Topics of the ENID-PRIME summer school on S&T indicators

Basic Epistemological and methodological issues (Rémi Barré and Benedetto Lepori)
This lecture will provide a broad introduction to S&T indicators, looking to their epistemological status and main methodological issues. it will be driven by the conception of indicators as contestable constructs based on theory and normative and choices, which have to be considered as an instrument to nurture the stakeholders debate rather than firm quantitative answers. Further, the lecture will deal with recent changes in the nature and use of S&T indicators and on their implications for the organization of the indicators production system. We will show that the changes in the science and innovation system towards a more complex and interconnected system implies a broadening of the realm of S&T indicators, with complete new domains of indicators emerging, but also a multiplication of the customers, since S&T indicators are increasingly required by different actors as a tool for their strategy, thus introducing the notion of positioning indicators as a new conceptual framework for these developments. We will argue that two functions are critical to provide an answer to this issue. The first one is the capability of designing new indicators (*experimental design function*), the second one is the capability of transferring effectively those indicators which stand-up the early phases of their development to a systematic and long-term production setting (*capitalization function*), which jointly allow for a dynamics of innovation in the field of S&T indicators.

Readings
Lepori B., Barré R., Filliatreau Gh. (2008), New Perspectives and Challenges for the Design and Production of S&T Indicators, Research Evaluation, 17(1), 33-44.
Barré (2004), The Agora Model of S&T Indicators, in Moed, Glänzel and Schmoch, 115-132.
Godin, B. (2005), Measurement and Statistics on Science and technology, Routledge, London.
Moed H., Glänzel W., Schmoch U. (2004), Handbook of Quantitative Science and Technology Research, Kluwer, Dordrecht.

Characterizing public interventions in research and higher education (Benedetto Lepori)
This lecture will deal with the construction of indicators to characterize public interventions in research and higher education through the characterisation of public funding flows, both concerning their allocation modes and the amount granted. We will thus introduce the data from R&D statistics based on Frascati manual and their contribution in characterizing research systems at the performers side, as well as their limitations concerning the analysis of funding flows and interactions between funding agencies and performers. In the second part of the session, we will present the new positioning indicators which have been developed inside PRIME to characterize and compare between countries the structure of public project funding. This will includes a discussion of conceptual model behind these indicators, the strategy for data collection and resolution of comparability problems and, finally, the development of categories for the comparative analysis (and their limitations). Selected results and interpretation for science policy will be presented.

Readings
Lepori B. (2006a), Methodologies for analysis of research funding and expenditure: from input to positioning indicators, Research Evaluation 15 (2).
Lepori B., van den Besselaar P., Dinges M., van der Meulen B., Potì B., Reale E., Slipersaeter S., Theves J., (2006), Indicators for Comparative Analysis of Public Project Funding. Concepts, Implementation and Evaluation, Research Evaluation, Research Evaluation, 16 (4), 243-255.
Lepori B., van den Besselaar P., Dinges M., van der Meulen B., Potì B., Reale E., Slipersaeter S., Theves J., (2007), Comparing the evolution of national research policies: what patterns of change?**,** Science and Public Policy, 34 (6), 372-388.
Braun D. (2003), Lasting tensions in research policy-making – a delegation problem, Science and Public Policy 30 (5), 309-321.
OECD (2002), Frascati Manual: Proposed standard practice for surveys on Research and Experimental Development. Paris: OECD.

Knowledge Dynamics and Knowledge Visualisation (Peter van den Besselaar and Robert Braam)
This lecture focuses on knowledge dynamics and visualization of indicator information. Visualisation is the graphic display of indicator information, such 'laboratory activity profiles', and 'maps of science'. Knowledge dynamics can be visualised by longitudinal displays of STI-indicator based information. In this session we will give a brief overview of types of knowledge dynamics that can be distinguished, of the indicators to measure knowledge dynamics, and of visualization tools to communicate indicators and the lessons that can be derived.
1. We start with a brief overview of the possible types of dynamics, related to recent and older theorizing about knowledge dynamics. We will distinguish between several phases of development, and several modes of development.

2. We will present examples of research fields and show how the set of indicators adequatly distinguishes between phases and modes of development.
3. Then the step to visual representations will be made, and we will discuss the advantages and risks of using visualization as technique for deriving indictors for knowledge dynamics
4. Examples will be shown of policy relevance and use of the indicators, based on our experience.

Visualisation tools (Thomas Gurney, technical support)

In the laboratory sessions the participants will be provided with some hands on experience, regarding visualisation tools, through the analysis of real and interesting (prepared) examples, aided by technical support. This session will help to grasp possible usage and limitations of knowledge dynamics visualisation.

Readings

Kahane, B., A. Delemarle, L. Villard & P. Larédo, *Knowledge dynamics and agglomeration phenomena : the case of nanotechnology*, paper presented at the 2nd PRIME-ENID Conference on STI-Indicators for Policy, May 28-30, Oslo University College, Oslo, Norway.
Larédo, Philippe, and Philippe Mustar, 2000, *Laboratory activity profiles: an exploratory approach*, Scientometrics 47(3):525-539.
Braam, Robert, 2008, *Everything about genes: some results on the dynamics of Genomics research*, Scientometrics 79(1-2), Online First, November 2008, 10.1007/s11192-009-0404-4.
Braam, R. and P. van den Besselaar, *Bibliometric life history of organisation based research groups as positioning indicators of group strategies and performances*, paper presented at 2nd PRIME-ENID Conference on STI-Indicators for Policy, May 28-30, Oslo University College, Oslo, Norway.
Zuccala, Alessia, and Peter van den Besselaar, 2007, *Mapping review networks: Exploring community roles and contributions*, Scientometrics 79(2), forthcoming.
Tufte, Edward R., 2001, The Visual Display of Quantitative information, Graphics Press, Connecticut, USA

Positioning Higher Education Institutions (Ben Jongbloed and Frans Kaiser)

Going beyond one-dimensional rankings and their associated problems, this session will address new indicators and related techniques that allow the various stakeholders in higher education and S&T communities to characterize and assess the multi-dimensional performance of individual higher education institutions (HEIs). Europe's HEIs reveal a large diversity in strategies and missions. Therefore the challenge is to capture (to 'map') this diversity, using a set of indicators from which spidergrams and institutional profiles can be derived. We will discuss multi-dimensional classifications, performance profiles, and user-driven ranking methods. Using real data, we will demonstrate how these tools can be used for mapping diversity, positioning HEIs and how they can inform policy making.

Readings

Van Vught, F. et al. (2008). *Mapping Diversity. Developing a European Classification of Higher Education Institutions*. Enschede: Center for Higher Education Policy Studies. Downloadable from: http://www.u-map.eu/CHEPS_Mapping%20Diversity.pdf

Laboratory session: working with institutional level university data (Cinzia Daraio)

This session will present the work done in the PRIME-AQUAMETH project for the construction of a database of institutional-level data on universities and deal with methodological problems, data collection and the solution of main comparability problems. Besides a general presentation and on overview on the possible exploitation of the database for higher education studies, students will be requested to do an exercise in the extraction and analysis of a set of data, in order to grasp the practical difficulties and skills required for this kind of work. The session will thus be highly complementary to the general session on higher education indicators.

Readings

Bonaccorsi A., Daraio C. (2004), "Econometric approaches to the analysis of productivity of R&D systems. Production functions and production frontiers", in H.F. Moed, W. Glanzel and U. Schmoch (edited by), Handbook of Quantitative Science and Technology Research, Kluwer Academic Publishers, 51-74.
Bonaccorsi A., Daraio C., Lepori B., Slipersaeter S. (2007). Indicators for the analysis of Higher Education Systems: some methodological reflections. Research Evaluation, 16(2), 66-78.
Bonaccorsi A., Daraio C. (2007), edited by, Universities and Strategic Knowledge Creation. Specialization and Performance in Europe, Edward Elgar Publisher, Cheltenham, PRIME Series on Research and Innovation Policy in Europe.
Daraio C., Simar L. (2007), Advanced Robust and Nonparametric Methods in Efficiency Analysis. Methodology and Applications, Springer, New York.

Innovation indicators (Svein Olav Nas)
This session will present and discuss different approaches to constructing empirical indicators for innovation activities and outcomes in firms and public organisations. The main focus will be to discuss concepts and selected approaches in the Oslo manual with the related CIS data collection effort. This particular data source will be put in context to other supplementary or complementary indicators, such as R&D investments, IPR, human resources etc. In addition to the theoretical discussion the session will present examples of use of the data, for instance in the European Innovation Scoreboard and in a variety of micro-econometric studies. Lastly the session will address the desire for and some challenges related to developing indicators for innovation in public sectors/services. The latter will in part be based on ongoing work in the Nordic countries and the UK.

Readings
OECD, EUROSTAT (2005), Oslo Manual: *The Measurement of Scientific and Technological Activities.* Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition
OECD (2002), Frascati Manual: Proposed standard practice for surveys on Research and Experimental Development. Paris: OECD.
European Innovation Scoreboard 2008
Svein Olav Nås (2009): *micro-economic analysis of innovation and productivity*; and *measuring innovation in the public sector* (forthcoming; full references follow later)