

Chapter 2

In Search of Excellence? An International Perspective on Governance of University Research

Mats Benner

2.1 Introduction

A research policy doctrine characterized by resource concentration to fewer universities and areas selected on the basis of their scientific excellence is emerging worldwide. The doctrine is based on the assumed contributions of high-quality research environments to industrial innovation. The foundation of the governance model is a fusion of the linear model – stressing academic self-organization – and the innovation systems model, emphasizing the systemic interaction between academic research, and the economy and significance of clusters around leading universities and research environments. This chapter traces the emergence and rise to prominence of this policy paradigm in several OECD countries. It is discussed, on the basis of the material from the UniDev country case studies, if this model is transferable to developing countries.

2.2 The End of Basic Research?

Postwar research policies in Europe and North America were based on the so-called linear model, postulating that basic research – evaluated by scientific peers – would eventually lead to industrial applications and economic growth. The model made legitimate a radical increase in spending on academic research, mainly channeled through university bloc grants or through research councils' appropriations (Elzinga and Jamison 1995).

It has been claimed that basic research in this format no longer holds a privileged position in research governance, primarily due to rising costs to the government without corresponding returns on investment (Nowotny et al. 2003). “Excellence,”

M. Benner (✉)

Research Policy Institute, Lund University, Lund, Sweden

e-mail: Mats.Benner@fpi.lu.se

as determined in collegial procedures, has been replaced by “social robustness” evaluated in broad-based processes, as the prime goal for research policy. The governance of academic research should accordingly be based on interest mediation rather than intra-academic priority setting (Gibbons 2001). This implicates that research and innovation govern in a more open and flexible manner – involving more actors and operating through broader agenda setting.

A more careful reading of research governance will reveal that the picture is less clear-cut and that the linear ideals still matter in research governance. If anything, the relative autonomy of the academic system has been strengthened. We argue that research governance in Europe and North America is still very much “excellence driven,” with a stress on quality criteria and peer review procedures for the allocation of resources. The model is tailored on the form and function of the US research system. The rapid growth of the US economy in the 1990s resulted in a reconsideration of research policies worldwide, as the growth pattern was attributed to the strength of the research system and, in particular, the US university system (Pavitt 2000). Research governance has targeted excellence-driven milieus as an essential underpinning of a dynamic economy. Such research milieus are expected to attract other growth-enhancing institutions such as venture capitalists, science parks, technology-based firms, service providers, and so on. Hence, excellence-driven academic milieus are viewed as strategic elements in the emergence of knowledge-intensive economy; hence, the model has gained worldwide prominence and attraction.

2.3 Explaining Research Governance: An Analytical Model

Research governance takes place on three levels: on a macro level (policy), meso level (funding), and micro level (laboratory organization). Most studies of research governance focus on the meso level and, in particular, the interaction between funding agencies and researchers in the selection, monitoring, and evaluation of publicly funded research (e.g., Geuna and Martin 2003). Microlevel studies on the governance of research stress the negotiated practices in academic organizations, in laboratory work, in interaction pattern, and in writing and communication (Knorr-Cetina 2000).

This paper deals primarily with the macro-governance of research, articulating goals for public research and its role in relation to the political and economic systems, although it also covers some aspects of meso-governance (such as research funding and models for university–industry interaction). It sets the framework for both meso- and microlevel governance by identifying overarching goals and priorities, and by regulating funding streams and research practices (Elzinga and Jamison 1995). There are stable systemic differences in the macro-governance of research systems, for instance, with respect to the funding and regulation public research organizations (Whitley 2000). These differences are mainly based on institutional variations in the relationship between states and universities. Even if

governance trajectories are relatively stable over time, and national institutional differences tend to prevail over short-term policy trends, there are tendencies toward policy convergence as well, not least driven by the apparent “success” of certain institutional models (Drori et al. 2003). The Humboldtian research university became a global model in the late nineteenth century, spreading from Europe to USA (and further, through colonialism, to Latin America and Asia); in recent years, a reverse policy transfer has taken place where the North American “entrepreneurial” university has become the beacon for university reformers worldwide (Marginson 2006).

2.3.1 Comparative Aspects

In the first three decades after World War II, economic growth was based on economies of scale. The centrality of national political and economic space and of the national regulation of the mode of growth led to the emergence of many different institutional configurations in this period. The contrasts between national production systems were stark, with the Anglo-Saxon countries organizing their economies along competitive lines, with few coordinating mechanisms. As a contrast, Nordic and Continental European countries developed a broad range of coordinating mechanisms (Hollingsworth and Boyer 1997). In a similar vein, rather idiosyncratic research governance models emerged: in USA and the UK with a strong emphasis on universities as the key arena for research, whereas many Continental European countries developed a large institute sector (often in correspondence with dominant industrial sectors), while the Nordic countries combined elements of both the Continental and Anglo-Saxon models (Clark 1983; Ronayne 1984).

The period since the early 1970s has been characterized by the search for a new growth model with institutions that can support the transition toward a knowledge-based economy (Jessop 2002). In science and technology policy, there has been a shift toward the creation of “knowledge infrastructures” relevant to business development. In this process, the university has emerged as an important source of company formation but and of linkages with existing and emerging industrial sectors (Martin 2003).

However, transforming research governance is a complex process. Institutional change emerges in a dialectic process of path dependence and adjustments to changing conditions and power constellations (Thelen 2004). We would therefore assume that governance systems are relatively stable over time, although new functions can be added to the original institutional set up. Several experiments with the institutional structure of research governance have taken place recently, where novel funding models and organizational structures have been introduced. Many of these experiments have been inspired by the evolution of the US research and innovation system and have been added to existing institutional structures. The focus of this paper is to explore the forms and content of these adjustments.

The ambitions henceforth are twofold: to study the rise and dissemination of the excellence-driven governance model and to analyze its diffusion across countries. This is done through a survey of research policy priorities in a number of OECD countries in the recent decade. The analytical dimensions include the structure of support, the policy discourse, and the prescribed role of academic research in innovation systems. The analysis is comparative, searching for possible variations of research governance models in different socioeconomic systems. The analysis will then proceed to a critical discussion of the impact of such concentration policies on the fabric of higher education and the possible lessons for higher education policy in developing countries.

2.3.2 Anglo-Saxon Research Governance

The US economy was, at least until the fall of 2008, portrayed as a global role model in debates on economic growth. Among the institutions that were singled out as core elements in the US growth model are the research universities and the risk capital market (Powell et al. 2003). From such a perspective, US economic prosperity and innovation dynamics build upon the combination and concentration of advanced technology, talented people, and social diversity, resources that are highly dependent on universities, in combination with public and private actors with complementary resources. The US research system has become a magnet for talented scientists worldwide, which contributes to the concentration of leading knowledge and innovation centers to North America (Cooke 2004). These centers tend to be organized around not only a limited number of “star scientists” with a high profile in research but also tight connections to the market (Darby et al. 1998). This concentration process has been reinforced by the aggressive recruitment strategies of leading research universities, which have resulted in the clustering of prominent scientists to a small number of institutional settings (Geiger 2004). This process is reflected in and has been further reinforced by the concentration of support from the dominant funding agencies. Hence, a limited number of universities have reinforced their position in the research system on the basis of aggressive managerial strategies to recruit leading scientists, large endowments, and strong position in the highly stratified funding system.

The research governance model has emerged not by design but as a result of an uncoordinated evolution of different policy spheres. One such sphere is the research laboratory system, which accounts for about a third of total public R&D expenditure in USA. The laboratories combine a high level of scientific activity with a mission-oriented role, if only indirect. The National Institutes of Health (NIH) and Department of Energy laboratories perform basic research, although they are nominally mission oriented. In a similar vein, government laboratories in agriculture and defense also conduct a large share of basic research (Bozeman and Dietz 2001).

Many of the pillars of US research policy tend to be based outside a policy for research per se. Whether this lack of a coordinated policy approach is an

advantage or a disadvantage is a debated issue; it has even been claimed that the productivity and visibility of US science can be explained by the very lack of policy integrative mechanisms (Savage 1999; Stokes 1997). The civilian part of the funding system is heavily biased toward the biomedical area: while resources for many other areas are growing slowly, or even decreasing (for instance in energy), support of biomedicine grew dramatically in the 1990s and the beginning of this decade, and now represent about half of federal research funding (AAAS 2005). The strength of biomedical research in USA has been further reinforced by the rich supply of private funding. The US research system is therefore marked by resource concentration to a limited number of research organizations, intense competition for funding, a rich supply of relatively undirected research support (with allocation criteria mainly based on scientific quality), and a marked focus on the biosciences.

The US political economy is often viewed as the ideal typical example of a liberal market economy, with few strong binds between actors and organizations, but a large degree of flexibility based on the flexible deployment of resources, a vigorous capital market, and a vivid culture of entrepreneurialism. The mechanisms for integrating the research system with the market are, therefore, exceptionally well developed in USA if compared with that in the European countries. First, the universities are often based in an entrepreneurial tradition and are accustomed to operating according to market or quasi-market conditions (Etzkowitz 2001). Second, academics have historically been subject to many incentives to combine traditional academic tasks with entrepreneurial activity, without necessarily having to depart from their academic positions (Mowery et al. 2004; Etzkowitz 2003). Third, the infrastructure for science-based entrepreneurship is highly developed, with a rich flora of venture capitalists, organizational brokers, university patenting, and licensing organizations surrounding the academic centers (Mowery 2001).

As a result, the research system has emerged as an integrated part of the development, dissemination, and exploitation of new knowledge. Key aspects in this institutional set up include the mobility of scientists, the amount and scope of policy initiatives to support academy–industry linkages, the openness of research organization to scientific change, and the importance of integrative mechanism between academics and entrepreneurs.

However, knowledge interplay is less well developed outside the science-based sectors where investments in skills tend to be marginal, and networks and systemic interaction between institutions and organizations are much weaker. Several attempts were made in the 1980s and early 1990s to mimic the institutional structure of the European countries to remedy some of these shortcomings, with public technology transfer programs to increase competence accretion in the manufacturing sectors and in strategic fields such as microelectronics (Gulbrandsen and Etzkowitz 1999). Due the continued resistance against direct state interventionism in the economy, these policy initiatives were never fully institutionalized and now play a marginal role in the policy mix.

While USA is the premier example of this type of research governance, similar institutional structures have emerged in other Anglo-Saxon countries. Canada has

taken steps to support the concentration of research activities into “networks of centers of excellence” combined with support of individual researchers with a strong scientific track record. The ultimate goal of this radical increase in government spending on research – with a special focus on excellence-driven activities – is to reinforce the country’s position in a new economic landscape (Bernstein 2003).

Funding of academic research in the UK has been more competitive than that in most other European countries. The introduction of resource allocation on the basis of the Research Assessment Exercise, together with the program-based structure of research council funding, has fostered competition and concentration in the research system (Georghiou 2001). Furthermore, the importance of private sources of funding has increased rapidly. UK research governance is similar to the US model, with a highly competitive funding regime, a premium placed on scientific excellence but with many incentives for academic–industrial collaboration (PREST 2000). This indicates that several governance instruments are in operation in parallel and that the successful research environments are those that can fulfill several different roles at the same time: scientific excellence, the concentration of resources to larger and multidisciplinary research programs, and industrial collaboration. The UK research system is marked by an increasing concentration of both academic research and industrial activities to a relatively limited number of settings (Riccaboni et al. 2003).

The UK political economy shares many of the characteristics of USA, with its dual structure of the economy, consisting on the one hand of a highly competitive science-based sector (notably in pharmaceuticals and chemistry) and on the other, industries such as mechanical engineering and manufacturing with much weaker performance (Rhodes 2000).

To sum up, the governance of research in the Anglo-Saxon liberal market economies is based on resource concentration via competitive funding programs. The strong focus on resource concentration has been accompanied a rich institutional structure for the commercialization of public research, either directly or through dense networks between academic environments and companies (Pavitt 2001). Hence, there seems to be no necessary trade-off between “excellence” and “relevance,” but rather a reinforcing relationship, at least in many areas. It has, obviously, resulted in the hegemony of academic institutions in USA – and to a lesser extent in UK and Canada – in the global research system.

2.3.3 Research Governance in Continental Europe

Despite the historical origin of the modern research university in Germany, Continental European universities function primarily as educational organizations, whereas research institutes are the dominant organizations for basic as well as applied research (Meyer-Krahmer 2001). Universities perform far less than half of public sector research in France and Germany. Studies of the development of

science-based areas indicate that the large Continental European countries follow a policy trajectory of resource concentration to one or very few organizations, mainly research institutes (Riccaboni et al. 2003). Furthermore, universities and other public research organizations play a marginal role in R&D collaboration, a role instead played by larger firms (Ibid: 179–181).

Continental universities with their tradition of rigid career structures and professorial hierarchies have had difficulties in adapting to a more fluid and flexible knowledge-producing system. The university system is considered inflexible, segmented, and too overloaded to be able to provide a strong infrastructure for top-class research (Krull 2003). Continental universities have suffered from an overburdened education component and have had difficulties in exploiting the dynamic local interactions that characterize leading universities in USA and UK.

Research governance in the Continental European countries has traditionally focused on the interests of existing industrial strongholds. This is the case not least for the applied research institute sector where rich ties and networks have strengthened the corporate capacity for technological upgrading and renewal (Becker and Dietz 2004).

To counteract some of the imbalances, several of the Continental European countries have pursued institutional reforms in science and innovation policy. In Germany, in the absence of a developed venture capital system, the government has fuelled the development of a biotechnology sector, for instance through efforts to support university spin-offs, a total investment of over €150 million annually (Kaiser and Prange 2004: 402). Another aspect has been increasing spending on research, especially the biosciences. The German Research Council expanded its support of biotechnology research rapidly in the 1990s and 2000s, and a similar adaptation pattern is found in France (Kaiser and Prange 2004: 404; Larédo and Mustar 2003: 21). The funding basis and the organizational standing of universities have also been reinforced. Recently, the German government announced major initiatives to modernize its academic system, by adding more resources but at the same time pressing for a concentration both among universities and research constellations, to so-called excellence clusters. A similar transformation of research governance has taken place in France, where money has been reallocated from the research institute sector to universities, to address the dismal performance of French universities in international ranking exercises (Laredo *et al.*). Hence, resource concentration and a competitive allocation of resources are an emerging phenomenon in many Continental European countries; however, as noticed by Schmoch in his contribution to this volume, the signals are mixed, as university governance in Continental Europe strongly emphasizes the contribution of universities to technology transfer (see Chap. 13).

The exceptions to the pattern of weak university performance in Continental Europe are the Netherlands and Switzerland. Dutch research governance is similar to the model that has emerged in USA, with a university system taking a lead in both research and innovation networking (Van der Meulen and Rip 2001: 318). The issues of resource concentration and support of excellence-driven research

milieus have also been addressed by the Dutch political system with strings of programs to support “top-class research groups at the universities” (Dutch Ministry of Education, Culture and Science 2004). A similar pattern can be found in Switzerland, where public resources are concentrated to a small number of actors – actors which operate in relative autonomy from public regulation (Braun and Benninghoff 2003).

The background to the reforms of research governance in Continental Europe can be found both in the inertia of the academic system and in the search for new innovation policy instruments. Traditional instruments for supporting economic growth and innovation have become increasingly obsolete, as indicated by sluggish growth, especially in science-based sectors. In France, the importance of large governmental programs for technological development has waned during the last decades, due to a more stringent financial policy, deregulations, and changing ideological commitments (Schmidt 2002). The German model of a coordinated structure to manage industrial and technological change has also been weakened in the 1990s. The German political system has struggled with structural reforms for well over a decade, but the strong institutional regulation in employment, welfare, and economic development has hindered the development of alternative sources of growth and employment (Streeck 2008).

In the light of these rigidities and the obsolescence of traditional policy instruments, and with ubiquitous references to the “American challenge” in basic research and in science-based sectors, state support of excellence-driven research milieus has come to the forefront in Continental European research governance as have state-initiated programs to improve the supply of venture capital. This represents both continuity and change in research governance. The break lies in the radical reforms of the research system, with a partial dethronement of the professoriate and a parallel strengthening of the universities within the research landscape – also at the expense of the traditionally very powerful institute sector (which has responded vigorously to the political challenges; Laredo et al., *fc.*). The strengthening of universities and academic research is therefore seen as a necessary part in the renovation of the innovation system of the Continental European countries, even at the price of a confrontation with embedded interests.

2.3.4 A Nordic Model of Research Governance?

The Nordic countries are usually singled out as a group of their own in comparative studies of political institutions and economic development. They are often labeled as social-democratic, indicating the strong legacy of social democratic values in their commitments to general welfare and full employment, enabled by a historical compromise between the labor movement and the organized business interests. Their economies are institutionally embedded, as in the case of the Continental European countries, with highly advanced systems of investment regulation, labor market interaction, and social protection. On the contrary, the countries have been

open economies, already from an early stage developing mechanisms to adapt their economies according to changes in world markets and to technological dynamics (Scharpf 2000).

Traditionally, research governance in the Nordic countries was based on bloc grants to universities together with a relatively small competitive funding layer in the form of research council funding (Skoie 1996). The countries also established relatively large institute sectors, funded by both the state and industry, mainly performing near-market R&D. This governance model has been partially transformed in the last decade. The dominant parts in the reform process have been the proliferation of competitive funding, the concentration of resources in the form of larger and excellence-oriented programs, and the relative decline of the institute sector.

Hence, a convergence of research governance has taken place, based on resource concentration and a growing share of funding exposed to peer-reviewed competition, together with institutional reforms to reap the benefits of growing spending on R&D (Kim 2002). The Research Council of Norway has been restructured due to the instability of the interdisciplinary and cross-organizational agency established in the early 1990s (Skoie 2000). The reformed council has adopted a governance structure based on role differentiation, with earmarked support for basic research projects and for large center support. Along similar lines, the Danish funding system has been amended by a basic research foundation and also by a program to establish centers of excellence. Another striking feature of research governance has been the reorganization of the university system – including state-initiated mergers and detailed “contracts” between the state and universities (see Chap. 14). While universities have been empowered and have seen their resources for basic research increase, they have at the same time been re-regulated and enmeshed in ever more complicated negotiations with the state. In Finland, a center of excellence initiative was devised in the early 1990s, operating in parallel with a large technology-driven program and with several support mechanisms for regional science-based development (Lemola 2004). In Sweden, the process of concentrating resources to a more limited number of institutions begun more recently, partly explained by the large number of funding agencies and the limited interaction between them (Benner 2008).

Despite the convergence in research governance mechanisms, the countries show variations, especially in their levels of R&D expenditure – variations that primarily reflect the different compositions of their economies, where raw materials- based sectors and SMEs are more significant parts of the economy in Denmark and Norway than in Sweden and Finland. These variations aside, the countries have all increased funding to university research organized in larger constellations and evaluated according to scientific quality criteria. This excellence orientation in research governance has then been accompanied by initiatives to bolster the interaction between universities and industry. As a result, many Nordic universities have evolved along similar lines as their US and UK counterparts, taking on entrepreneurial roles involving licensing and firm formation (Jacob et al. 2003).

This has corresponded with the growth of technology-based firms, many with a background in academic research. By European standards, the risk capital markets are relatively well developed as are the mechanisms for integrating academic research and market actors (Henrekson and Rosenberg 2001).

The Nordic countries thus seem to be mimicking the US research governance model, with strong position for universities, a high profile in growing research areas, and strong ties between the research system and high-technology firms and sectors. Contrary to the development in USA and the UK, however, this governance model has been combined with a strong public support of research areas with connections to low-technology industries and to mature industrial fields such as food, engineering, and the transport industry. Furthermore, the drive to concentrate resources to fewer recipients and fields has been balanced by regional considerations: the Nordic countries, with the partial exception of Denmark, have all made major investments in peripheral universities. Hence, the Nordic countries face the challenge of combining policy goals: resource concentration and adaption of the research system to economic and regional interests.

2.4 Discussion – Where Is Research Governance Going?

Research governance in the Nordic countries, Continental Europe, and the Anglo-Saxon countries has converged around a pattern of resource concentration to fewer field and fewer recipients. Universities have become the most important instrument for securing a position in the globalized knowledge-based economy – by securing scientific visibility and by fostering networks of innovators and innovating sectors around them. These processes are assumed to develop in parallel, where scientific visibility is supposed to be related to innovative capacities. Hence, universities are subject to dual steering signals, on the one hand relating resources to scientific impact, and on the other, directing resources to maximize their interaction with the market. The new global policy is clearly tailored on the US experience, in and particular the very strong emphasis on a select number of universities as engines of scientific visibility and innovation activities. Universities are being highlighted as engines of economic development, and research policy is empowering a small number of elite institutions. The expectation is that these will become nodes in global research networks. From a global perspective, we find trends toward resource concentration.

How, then, are countries outside the European–North American model responding – is the emerging governance model emulated also outside Europe and North America? Generally speaking, most countries have fostered at least one leading national university, although these universities have neither always been the foci of research activities, nor have they always taken on broader roles in economic development. Some of these national, “flagship,” universities are extremely large by international measures, and are therefore more cumbersome to reform. The general view seems to be that universities in developing countries

are large (in terms of student intake), weak (in their research profile), and rigid (in their management). Nonetheless, a recent survey of university politics and research governance in Asia and Latin America indicates a trend not only toward empowering universities but also toward a more stringent evaluation of their performance, to make them more responsive to the dynamics of research and to the socioeconomic demands (Altbach and Balán 2007). The case studies conducted within the UniDev project also point to the slow and uneven emulation of the university-centered model – focusing public support to a limited number of universities that are expected to increase the visibility of the national scientific fabric and the connections to global knowledge networks.

Again, there are marked variations along this theme. The Cuban experience is telling, with universities being responsive to the demands of the domestic economy, but obviously at the price of research with a more long-term perspective – with the exception of biotechnology (see Chap. 6). A similar pattern is found in Tanzania, where universities still focus, and increasingly so, on near-market issues rather than basic research. In both these countries, severe economic conditions limit the possibilities of developing full-fledged research universities; universities still plays an intermediary role as providers of education for a selected elite and performing applied research with the national firms and sectors in mind (see Chap. 9). Even Russia, historically a scientific powerhouse in its own right, has seen a deteriorating position for the universities with sliding state appropriations for research and a general political neglect of the university system (see Chap. 12). China is the most obvious contrasting case, where various policies have been devised to elevate select parts of the Chinese university system to a level of international eminence, while at the same time, the contribution of universities to technological upgrading and organizational networking (for instance through spin-offs and technology transfer) has been stressed (see Chap. 8). The rapid transformation of Chinese universities, some observers argue, will create a more multipolar research system, dethroning European and (in particular) US universities from the currently hegemonic position in virtually all scientific fields (Hollingsworth et al. 2008). In a similar vein, the Vietnamese universities have taken on a much more proactive role in the economy (see Chap. 7). In both of these cases, universities have a broad function, acting as midwives (in the relative absence of high-technology-based firms) for technological development and as a complement (and in some cases a replacement) of the academies as the center of public research activities.

2.5 Conclusions

While the political and economic centrality of universities has increased dramatically and has fostered more autonomy for universities in stark contrast with a tradition of often coercive state steering, it has also created overly optimistic expectations on the university system, and a search for “quick fixes” in the form of a simplified emulation of a US-styled governance model. This does not necessarily fit very well

with existing institutional structures or with the socioeconomic conditions surrounding universities; it might instead create “islands of excellence” with global connections but limited interaction with broader social and economic interests. It can also overshadow and marginalize developments toward a new type of “indigenous university.” In this respect, Arocena och Sutz (see Chap. 5) points at the emerging role of a developing university, a new species that neither resembles the old-style “flagship university” nor the global, US-style university but a university that connects local interests with global research dynamics. This is not a theoretical excursus, as the experience in many countries such as South Africa and Brazil both exemplify a more ambitious and original approach to tailor and adapt the generic university concept – modeled on the USA style governance mechanisms – to indigenous needs (see Chaps. 4 and 10). In particular, a more comprehensive overhaul of governance mechanisms – to rid the universities of hierarchical, etatist, and racist sediments – has been combined with a leading role for national economic and social development and the ambition to play important roles in global knowledge networks. If realized, this model is in itself a most important contribution to policy formation in developing and developed countries alike, and an attractive alternative to the current hegemony in university governance.

References

- AAAS (American Association for the Advancement of the Sciences) 2005 AAAS *Analysis of R&D in the FY 2005*. Washington, DC: AAAS.
- Altbach PG, Balán J, eds. (2007). *Transforming Research Universities in Asia and Latin America: World Class Worldwide*. Baltimore: Johns Hopkins University Press.
- Becker W, Dietz J (2004). R&D Cooperation and Innovation Activities of Firms – Evidence for the German Manufacturing Industry. *Research Policy* 33: 209–223.
- Benner M (2003). The Scandinavian Challenge: The Future of Advanced Welfare States in the Knowledge Economy. *Acta Sociologica* 46 (2): 132–149.
- Bernstein A (2003). Canadian Institutes of Health Research Budgetary Dilemma. *Canadian Medical Association Journal* 169: 6.
- Bozeman B, Dietz JS (2001). Research Policy Trends in the United States, in Larédo P, Mustar P, eds. *Research and Innovation Policies in the New Global Economy*, 47–78. Cheltenham: Edward Elgar.
- Braun D, Benninghoff M (2003). Policy learning in Swiss research policy – the case of the National Centers of Competence in Research. *Research Policy* 32; 10: 1849–1863.
- Clark BR (1983). *The Higher Education System*. Berkeley: University of California Press.
- Cooke P (2004). Biosciences and the rise of regional science policy. *Science and Public Policy* 31; 3: 185–198.
- Drori GS, et al. (2003). *Science in the Modern World Polity*. Stanford: Stanford University Press.
- Dutch Ministry of Education, Culture and Science (2004). *Science Budget 04: Focus on Excellence and Greater Value*. Downloaded at: www.minocw.nl/english/doc/2004/sciencebudget.pdf.
- Elzinga A, Jamison A (1995). Changing Policy Agendas in Science and Technology, in Jasanoff, Sheila, et al., eds. *Handbook of Science and Technology Studies*, 572–597. London: SAGE.
- Etzkowitz H (2001). *MIT and the Rise of Entrepreneurial Science*. London: Routledge.
- Etzkowitz H (2003). Research Groups as ‘Quasi-Firms’: The Invention of the Entrepreneurial University, *Research Policy* 32; 1: 109–121.

- Geiger R (2004). *Knowledge and Money: Research Universities and the Paradox of the Marketplace*. Stanford: Stanford University Press.
- Georghiou L (2001). The United Kingdom National System of Research, Technology and Innovation, in Larédo P, Mustar P, eds. *Research and Innovation Policies in the New Global Economy*, 253–296. Cheltenham: Edward Elgar.
- Geuna A, Martin BR (2003). University Research Evaluation and Funding: An International Comparison', *Minerva* 41: 277–304.
- Gibbons M (2001). Governance and the New Production of Knowledge, in de la Mothe J, ed. *Science, Technology and Governance*, 33–49. London: Continuum.
- Gulbrandsen M, Etzkowitz H (1999). Convergence Between Europe and America: The Transition from Industrial to Innovation Policy. *Journal of Technology Transfer* 24 (2–3): 223–233.
- Henrekson M, Rosenberg N (2001). Designing Efficient Institutions for Science-Based Entrepreneurship: Lessons from The US and Sweden. *Journal of Technology Transfer* 26 (2): 207–231.
- Hollingsworth JR, Boyer R, eds. (1997). *Contemporary Capitalism: The Embeddedness of Institutions*. Cambridge: Cambridge University Press.
- Hollingsworth JR, et al. (2008). China: The end of the science superpowers, *Nature* 454, 412–413.
- Jacob M, Lundqvist M, Hellsmark H (2003). Entrepreneurial Transformation in the Swedish University System. *Research Policy* 32; 9: 1555–1568.
- Jessop B (2002). *The Future of the Capitalist State*. Cambridge: Polity Press.
- Kaiser R, Prange H (2004). The Reconfiguration of National Innovation Systems – The Example of German Biotechnology. *Research Policy* 33 (2004): 395–408.
- Kim L (2002). *Lika Olika*. Stockholm: Högskoleverket.
- Knorr-Cetina K (2000). *Epistemic Cultures*. Cambridge: Harvard University Press.
- Krull W (2003). Toward a Research Policy for the New Europe: Changes and Challenges for Public and Private Funders. *Minerva* 42: 29–39.
- Larédo P, Mustar P (2003). Public Sector Research: A Growing Role in Innovation Systems. *Minerva* 42: 11–27.
- Lemola T (2004). Finnish Science and Technology Policy, in Schienstock G ed. *Embracing the Knowledge Economy*, 268–286. Cheltenham: Edward Elgar.
- Marginson S (2006). The Anglo-American university at its global high tide. *Minerva* 44: 65–87.
- Martin BR (2003). The Changing Social Contract for Research and the Evolution of the University, in Geuna A, Salter AJ, Steinmueller W, eds. *Science and Innovation*, 7–29. Cheltenham: Edward Elgar.
- Meyer-Krahmer F (2001). The German Innovation System, in Larédo P, Mustar P, eds. *Research and Innovation Policies in the New Global Economy*, 205–252. Cheltenham: Edward Elgar.
- Mowery DC (2001). The United States National Innovation System after the Cold War, in Larédo P, Mustar P, eds. *Research and Innovation Policies in the New Global Economy*. Cheltenham: Edward Elgar.
- Mowery DC, et al. (2004). *Ivory Tower and Industrial Innovation*. Stanford: Stanford University Press.
- Nelson RR (2004). The Market Economy, and the Scientific Commons. *Research Policy* 33 (2004): 455–471.
- Nowotny H, Scott P, Gibbons M (2003). Introduction: 'Mode 2' Revisited: The New Production of Knowledge. *Minerva* 41: 179–194.
- Pavitt K (2000). Public Policies to Support Basic Research. *Industrial and Corporate Change* 10(3): 761–779.
- Pavitt K (2001). Why European Union funding of academic research should be increased: a radical proposal, *Science and Public Policy*, 27(6): 455–460.
- Powell WW, et al. (2003). The spatial clustering of science and capital. *Regional Studies*, 36(3): 299–313.

- PREST (Policy Research in Engineering, Science and Technology) (2000). *Impact of the Research Assessment Exercise and the Future of Quality Assurance in the light of Changes in the Research Landscape*. Manchester: PREST.
- Rhodes M (2000). Restructuring the British Welfare State, in Scharpf FW, Schmidt VA, eds. *Welfare and Work in the Pen Economy*, Vol. 2, 19–68. Oxford University Press.
- Riccaboni M, et al. (2003). Public Research and Industrial Innovation, in Geuna, A, et al. *Science and Innovation: Rethinking the Rationales for Funding and Governance*, 169–201. Cheltenham: Edward Elgar.
- Ronayne J (1984). *Science in Government*. London: Edward Arnold.
- Savage JD (1999). *Funding Science in America*. Cambridge: Cambridge University Press.
- Scharpf FW (2000). Economic Changes, Vulnerabilities, and Institutional Capabilities, in Scharpf FW, Schmidt VA, eds. *Welfare and Work in the Open Economy*, Vol. 1, 21–124. Oxford: Oxford University Press.
- Schmidt VA (2002). *The Futures of European Capitalism*. Oxford: Oxford University Press.
- Skoie H (1996). Basic research – a new funding climate. *Science and Public Policy* 23: 66–75.
- Skoie H (2000). Diversity and Identity: The Merger of Five Research Councils in Norway. *Science and Public Policy* 27, 2: 83–96.
- Stokes DE (1997). *Pasteur's Quadrant*. Washington, DC: Brookings Institutions Press.
- Streeck W (2008). *Re-Forming Capitalism. Institutional Change in the German Political Economy*. Oxford: Oxford University Press.
- Thelen K (2004). *How Institutions Evolve*. (Cambridge: Cambridge University Press)
- Van der Meulen B, Rip A (2001). The Netherlands, in Larédo P, Mustar P, eds. *Research and Innovation Policies in the New Global Economy*, 297–324. Cheltenham: Edward Elgar.
- Whitley R (2000). *Divergent Capitalisms*. Oxford: Oxford University Press.
- Zucker LG, Darby MR, Armstrong J (1998). Geographically Localized Knowledge. *Economic Inquiry* 36, 65–86.

Universities in Transition

The Changing Role and Challenges for Academic
Institutions

Göransson, B.; Brundenius, C. (Eds.)

2011, XIII, 366 p., Hardcover

ISBN: 978-1-4419-7508-9