

Should developing countries publicly finance academic research?

Keith Pavitt

SPRU - Science & Technology Policy Research,
University of Sussex

SUMMARY

- Orthodox social science theories gives low priority to academic research (AR) in developing countries.
- These theories make misleading assumptions about the nature of useful knowledge, and of the economic and social role of AR.
- The output of such AR is increasing in many developing countries.
- We suggest how AR becomes endogenous to the process of economic development.

What the orthodoxy preached

In Economics.

- The output of AR is information that is costly to produce and ~ costless to reproduce.
- The social optimum therefore requires public funding.
- DCs can copy cheaply what they need from AICs

In Sociology.

- The purpose of AR is to gain recognition through publication and citation in international academic journals.
- Most research in DCs achieves neither of these objectives.

Limits to the Orthodoxy

Developed in the USA in the 1950s to justify public funding. But what about the interdependent, heterogeneous and developing world since then?:

- *Theory*: Justification for public funding also creates an international free-rider problem.
- *Evidence*: Although output of AR is a *public* good, it is not a *free* good. Imitation is costly (trained QSE, equipment).
- *Puzzles*: Why do many small West European countries perform so much basic research?

Resolution of Puzzle

Benefits of AR are mainly localised because:

- “know-how” to solve complex problems includes ability to absorb and interpret information;
- this ability depends on prior knowledge & research experience;
- through post-graduate training, AR provides basis for this experience;
- much output of AR is person-embodied, its benefits are more localised than information
- small high-tech countries therefore invest heavily in basic research.

How useful is AR in AICs?

- For practical problem solvers (e.g. industrialists) the main benefits of AR are trained researchers, research techniques, access to professional networks, published information.
- Useful AR = good (academic) research.
- However, basic research priorities are responsive to the problems posed by society.

Some lessons for developing countries

- Indigenous investment in local AR skills & equipment are necessary for imitation.
- Investment in local AR can provide capacity for local problem-solving, especially when linked to post-graduate training.
- Local AR does not have to be original to begin with.
- The “public goods” justification for government funding should include education.

Some expectations about AR in DCs

- Modernisation = problem solving
- Demands for AR increase with modernisation.
- Output of AR increases more rapidly in fields associated with national economic and social requirements.
- See a proposed taxonomy

Difficulties in Testing

- Inadequate public access to bibliometric data
- Distinguishing trends in research output from changing incentives to publish
- Collecting systematic evidence of usefulness to practitioners

**SHARE OF WORLD SCIENTIFIC PUBLICATIONS:
1999/1986**

Latin America 1.89	Asia 1.59	W. Europe 1.15	Nr. East & N. Africa 1.04	Sub-Saharan Africa 0.69	E. Europe & Centr. Asia 0.64
Uruguay 4.07	S. Korea 11.32	Turkey 6.26	Iran 5.69	Ghana 2.56	Romania 1.22
Cuba 3.00	Taiwan 5.48	Portugal 3.57	Morocco 4.45	Uganda 2.25	Poland 0.99
Mexico 2.32	Singapore 4.04	Spain 2.21	Syria 3.21	Kenya 0.93	Hungary 0.89
Brazil 2.53	China 3.51	Greece 1.69	Tunisia 2.73	S. Africa 0.67	Bulgaria 0.61
Argentina 1.42	Malaysia 1.96		Algeria 1.79	Nigeria 0.36	
Venezuela 1.27	Philippines 0.95		Egypt 0.98		
Peru 0.96	India 0.81		Lebanon 0.93		
Paraguay 0.58	N. Korea 0.44		Libya 0.39		
	Afghanistan . 0		Iraq 0.08		

INDICATORS OF NATIONAL PERFORMANCE IN BASIC RESEARCH

	Expend. on Academic Research (% of GDP (1992))	Papers per 1000 population in 1993	Papers per 1000 population in 1981	Citations per paper, 1981-1994
Switzerland	0.66	1.471	0.960	11.73
Sweden	0.87 (1993)	1.297	0.833	10.54
Denmark	0.40	1.074	0.741	9.93
Finland	0.48	0.964	0.548	7.72
Netherlands	0.60	0.962	0.510	9.40
UK	0.36	0.912	0.678	9.76
USA	0.40	0.886	0.750	12.07
Norway	0.47 (1993)	0.817	0.563	7.73
France	0.37	0.621	0.428	7.28
Germany	0.43	0.569	0.554	7.32
Japan	0.55	0.416	0.231	6.65
Italy	0.27	0.362	0.171	6.44

SOCIETAL REQUIREMENTS AND NATIONAL PATTERNS OF RESEARCH STRENGTH (1981-1994)

MAJOR SOCIETAL REQUIREMENTS (FIELDS OF RELATIVE RESEARCH STRENGTH)	COUNTRIES
<u>MEDICAL</u> (clinical medicine, immunology, molecular biology and genetics, pharmacology)	→ Denmark, Sweden, Finland, Switzerland, UK
<u>NATURAL RESOURCES</u> (agriculture, ecology, geoscience, plant and animal)	→ Australia, Canada, Chile, Indonesia, Malaysia, Mexico, New Zealand, Norway, Philippines, South Africa
<u>INDUSTRY</u> (engineering, computing, chemistry, materials)	→ India, Singapore, South Korea, Taiwan
<u>MIXED</u>	→ France, Germany, Japan, Italy, Netherlands, USA, Thailand

Source: Lattimore and Ravesz (1996)

COUNTRY LEVEL → TYPE ↓	BEHIND THE TECHNOLOGICAL FRONTIER	REACHING THE FRONTIER	STAYING AT THE FRONTIER
CATCHING UP: NATURAL RESOURCE-BASED	Strength in agriculture, ecology, geo-science, etc.	Rapid expansion of scientific output.	Improvement in quality of output
CATCHING UP: INDUSTRY-BASED	Strength in engineering, computing, chemistry, materials	Growing links with fundamental fields	Expansion of medical-related fields.
POST-IMPERIAL PROTECTIONIST	Weak links with techn. requirements. Slow growth of scientific output		?
POST-SOVIET MILITARIST	Weak links with civil techn. requirements Strong physics Declining scientific output in 1990s	?	?

The case of Turkey (1987-95)

Rapid increase in university and business R & D (>50%), and in published papers (>200%)

Relative strength in papers in:

- medicine (esp. public health), chemistry, & engineering (except IT)

Relative weakness in papers in:

- physics, biology (exc. food & nutrition), maths & astronomy

Difficult Unanswered Questions

- How to assess the impact of AR on practitioners? - More difficult to do this than in AICs.
- What is the role of foreign training of PhDs?

• **Major Sources**

K. Pavitt (1998) "The Social Construction of the Science Base" *Research Policy*, 27: 793-805.

K. Pavitt (2001) "Public policies to support basic research: what can the rest of the world learn from US theory and practice? (And what they should not learn.)" *Industrial and Corporate Change*, 10/3: 761-779

Lattimore, R. and J. Revesz (1996) *Australian Science: Performance from Published Papers*, Bureau of Industry Economics, Report 96/3, Australian Government Printing Office, Canberra.