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Evolution of academic knowledge networks in transition economies – the Chinese perspective

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Introduction

The Chinese science and technology system (S&T-system) is under extensive transition. Until the early 1990s, scientific knowledge was produced in a non-competitive soviet-style system, which has changed dramatically since then. Within a mere 10 years, not only was the university system consolidated and upgraded but also the public research organizations found themselves completely reorganized to meet their countries' future requirements – which are producing new knowledge. This, however, requires integrating the Chinese academic system into the global research system.

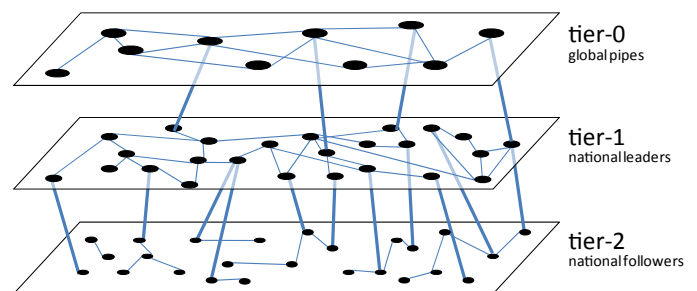
Theoretically, the global scientific knowledge system is assumed to be a hierarchical one (see fig. 1). The metaphor of global pipes that connect the world's leading institutions to locally embedded sub-systems of different levels was introduced in several concepts of knowledge networks (Bathelt, Malmberg and Maskell 2004; Revilla Diez 2001; Scott 1998). Usually the global reach is

limited at the beginning of the development for newcomers like China and only a few local institutions, especially in the metropolitan areas, are capable of keeping track (tier-1); they can be interpreted as proxy for the national followers (tier-2) to which they are connected. At later stages of development, these capabilities are enhanced to second tier institutions (Fosfori and Tribo 2008) and lead to an optimized trickle-down of global knowledge. This interrelation between knowledge flows/-spillover and urbanity/city size is picked up by Henderson (2007) and many others. Universities and other research institutions contribute greatly to the local knowledge base and thus to the regional innovation capacity (Liefner, Hennemann and Lu 2006). The innovation capacity is in turn a key determinant for knowledge-based economic development. Knowledge-based development is expected to be of increasing importance for developing countries like China (comp. Altenburg et al. 2008).

From this short discussion, the following research questions can be derived and seem promising for an investigation based on current network-analytical methods:

- 1) How is the regional integration of scientific institution into the global knowledge network changing over time? Are there indications that changes are triggered by policy intervention (e. g. new policies)?
- 2) Is the Chinese scientific knowledge system a true hierarchical one with few tier-1-institutions in metropolitan areas connected to global players while tier-2-institutions are strongly connected to the national leaders (tier-1)?

Figure 1: Schematic representation of the hierarchical knowledge system



- 3) Does this system show network-evolutionary aspects over time? (This means an improvement of the heterogeneity, density and diameter of the network.)

Preliminary results

Bibliographical co-authorship information was used to evaluate the knowledge network. The time-series covers 11 years (1997-2007) containing over 1 million edges connecting some 20,000 nodes in over 7,000 regions worldwide and forming an undirected graph for each year. Special attention is given to changes in composition of sub-networks over time. The preferential attachment of new institutions in the sub-graphs will give hints on the appearance of actors of lower global importance to the global network. First preliminary results show a growing importance of global-knowledge producers over time, whereas local institutions of minor importance (tier-2) show weak linkages and do not integrate into the hierarchical system as expected. Interestingly, some of the international institutions are much more central to the network than Chinese tier-1 institutions. The regional effects are highly visible. The size of the sub-networks is increasing dramatically and reflects the improvement of the scientific knowledge-creation activity through reorganization policy measures. The so-called 211-program universities as well as the key labs of the Chinese Academy of Sciences (CAS) are among the most important network-actors as predicted. They are all part of the largest sub-network.

Discussion

The importance of foreign actors is much higher than expected, whereas the linkages between tier-1 and tier-2 are fewer than expected. This type of global integration increases over time and might be interpreted as upgrading of the tier-1 actors. The preferential policy measures were successful. It seems that some of the Chinese top-class institutions are already part of the global pipes but they are too far ahead of the rather disconnected tier-2 institutions. From this, the notion of a hierarchical knowledge system in China has to be rejected. Moreover, this has large-scale implications for the central and regional governments, since increasing disparities will potentially hamper tier-2 institutions to contribute to regional economic development.

References

- Altenburg, T.; Schmitz, H.; Stamm, A., 2008: Breakthrough? China's and India's Transition from Production to Innovation. In: *World Development*, 36 (2): pp. 325-344.
- Bathelt, H.; Malmberg, A.; Maskell, P., 2004: Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. In: *Progress in Human Geography*, 28 (1): pp. 31-56.
- Fosfori, A.; Tribó, J. A., 2008: Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. In: *Omega*, 36 (2): pp. 173-187.
- Henderson, J. V., 2007: Understanding knowledge spillovers. In: *Regional Science and Urban Economics*, 37 (4): pp. 497-508.
- Liefner, I.; Hennemann, S.; Lu, X., 2006: Cooperation in the innovation process in developing countries: empirical evidence from Beijing Zhongguancun. In: *Environment and Planning A*, 38 (1): pp. 111-130.
- OECD (ed.), 2007: *OECD Reviews of Innovation Policy China - Synthesis Report*. Paris.
- Revilla Diez, J., 2000: The importance of Public Research Institutes in Innovative Networks. In: *European Planning Studies*, 8 (4): pp. 451-463.
- Scott, A. J., 1998: *Regions and the world economy: the coming shape of global production, competition, and political order*. Oxford University Press. Oxford and New York.