India and other Asian economies, their fast-growing pool of S&E personnel.

Need to keep climbing the tech ladder, to increase reliance on advanced Science & Technology, closer cooperation with countries such as India.

Globalization of Science and Innovation (S&I):

Trends in the global mobility of *Inventors, Scientists, Students*

Patent Inventors

Have data on **1,565,780** patent inventors, of whom those with

- 653,837 (42%) have 2 or more patents
- 203,302 (13%) have 5 or more
- 73,072 (5%) have 10 or more

These are driving innovation worldwide!

and we can trace them…

Flows of Inventors across countries

From

To

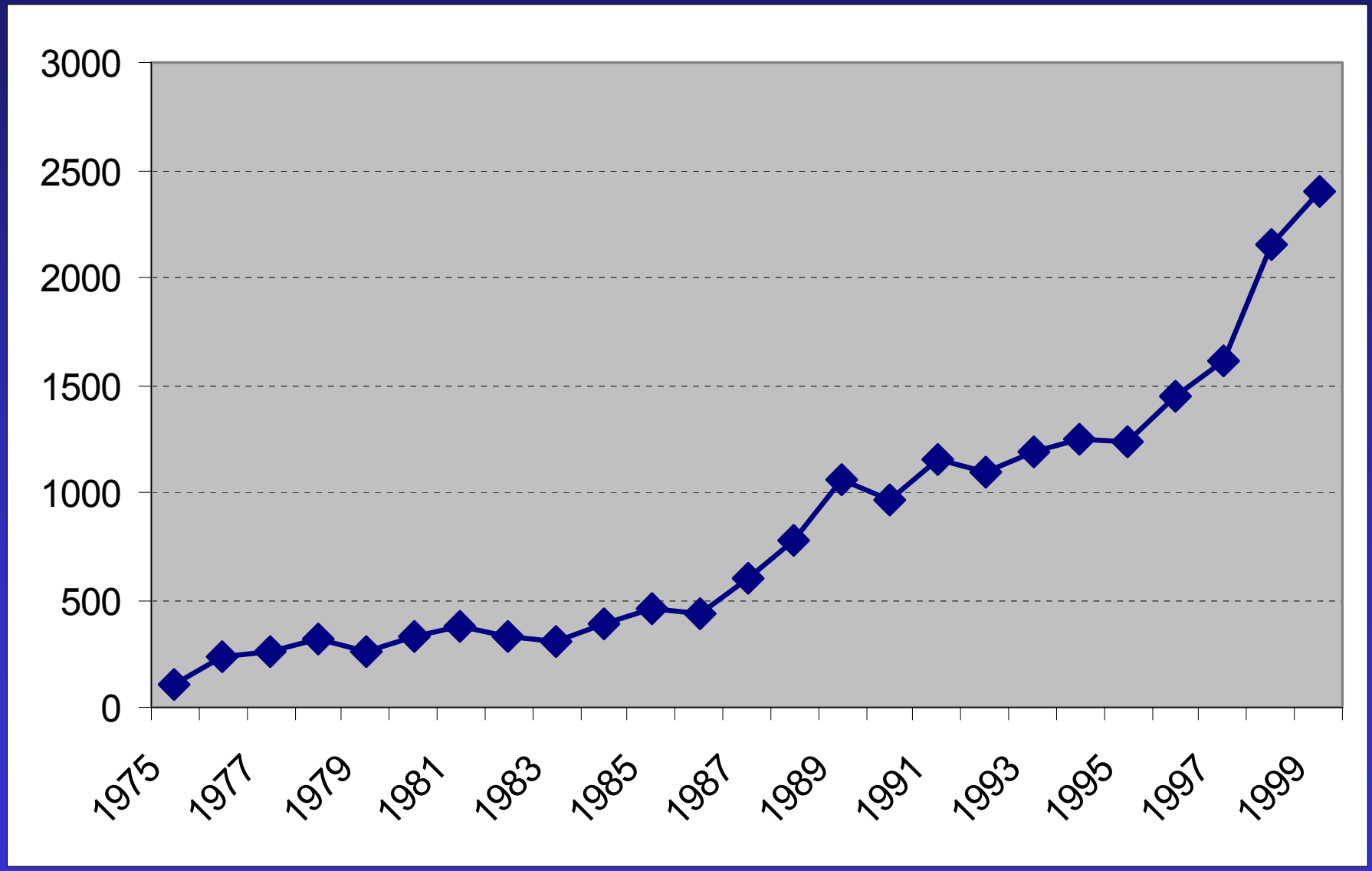
	US	Japan	Germany	UK	Canada	Other	Total
US	0	808	657	1,602	1,096	3,109	7,272
Japan	908	0	115	49	21	151	1,244
Germany	731	122	0	38	16	794	1,701
UK	2,077	41	51	0	131	509	2,809
Canada	1,308	23	11	106	0	106	1,554
Other	3,017	120	717	386	128	1,821	6,189

International flows of inventors: turnover

Country	Moves in	Moves out	Net	Turnover
Canada	1392	1554	-162	**2,946**
Switzerland	702	693	9	**1,395**
Germany	1551	1701	-150	**3,252**
France	665	665	0	**1,330**
UK	2181	2809	-628	**4,990**
Israel	248	219	29	**467**
Italy	205	186	19	**391**
Japan	1114	1244	-130	**2,358**
Korea	371	270	101	**641**
Netherlands	453	527	-74	**980**
Taiwan	275	176	99	**451**
US	8041	7272	769	**15,313**

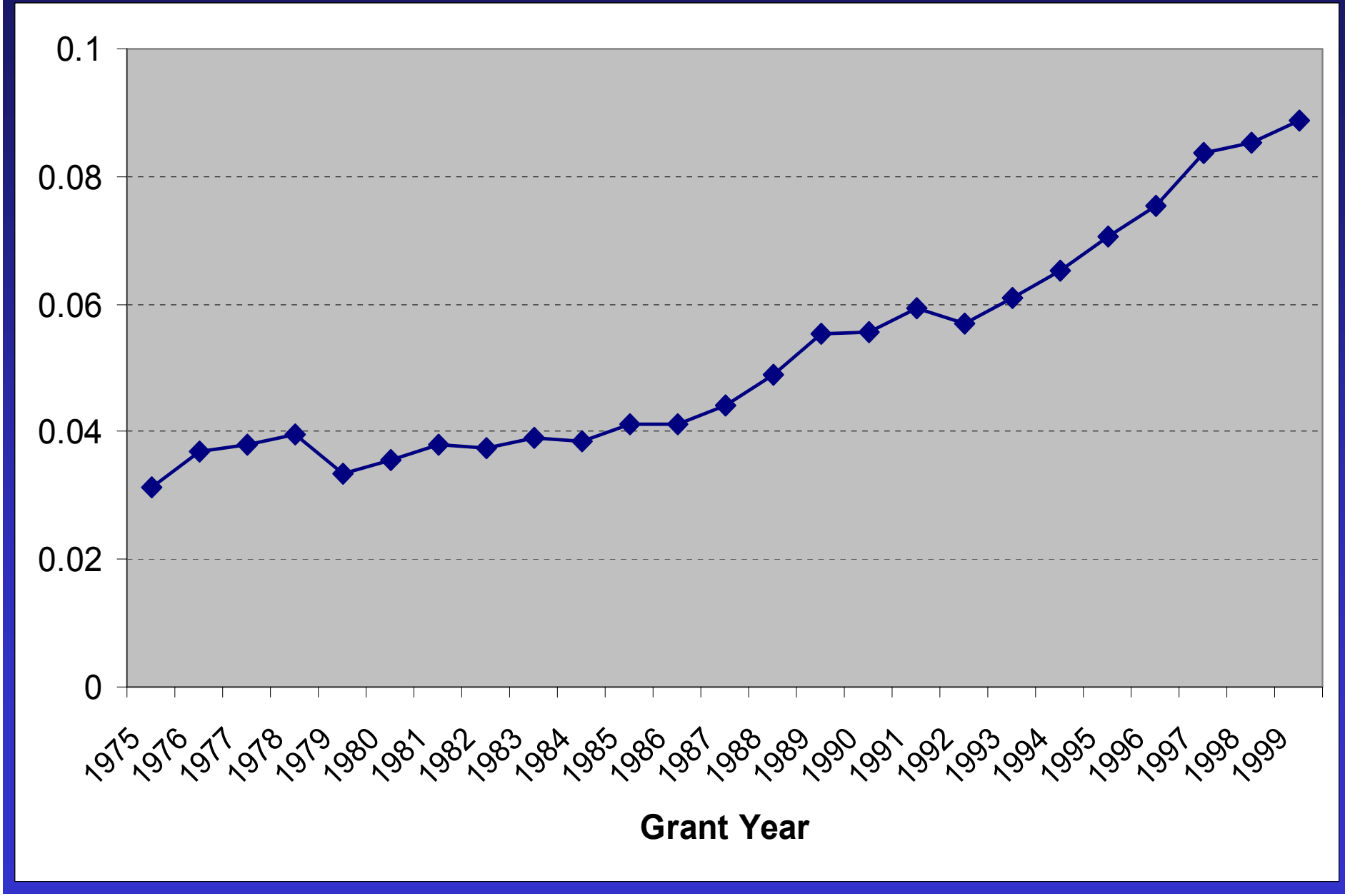
International Mobility of Patent Inventors

number of cross-country moves per year

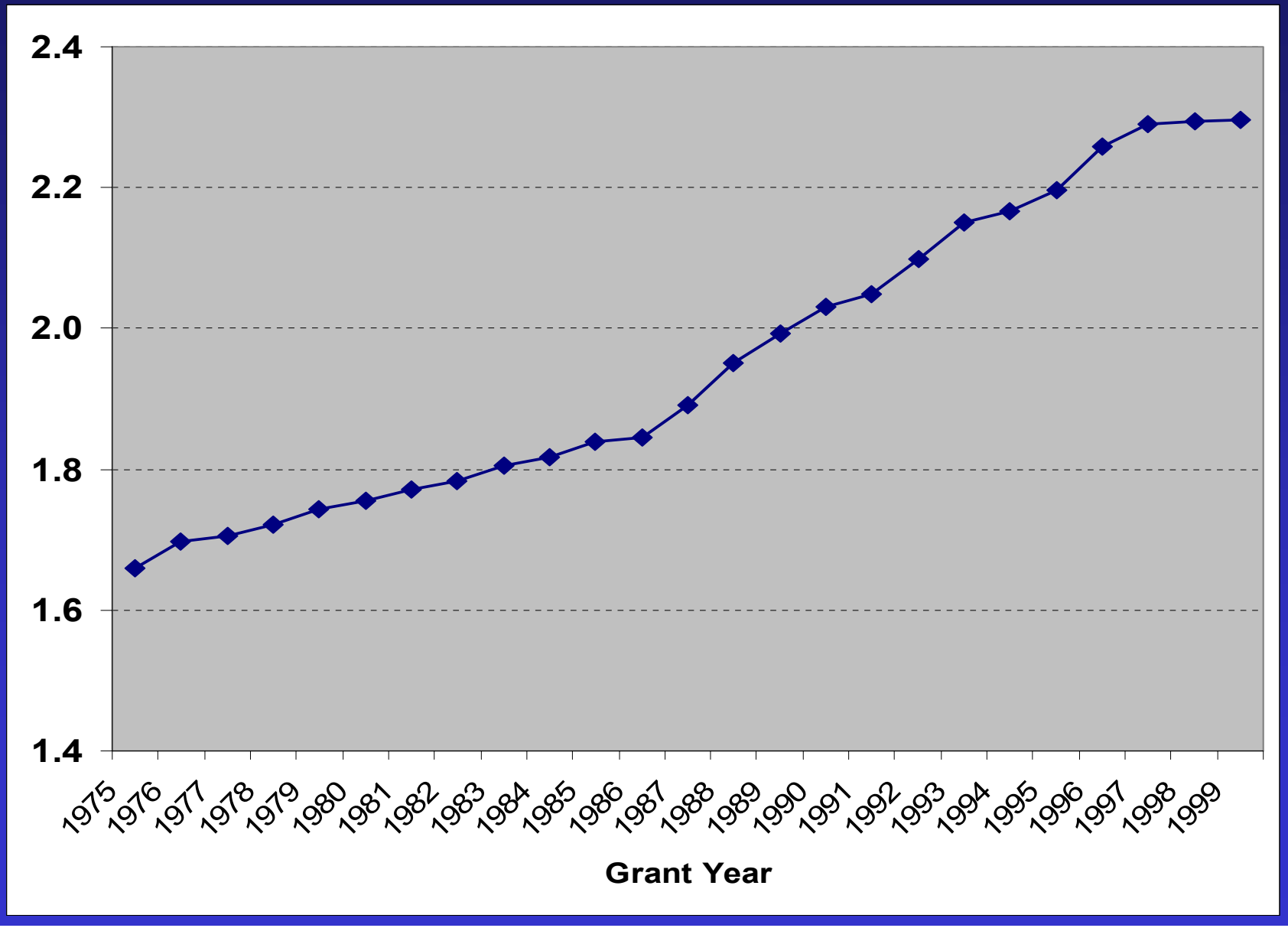


International *Diversity* of Teams of Patent Inventors

(1 – Herfindahl index on countries of inventors)

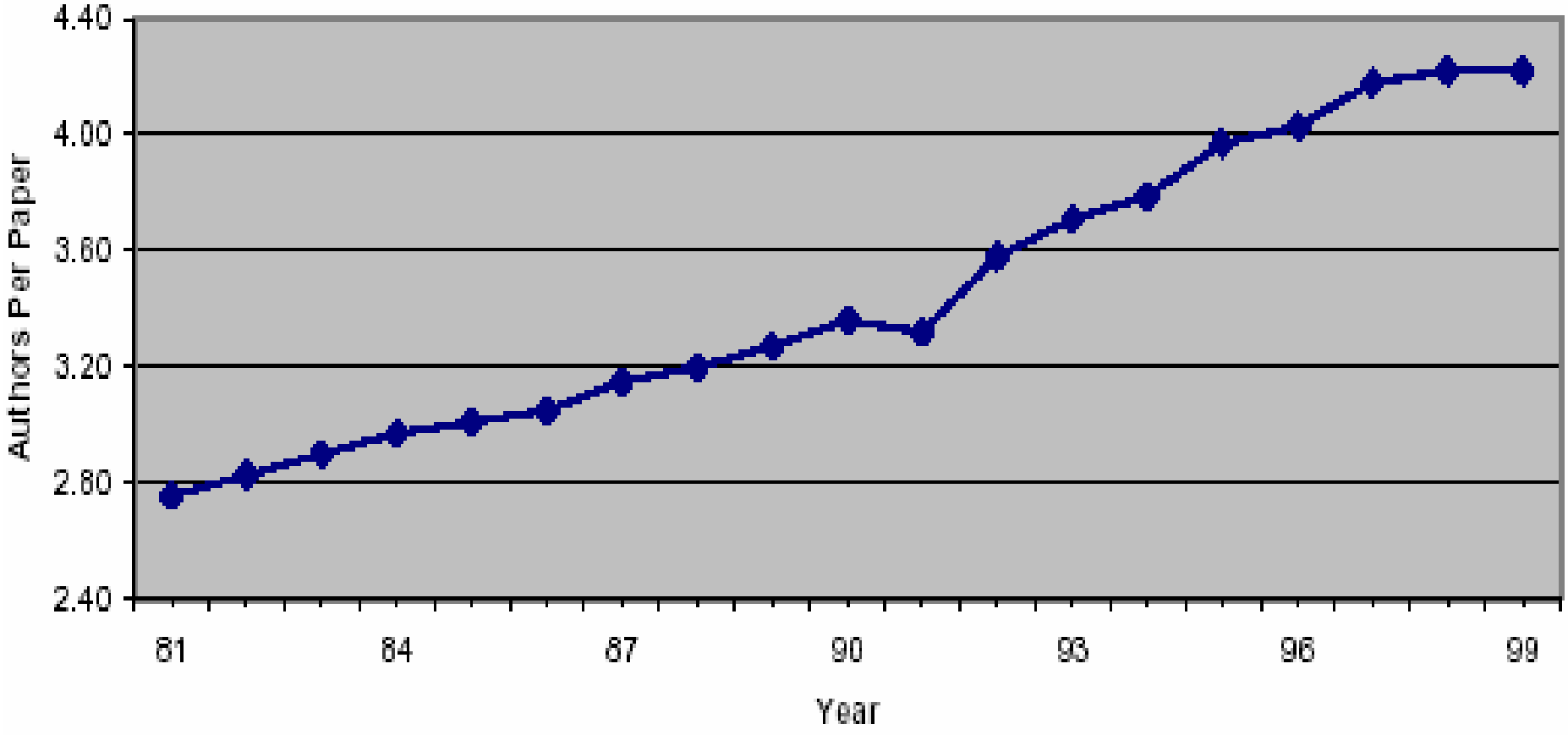


Size of R&D Teams: Average Number of Inventors per Patent

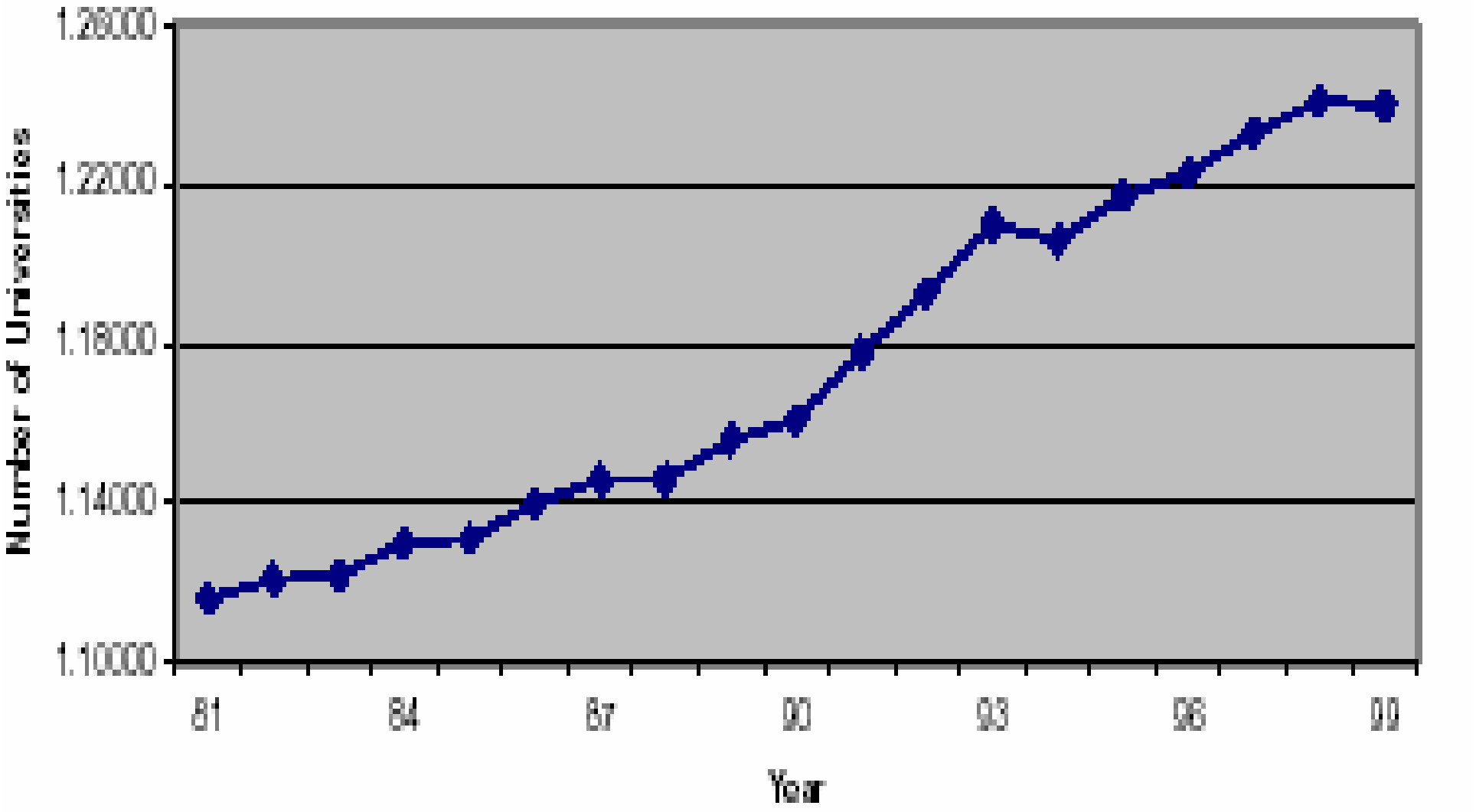


Mean Number of Authors per Scientific Paper

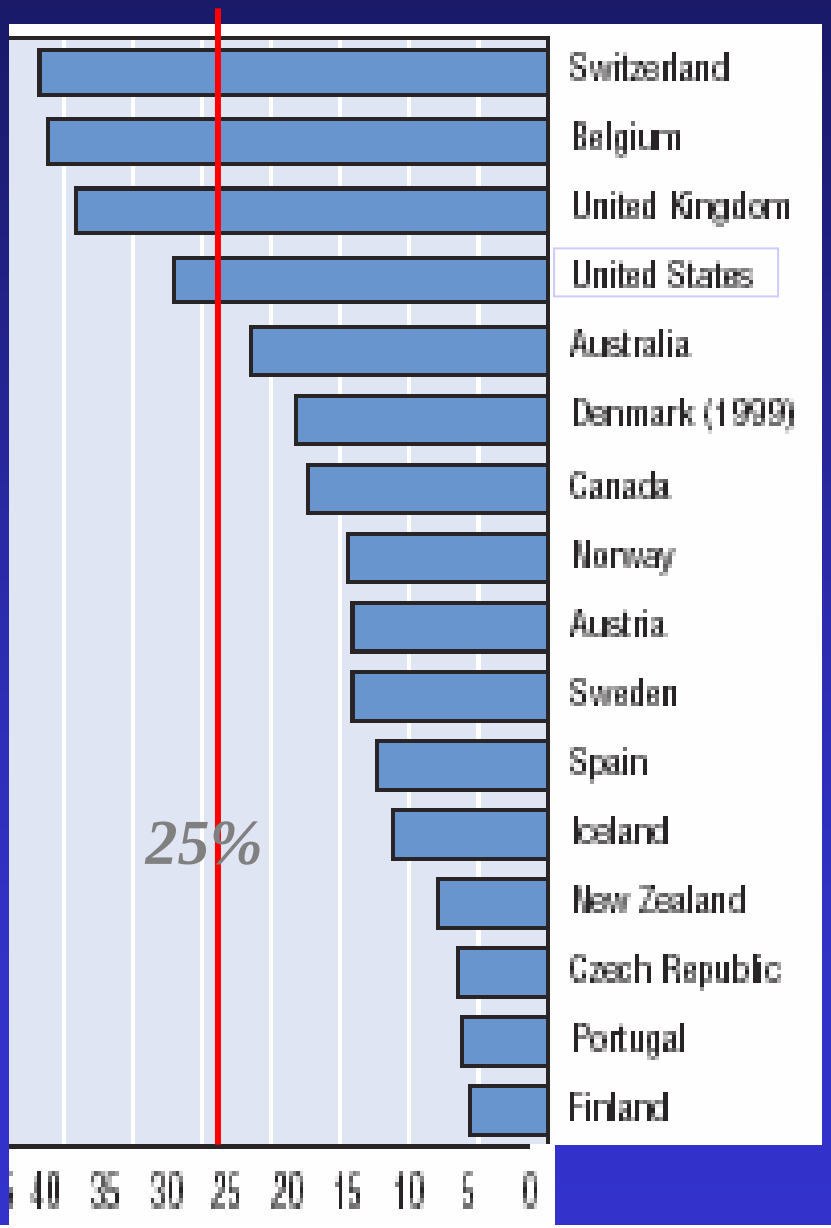
Figure 4--Mean Number of Authors per Paper, for Papers
With at Least One Author In the Top 110 U.S. Universities, 1981-1999



Institutional collaborations: Mean number of universities per scientific paper 1981-1999



International mobility of Ph.D. Students: Foreign Students as % of total PhD enrollment 2000



Israel and India

- A view of tech capabilities
- Basis for cooperation

Definitions of tech capabilities I

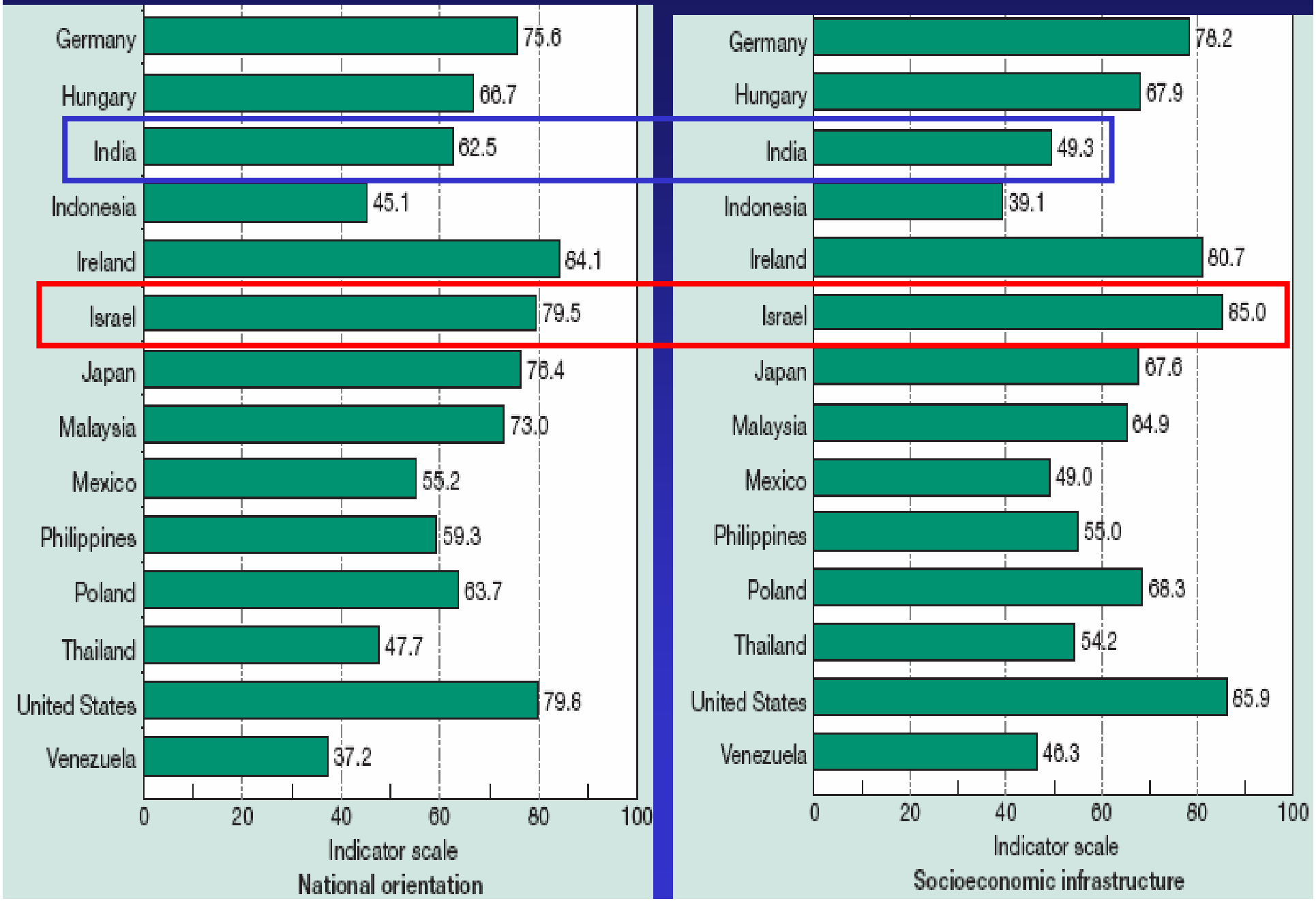
- **National orientation**:

  evidence that a nation is taking action to become technologically competitive, as indicated by explicit or implicit national strategies involving cooperation between the public and private sectors.

- **Socioeconomic infrastructure:**

  existence of dynamic capital markets, upward trends in capital formation, rising levels of foreign investment, and national investments in education.

Tech capabilities I

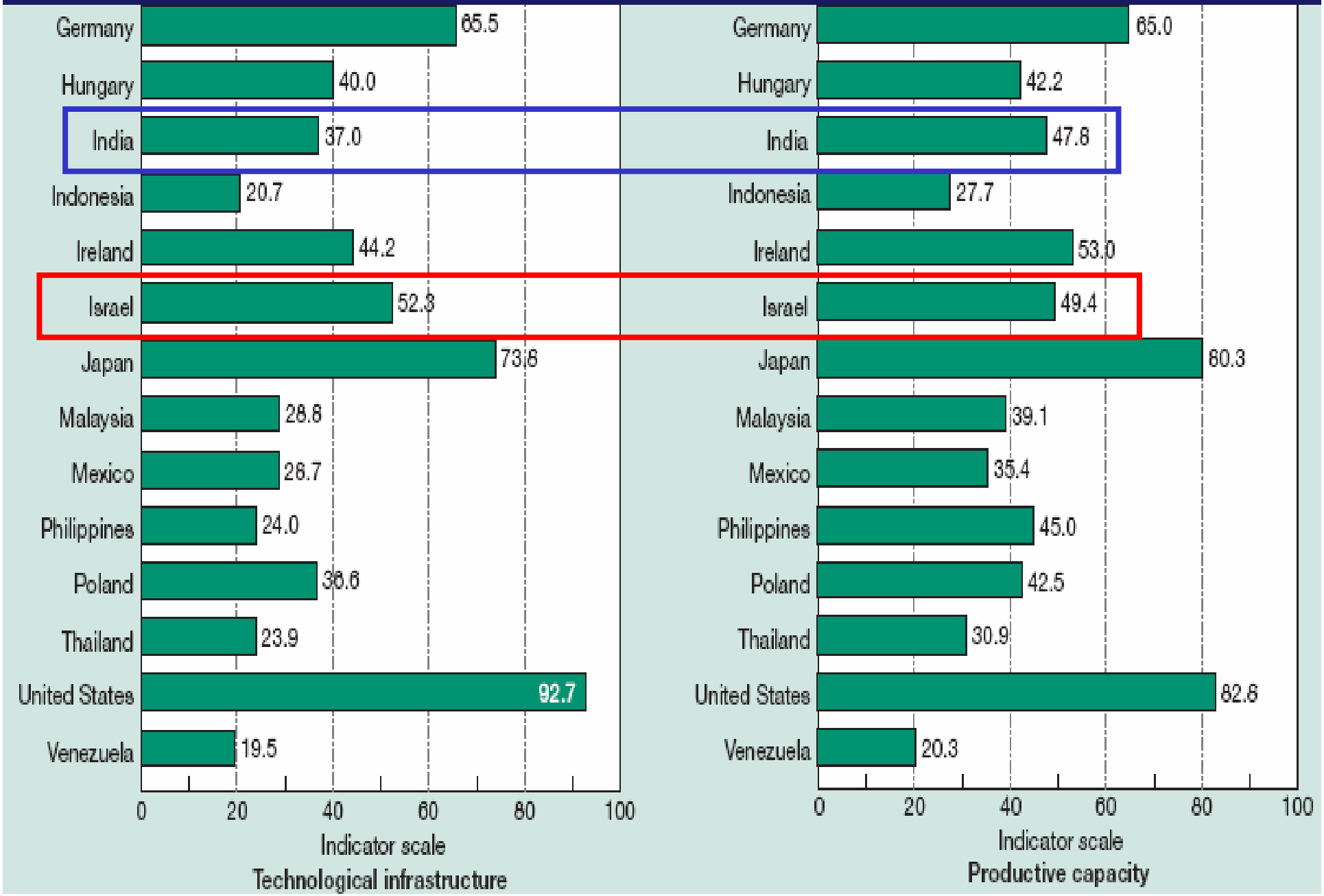


Definitions of tech capabilities II

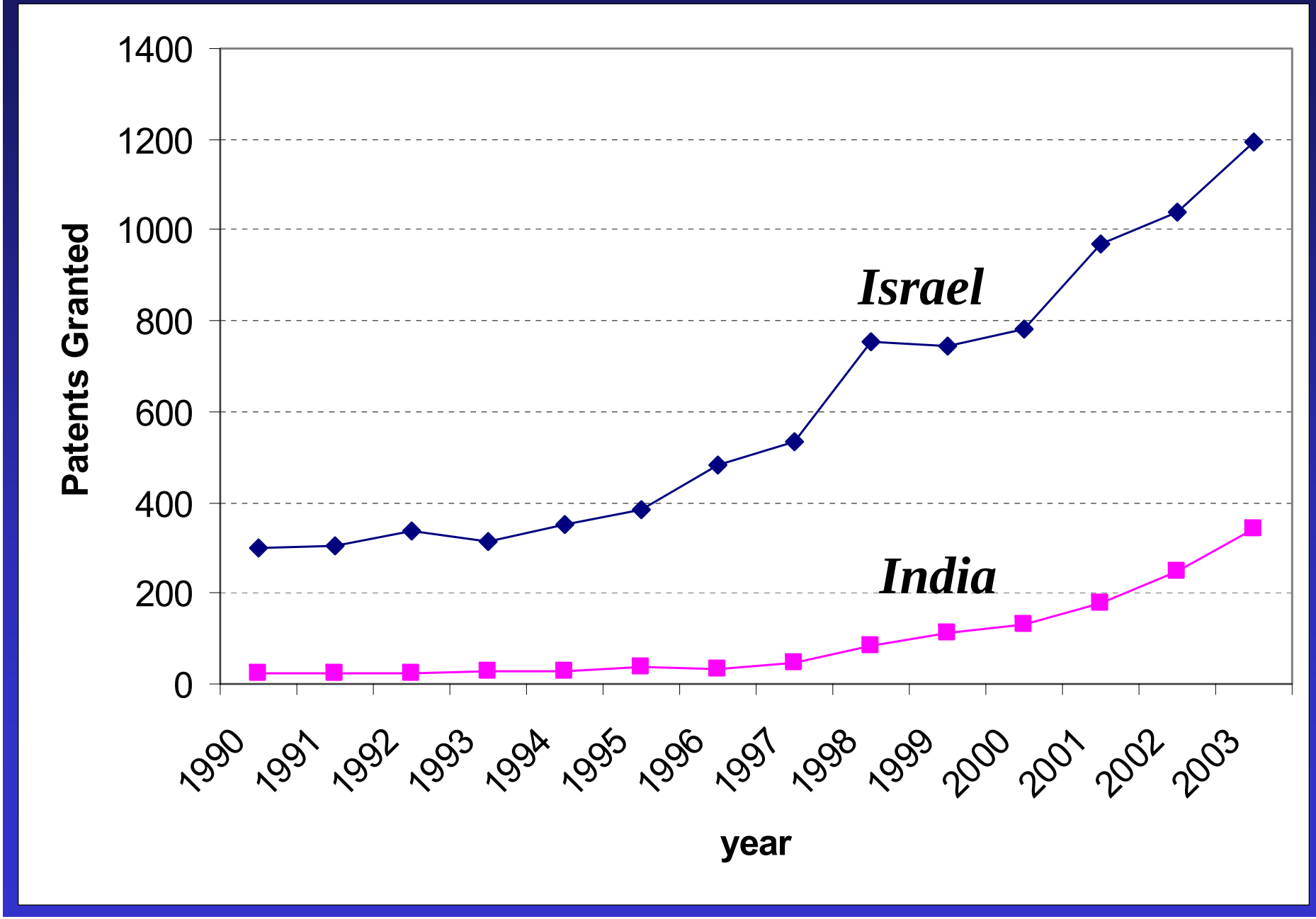
- ***Technological infrastructure:***
  existence of a system for the protection of intellectual property rights, the extent to which R&D activities relate to industrial application, competency in high-technology manufacturing, and the capability to produce qualified scientists and engineers.

- ***Productive capacity:***
  current level of high-technology production, the quality and productivity of the labor force, the presence of skilled labor, and the existence of innovative management practices.

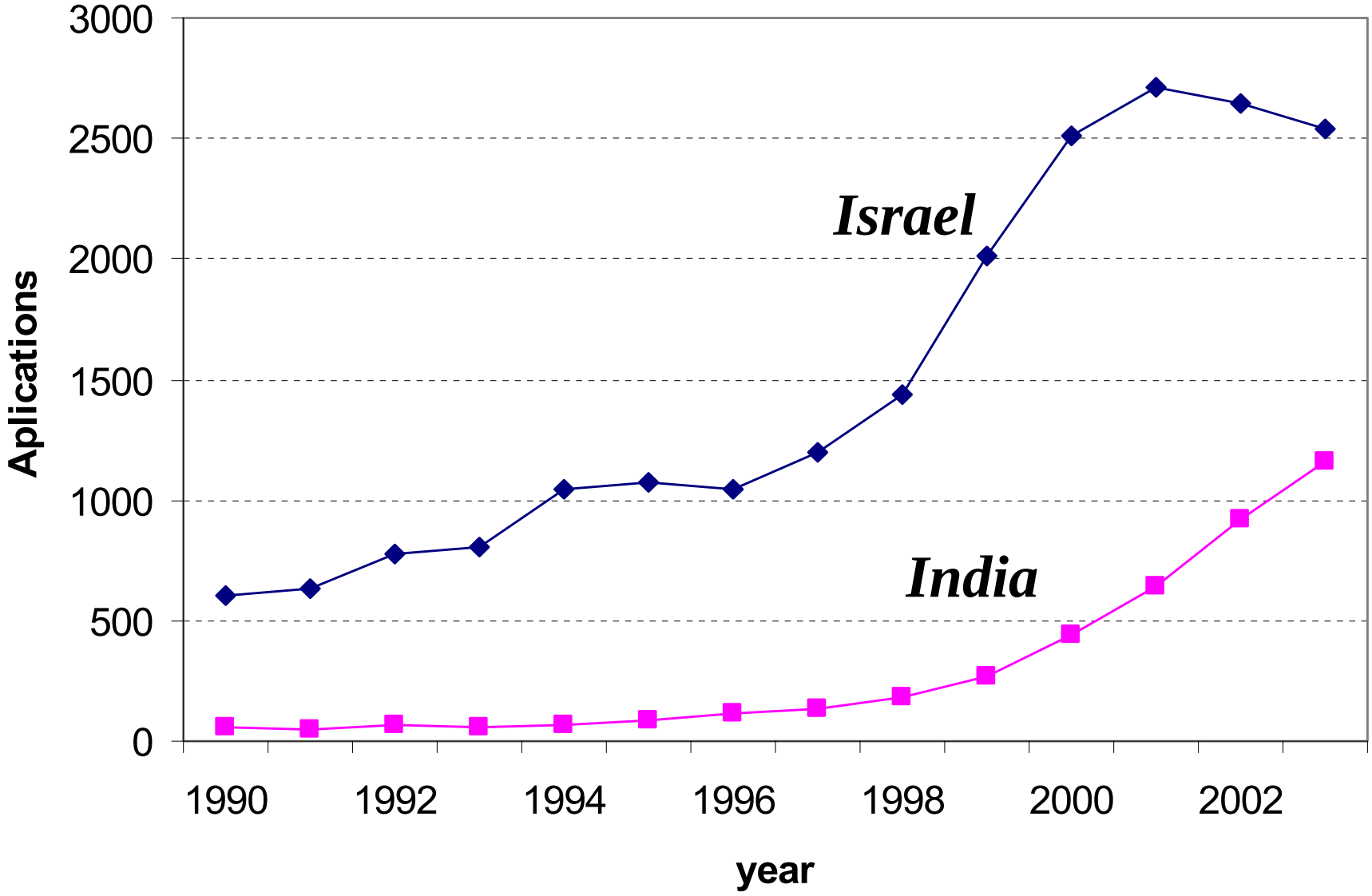
Tech capabilities II



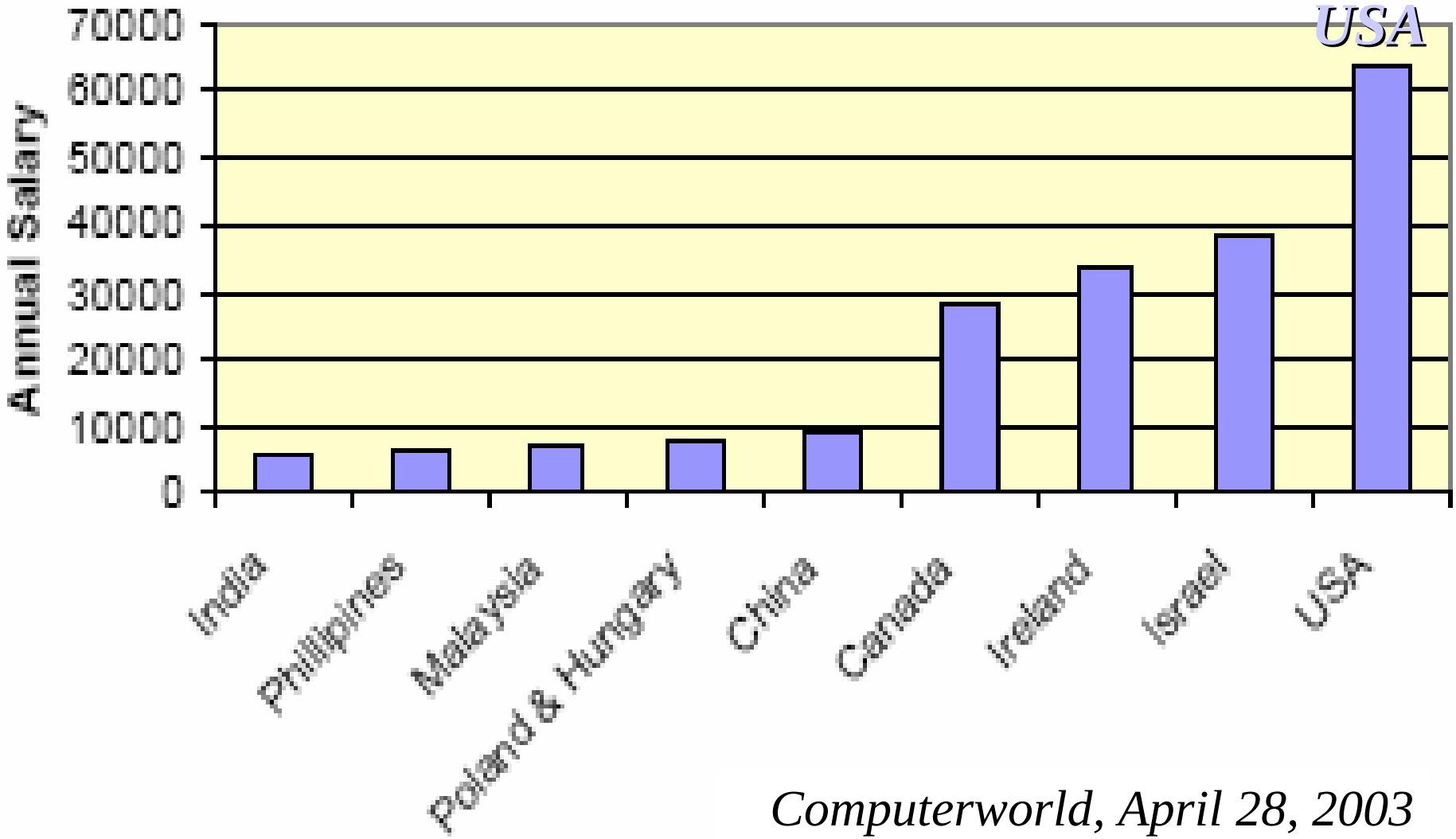
US Patents Granted – Israel & India



US Patent Applications – Israel & India



Annual Salaries of software programmers in various countries



Computerworld, April 28, 2003

India and Israel: Prospects

- In India: increasing quantities and quality of qualified manpower,
- In Israel: longer experience in High Tech, S&T prowess, access to markets from Israel.
- Non-threatening relationship for both
- Opportunities to grow in tandem

Why cooperation in R&D?

- Creativity in S&I nurtures from ***exchange*** of ideas, from ***exposure*** to diverging points of view;
- Much of S&I progress consists of ***recombination*** of existing ideas, principles, tools;
- The important point is the interaction, which allows for all the above.