Global excellence at the expense of local relevance, or a bridge between two worlds? Research in science and technology in the developing world

Helena Barnard*, Robin Cowan**, Moritz Müller***

* Gordon Institute of Business Science, Univeristy of Pretoria
** Beta, University of Strasbourg; UNU-MERIT, Maastricht University
*** Chair of Systems Design, ETHZ

E-Mail: m-mueller@ethz.ch

Research setting

- South Africa is a less-developed country.
- Access and absorption of external knowledge fosters development (e.g. Pack 2000).
- Globally connected but locally disconnected enclaves may form (e.g. Feinberg and Majumdar 2001).

National Research Foundation (NRF)

Mission

The development of South African research capacity.

Task

Distribution of funds among researchers.

Data

- Qualitative rating of researchers by
- research output (e.g. publications).

Co-authorship network

- Weighted network
- Peer-reviewed articles from 2000-2006,
- Nodes: one external source and (most) South African Scientists

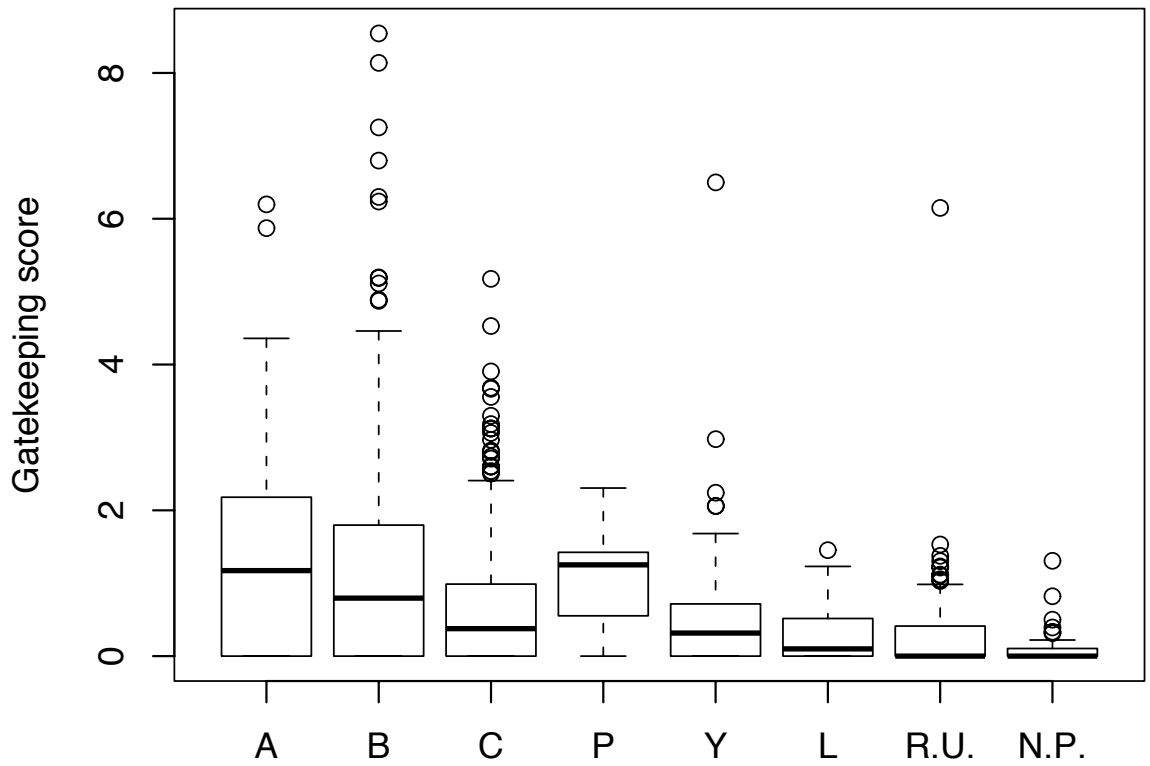
Co-authorship network

Table: Network statistics of co-publication network

Statistic	Value
No. of researchers in scientific fields	1330
No. of links	3651
No. of researchers in main component	877
No. of researchers in 2nd largest component	6
No. of isolates	278
No. of links to external source	1230
Average shortest path in main component (weighted Dijkstra)	9.3

Gatekeeping by rating

Gatekeeping = External weight / Average shortest weighted path



Decomposition of gatekeeping score

Rating	Gatekeeping score [Mean (S.D.)]	Average shortest path in network [Mean (S.D.)]	External collaborations [Mean (S.D.)]
A	2.11 (3.15)	10.06 (10.02)	29.4 (25.79)
B	1.23 (1.63)	10.32 (8.32)	18.2 (16.73)
C	0.62 (0.78)	9.12 (7.64)	10.81 (8.87)
P	1.07 (0.66)	10.59 (4.33)	16.04 (6.77)
Y	0.51 (0.72)	9.92 (7.42)	7.86 (7.19)
L	0.34 (0.43)	10.81 (9.36)	5.65 (5.22)
R.U.	0.3 (0.67)	7.32 (7.45)	6.24 (8.56)
N.P.	0.1 (0.23)	5.91 (7.57)	3.52 (3.81)

(*Gatekeeping* = *External weight* / *Average shortest weighted path*)

Methodology

Linear autoregressive error model

$$gatekeeping_i = \alpha\ rating_i + \beta\ controls_i + u_i$$

$$u_i = \rho \sum_{j \in N_i} u_j + \epsilon_i,$$

Permutation test

$H_0 : \alpha_A - \alpha_B = 0$

Permuting the rating of, say, A and B researchers in order to replicate data (and coefficient estimates) under the null.

Regression results

	Model 3	Model 4
Intercept	–	–
A-rated	3.15 (0.28)***	-0.24 (0.16)
B-rated	2.18 (0.24)***	-0.21 (0.13)
C-rated	1.61 (0.22)***	-0.18 (0.12)
P-rated	1.88 (0.40)***	0.01 (0.21)
Y-rated	1.40 (0.21)***	-0.16 (0.11)
L-rated	1.44 (0.26)***	-0.07 (0.14)
R.U.	1.34 (0.23)***	-0.09 (0.12)
N.P.	1.30 (0.25)***	-0.05 (0.13)
Articles	–	0.06 (0.00)***
Controls	...	...
$\hat{\rho}^2$	0.014 (0.001)***	0.024 (0.001)***
$\hat{\sigma}_\epsilon$	0.929 (0)***	0.486 (0)***
N	1315	1315
R^2	0.43	0.84
Moran's I p-value	0.43	0.43

Permutation test result

Table: Wald test statistic (p-value)

	Model 3	Model 4
A-B	2.85 (0.001)	-2.11 (0.951)
A-C	5.1 (<0.001)	-2.24 (0.967)
B-C	2.39 (<0.001)	0.02 (0.469)
P-Y	1.01 (0.070)	-0.09 (0.532)
P-L	1.07 (0.026)	-0.86 (0.773)
Y-L	0.26 (0.345)	-1.21 (0.873)

Conclusion

Higher rated researchers are better gatekeepers. They are better connected internationally and, due to their high productivity, remain connected to their local peers.

Future work

Capture quantitatively the actual knowledge diffusion process.

Thank you

References

Feinberg, S. E., Majumdar, S. K., 2001. Technology spillovers from foreign direct investment in the Indian pharmaceutical industry. *Journal of International Business Studies* 32 (3), 421–437.

Pack, H., 2000. Research and development in the industrial development process. In: Kim, L., Nelson, R. R. (Eds.), *Technology, Learning, and Innovation*. Cambridge University Press, Cambridge, pp. 69–94.