Agriculture & R&D

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Knowledge Systems Group

The National R&D Survey 2003/04

1. Knowledge in Development
2. Policy for Innovation
3. The National System of Innovation
4. Situating the Agriculture R&D Strategy
5. Human Resources Nexus
6. Implications for Policy

1. Knowledge in Development

- R&D and technological change
- Origins of the NSI
  - Early years; CSIR; The Security State
- Millennium Project Report
  - *1. Platform (generic) technologies*
  - *2. Improve infrastructure*
  - *3. Higher education SET; new roles*
  - *4. Business activities in STI*
  - *5. Enabling policy environment; target R&D*

Economic Realities

1. 20% of continental GDP; GNP/c PPP $10k; 60% GDP from Witwatersrand
2. Gini 0,59 - Two economies
3. Service industries now 60% of GDP. Large state sector (Utilities, transport, communications, natural resources)
4. High unemployment +/- 30%; HIV infections +/-20%
5. Population relocations of the 60s drive systemic poverty – distance; subsistence; 55% urbanised
6. Import parity pricing vs internal comparative advantage

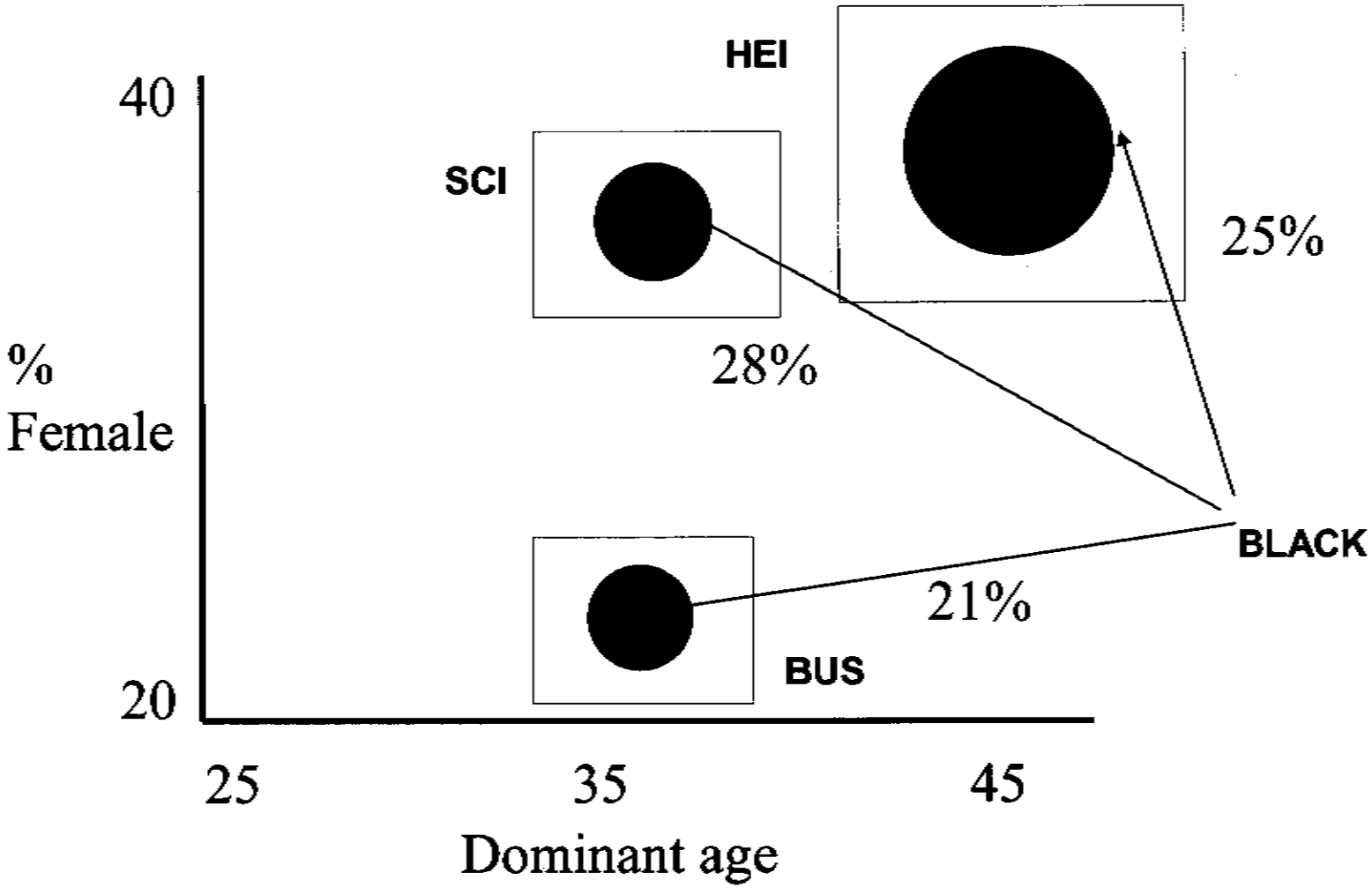
2. Policy for Innovation

- What counts as R&D; Innovation?
  - R&D is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications
  - Innovation is the dissemination of new products or processes in organizations, firms or systems
- White Paper 1996; R&T Foresight; SETI Reviews; Biotechnology Strategy; R&D Strategy
- Innovation Fund; SPII; THRIP;
- Industrial Policy? Immigration Policy? HE Policy?

3. NSI Characteristics

- From closed to open economy
- Globalization of financial, human and intellectual capital
- Global value chains including R&D
- Most multinational R&D still on home turf - shifts
- Science Councils, Framework Autonomy and PFMA
- Skewed HRD

Researchers: No, %F, Group, Sector (2001/02)



White males over 45 years comprise 21% of researchers

In HEIs % African PhD Researchers is 7%

4. Situating the Agriculture R&D Strategy

- GERD/GDP (in-house)
- FTE Researchers/1000 employed
- R&D expenditure/researcher
- Demographic data
- Concentration by type, RF, SIC, S codes
- Spatial and relationship data

CeSTII produces the numerators; Stats SA produces the denominators

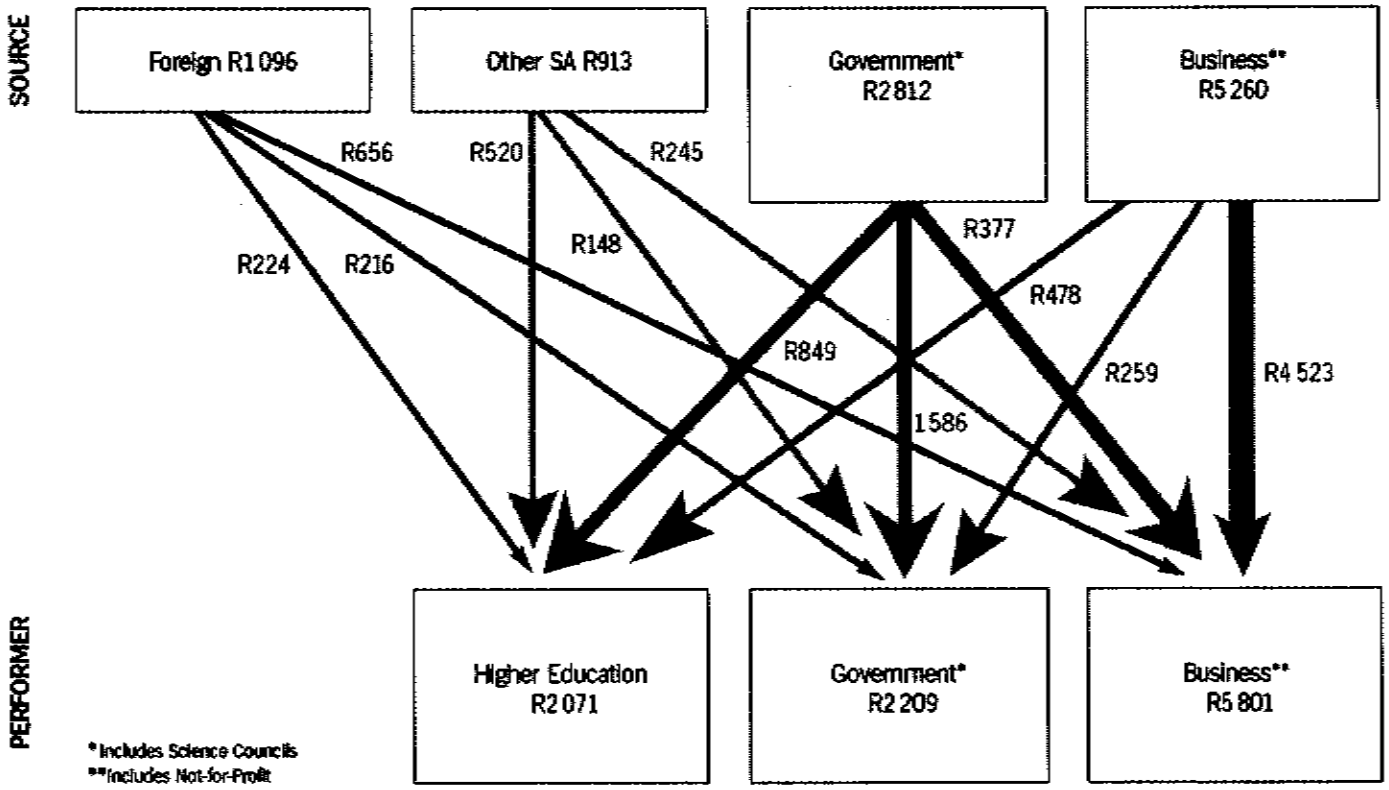
Findings of 2003/04 R&D Survey

- 2003/04 GERD R10.1 billion; 0.81% of GDP
- Gauteng GERD/GGP ~ 1,2% (Russia, China; Spain; Italy!)
- Agric R&D/Agric GDP ~ 2,4%
- National R&D strategy targets 1% by 2008. GDP will be R1600bn by then …. GERD ~ R16bn
- SA has a total of 25 185 FTE R&D personnel
- Researcher FTE (inc PhDs) is 14 129
- Researchers/1000 employed is low

Official Statistics; OECD Recognition in MSTI

Fig 8:

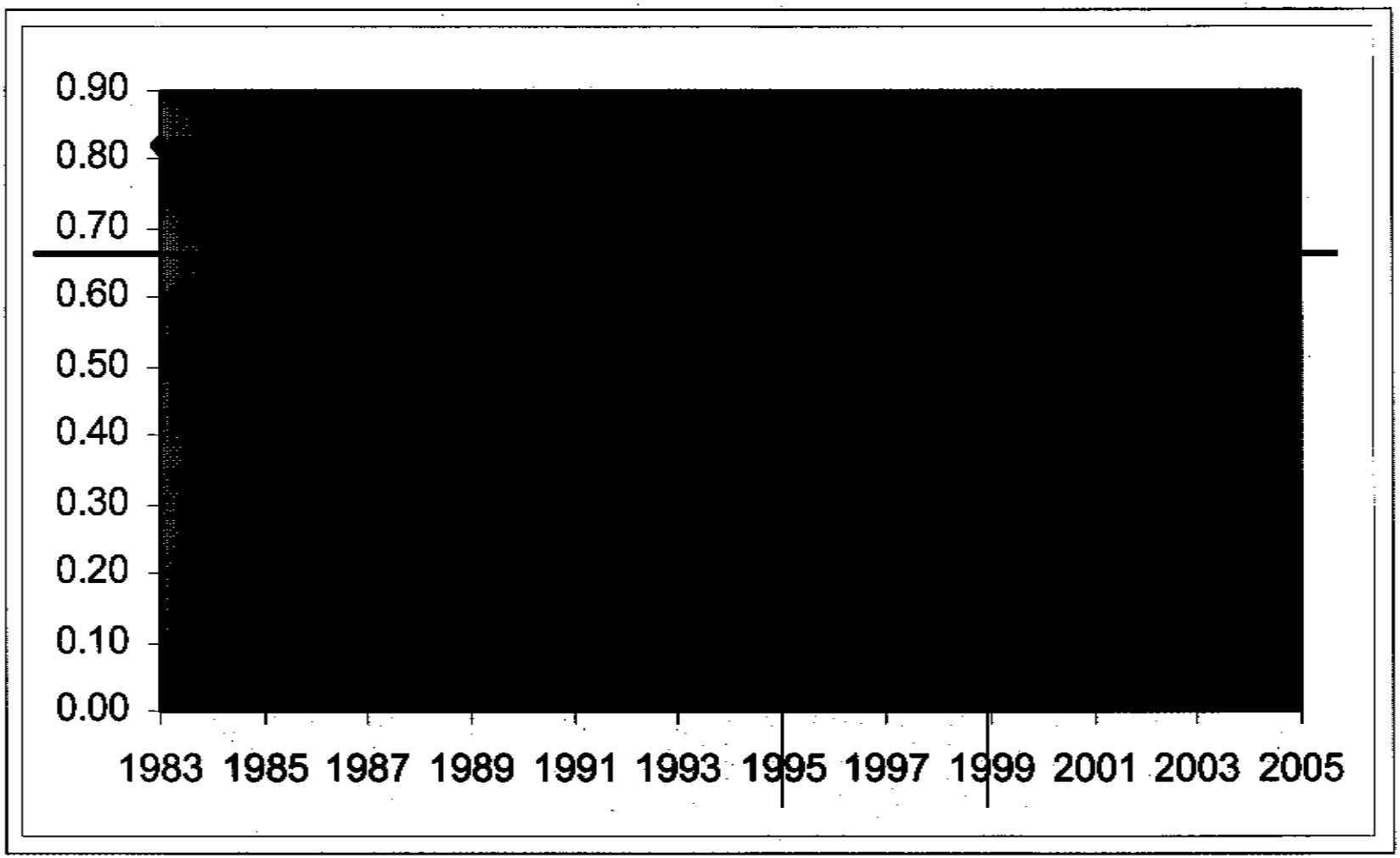
Major flows of funding for R&D, 2003/04 (R millions)



Main findings continued...

- Business major performer at 55,5% (EU average)
- Business to business funding 80% (EU average)
- HE sector 20.5%
- Business to HE funding at 20% (>> EU average)
- Government performs 21.9%, finances 28.1%
- 38% Researchers are female
- Concentrations: top 5 HEIs = 60%; top 2 Sci Co = 60%; top 10 BUS = 50%

GERD/GDP time series



Source: Kahn and Blankley, 2005

GERD by sector, 1991-2003

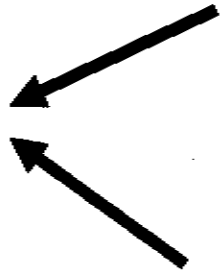
	1991		2001		2003	
Sector	**R m**	**%**	**R m**	**%**	**R m**	**%**
Business, including NPO	**1329**	**47.7**	**4094**	**54.7**	**5800**	**57.6**
Higher Education	**554**	**19.9**	**1896**	**25.3**	**2071**	**20.5**
Government and Science Councils	**903**	**32.4**	**1498**	**20**	**2210**	**21.9**

Source: Kahn and Blankley, 2005

Research Fields in HE

- Natural Sciences, Technology and Engineering to Social Sciences and Humanities about 68:32
- Canadian ratio about 80:20
- S Korea ratio 90:10
- What ratio is 'appropriate' to SA?

Expenditure by Socio-economic Objective



Source: www.hsrc.ac.za/RnDSurvey

Science Councils 2004

COUNCIL	EXPENDITURE
African Institute for South Africa	8,866,000
Agricultural Research Council	459,707,000
CSIR	652,334,000
Council for Geoscience	60,365,000
Human Sciences Research Council	138,382,000
Medical Research Council	187,521,000
Mintek	132,731,000
National Research Foundation	103,523,000
South African Bureau of Standards	2,064,000
Total	1,745,493,000

Agriculture R&D

Biotechnology R&D Spend (R 000,000)

	Business		Higher Education		Science Councils		TOTAL	TOTAL
Year	**2002**	**2004**	**2002**	**2004**	**2002**	**2004**	**2002**	**2004**
Biochemistry	3.2	4.7	16.5	12.2	3.0	12.7	22.7	30.0
Genetics & mol. Biology	5.4	8.1	13.2	14.8	12.5	25.3	31.1	48.4
Microbiology	9.9	7.1	12.6	26.4	14.4	39.9	38.1	73.4
Genetic engineering	0	10.9	6.0	3.7	0	13.0	6.0	27.6
Biotechnology	7.7	16.2	17	21.7	54.8	42.6	79.5	80.5
TOTAL	**26.2**	**47**	**65.4**	**78.7**	**84.7**	**133.5**	**177.5**	**259.9**

Source: CeSTII, 2005

5. The Human Resources Nexus

FTE's per sector, 1991-2003

SECTOR	1991/92	2001/02	2003/04
Government (incl. Science Councils)	2428	2134	2343
Business (including NPO)	3395	3149	4411
Higher Education (excludes PhD & post docs)	3631	3424	3373
Total	**9454**	**8707**	**10127**

Source: Kahn and Blankley, 2005

HE Headcount and FTE, 2001-2003

		2001			2003	
	Count	FTE	% Time	Count	FTE	% Time
Researchers	12626	3425	27.1	14055	3374	24
Technicians	827	217	26.2	2594	763	29.5
Other Support Staff	2314	401	17.3	2729	417	15.3
Tot R&D personnel	15767	4042	25.6	19377	4554	23.5
PhD students	7507	5475	72.9	7947	3960	46.4

Source: Kahn and Blankley, 2005

ISI Publications

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
No.	3,323	3,411	3,417	3,374	3,337	3,472	3,629	3,482	3,639	3,942	3,819

1. SAPSE 2003 records 5,800 publications
2. Universities account for 90% ISI; Science Councils, Institutes and Museums 9%; BUS ~1%
3. Around 75/million ~ 'take off at 150? .

Source: Kahn and Blankley, 2005

USPTO Patents granted

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
No.	89	99	137	112	112	115	110	111	120	113	112

1. Non-examining S A patent system
2. Copyright, Registered design
3. Strong performance on plant breeder's rights
4. Going global via USPTO, EPO, JPO is costly

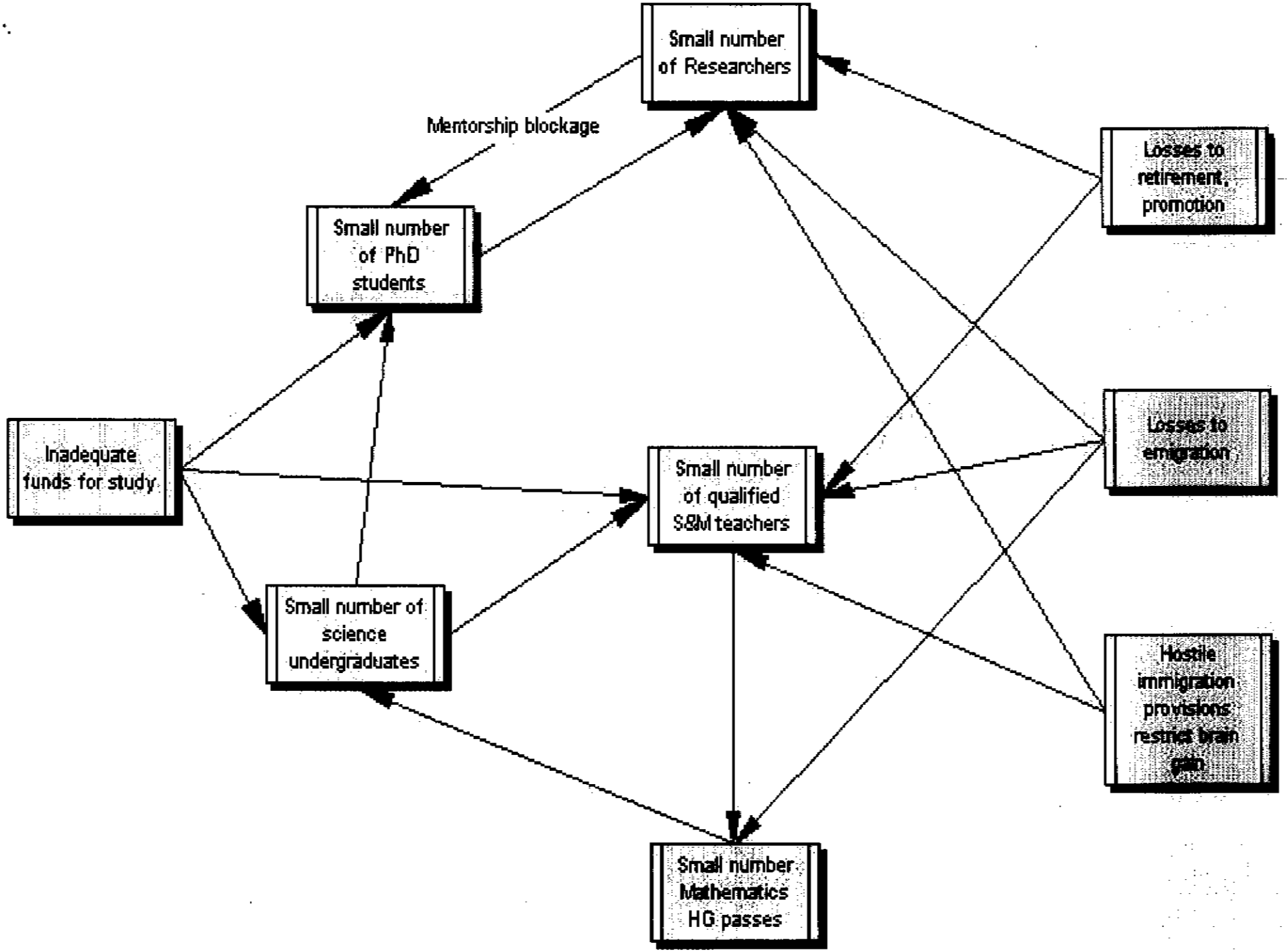
Source: Kahn and Blankley, 2005

Mathematics HG Passes, 1997-2003 (000s)

Year	1997	1998	1999	2000	2001	2002	2003
Wrote	68.5	60.3	50.1	38.5	34.9	35.5	35.4
Pass	22.8	20.3	19.9	19.3	19.5	20.5	23.4

30% are from the African group

Source: Kahn, 2005


Small number of Researchers
Mentorship blockage
Losses to retirement, promotion
Small number of PhD students
Losses to emigration
Inadequate funds for study
Small number of qualified S&M teachers
Small number of science undergraduates
Hostile immigration provisions: restrict brain gain
Small number Mathematics HG passes

Observations

- Similar to status of S. Korea ca. mid 1980
- Gauteng is the Innovation Hub
- 'Build the Base'
- Financial : additional R1bn p.a. into the future
- Growing economy; open economy
- What role for R&D in exports?
- What role for R&D in trans Limpopo business?

People turn money into knowledge

6. Implications for Policy

- GERD increase: wider coverage; organic growth
- Researcher FTE is steady over time
- NSI resilience or NSI 'moving sideways?'
  - Grow our own staff
  - Nurture and retain staff
  - Harvest abroad (remember Theiler?)
- Joined up policy
- Tax incentives – direct and indirect
- Who will use the R&D?
- Measuring innovation – formal and informal sectors
- Bridging the two economies

When Asia sneezes the West catches a cold

View surveys at www.hsrc.ac.za/RnDSurvey