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Science and Technology Studies and Policy in Central and Eastern Europe: What Next?

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Trends So Far: A Summary

Inevitably, the case studies presented in this Special Issue highlight both the local variation between the countries of Central and Eastern Europe (C&EE) and the considerable uncertainty which hangs over the economic and political forces shaping research systems in the region. Three general conclusions nevertheless emerge with respect to the institutional changes in these systems. First, new arrangements for evaluating and rewarding research are slowly becoming established, not least through the partial introduction of a contract-based system of funding and the increasing opportunities for contact with the international scientific community. Even if such new forms of regulation are not entirely meritocratic (and the issue bears investigation), and even if fully effective evaluation mechanisms have yet to be established, it is clear that the Soviet-style link between politics and science has been irrevocably broken and knowledge exchange has been opened up.

Second, despite the widespread view that the research systems of C&EE needed to lose their 'ballast' of overstaffed research institutes, it would seem that inefficiency has not really been tackled. Only in East Germany and the Czech Republic has there been the political will and machinery necessary to implement a policy of selective closure and redundancy. (In the former case, of

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course, the model came from West Germany and the changes were essentially imposed.) The emergence of trade unions in some countries (Hungary, for example) has had no real impact here since their project has been to 'save jobs' rather than 'save science'. In the absence of effective intervention, there are two contradictory tendencies. On the one hand, many of the more able researchers have left research for jobs overseas or in the private sector. On the other hand, a strong Matthew Effect[1] is emerging within the research community which will probably mean that those who survive the 'shake out' will be those who establish effective links with the international research community. One might conclude that world science is beginning to operate as both the market for, and regulator of research, in C&EE. A slightly different picture emerges to the degree that foreign companies are funding research in the region, however. Such funding tends to go to those institutes which have a proven track record of contacts with local industry and/or capability in a particular field.

Finally and perhaps surprisingly, there has been very little restructuring of the research system, though some shift in the orientation of research. The inherited political influence of the academies has strongly shaped the transformation so far, with the result that they have suffered least from the shrinking resources base, and there has been some polarization in the type of research conducted. Thus, while basic research continues (albeit on a considerably smaller scale), the level of applied research and development work is now very low as industrial research institutes have closed and industrial contracts to the academies are (for the most part) confined to low-level technical servicing. The conservative sectionalism of the academies, described in this Special Issue,[2] has also meant that the inflexibility and fragmentation of the former research systems remain, with very little effective communication between academic, university and industrial sectors.

The immediate backcloth to these changes has of course been a dramatic decline in the resources available for science and technology (S&T) as a result of the economic and political upheavals of the late 1980s and early 1990s. This situation is unlikely to improve in the foreseeable future, because of the dual problem of the lack of economic demand for research and the political neglect of S&T. Severe shortage of funds, coupled with more immediately pressing priorities, is engendering short-termism in both industry

and government. But there is, in addition, limited recognition of the strategic importance of S&T in either arena. The emphasis on monetary and fiscal economic policies, plus an ideology of freeing market forces that does not allow for the moderating influence of government regulation found in the older capitalist countries, leaves little space for strategic intervention.

Policy Implications

In thinking prescriptively about the situation we have described here, our starting point is that the countries of C&EE, like those in Western Europe, need a research system which allows them both to participate internationally in the modernist project of the pursuit of knowledge, and to support their own national industrial development and economic recovery. Beneath the surface, there is heated debate about the relative importance of these two goals for C&EE, and thus about the relative importance of supporting basic as opposed to applied research at the current time — though all readily acknowledge the vital strategic importance of basic research to industrial innovation. While our deliberations within the editorial group revealed differences with respect to *degree* on this issue, we were unanimous about the *kind* of changes which are necessary. These changes concern industry and government as well as the research system, and involve judicious blends of strategic financial support, organizational innovation and attitudinal change. Given the dire economic situation in the region, it seems inevitable to us that major additional financial inputs must continue to come from the West. But we are equally clear that such inputs must be strategic in nature — in that they must contribute to rebuilding the research system in such a way that it is able to meet its goals, and that the funding can eventually be taken over by local industry or government.

External strategic funding is urgently needed to safeguard the training of qualified scientists and engineers, and to create opportunities specifically for young people within the research system. Organizationally, there is probably room for improvements to introduce checks in the evaluation system, for example by the use of foreign experts in peer review procedures to avoid 'buddying'.[3] While the academy structure may well remain, it is worth exploring how funding mechanisms might be used to open institutional

space for greater flexibility to pursue new avenues, and for greater collaboration between the three sectors. Attitudinally, the main need is for government, researchers and the wider society to establish and implement criteria for the prioritization of research expenditure — priorities in both type and area of research. And this should arguably be the context for privatization programmes: there is a strong *a priori* case that strategically important research facilities should not be privatized.

With respect to industry, the requirements are twofold: to encourage the development of applied research and development, and to facilitate communication and collaboration between research and industry. It is hard to envisage how industry will begin to exert an effective 'pull' on the research system, and it may be that new models will emerge in the context of the C&EE countries. Foreign capital is in effect saving some important areas of technological capability, though it is yet to be seen how much this contributes to indigenous industrial development. Alongside some large national firms and international firms, small- and medium-sized enterprises (SMEs) are emerging as very important. For these firms especially, there may be a case for temporary western support to establish industrial R&D centres (perhaps on the US networking or UK research association models) and/or collaborative programmes (on the EU model), where precompetitive research and/or the development or adaptation of manufacturing processes can be undertaken on a shared basis. We would suggest that the state could play a catalyzing role here by working both to save as much industrial R&D capacity as possible, and to encourage emerging new forms of innovation such as those of researcher entrepreneurs.

Of course, funding collective R&D is not enough: all companies need some in-house capability in order fully to make use of external S&T, and they need effective communication with the research system.[4] With respect to the former, the pressure to internalize (at least some) R&D capability can only increase with competition. Even if research-based innovation is not an immediate option for most companies, incremental development-based improvements in products and in quality will be increasingly decisive. With respect to the issue of communication, current developments suggest to us two promising lines of advance. First, there may emerge a more networked and flexible model in the innovation systems of C&EE, for example through the activities

of spin-off companies from local universities and industrial research institutes.[5] Second, informal links and communication may overcome the pre-existing formal barriers between industry and research. For example, scientists and engineers who move into companies take with them important technical knowledge and skills, as well as contacts in research and an awareness of how research might be of practical assistance. (To this extent, the migration of researchers into private sector jobs may be a wholly positive development.)

Support for industrial R&D and technological development needs to be targeted strategically.[6] Considerations of competitiveness suggest that this should focus on industries where there is some basis for the development of technological capability, on generic technologies such as information technology, and on the improvement of quality in production. In addition to supporting R&D in specific sectors, we would suggest that in C&EE, as elsewhere, the scientific instruments sector is likely to be important.[7] Given the historic strength of this element of the research system, plus reports that this sector is declining or has reoriented itself to more mass market products,[8] there may be a case for protectionist measures — both for its direct contribution to indigenous R&D and as a lever for international funding and collaboration of research.

In the political sphere, there is a need to develop an S&T policy based on clear perceptions of goals and a willingness to prioritize resources accordingly. In some ways this is the hardest area of all, though it is also most symptomatic of the wider transformation taking place in C&EE. Under communist party rule, collective ownership created little sense of collective responsibility (in the bureaucracy, as well as in the population at large). Now the state represents public interests (rather than the political interests of those running the state) and some of the state apparatus has been privatized, but there is no political perception yet that public ownership demands a sense of public responsibility — expressed through a state representing public interests, in a way that collective ownership did not. Such changes are not simply switched on or off, but involve a slow, historical learning process. In a very profound sense, the political challenge facing the peoples of C&EE — in rebuilding the research system as much as wider society — is to develop a sense of individual agency and responsibility, including the ability and confidence to express interests, to

negotiate and work with others, to make choices for the long term, and to 'own' the consequences of those choices.

It must be said that western democracies have never really achieved this ideal, which prompts us to make one final comment. In the area of S&T policy, fully-fledged capitalist countries face the same kind of problems as the former communist countries of Europe — redistribution of limited resources, effective evaluation procedures, priority setting, knowledge flows into industry and so on — albeit on a lesser scale. Even in western countries with institutionally stable economic and political systems, these problems are hard to solve — not least because of researchers' vested interests. This gives some ideas of the magnitude of the task in C&EE.

Avenues for Future Research

The opportunity to study Soviet-style science historically, and to contrast the changes now taking place in the region, offers something of a unique insight into changing social institutions of science. The apparent rapidity with which researchers rejected political influence over research institutions appears to confirm universalistic assumptions about the organization of science — namely, that self-regulation by Mertonian reward systems (and their associated 'norms') leads to the 'natural', or most effective, forms of organization for science — forms which, in the case of C&EE, have re-emerged once constraints were removed, and which have quickly been legitimated by 'universalistic' rhetoric. For some two decades now, western sociology of science has been characterized by deep scepticism about functionalist explanations in general, and about the nature and role of Mertonian norms in particular.[9] Recent C&EE experience may offer a strategic research site at which these emphases can be challenged and tested — and perhaps reassessed.

One angle for investigating this theme concerns the relationship between the institutional transformations of science in C&EE and its cognitive content. How 'distorting' of science was the Soviet system? A cursory reflection would suggest that the Lysenko affair was exceptional and that, in big S&T projects that really mattered to them, communist authorities adopted a pragmatic attitude: even dissident scientists were left to get on with their work

relatively autonomously, albeit at times in closed cities or, at least, separated from the young people in the academies. Clearly political influence on Soviet research was by no means absolute, just as western science is in no absolute sense self-regulating. Looking forward, the removal of political control has had a palpable influence on both the conceptual framework and empirical focus of the social sciences, but what of the natural sciences? The case of earth sciences provides evidence of greater openness to new theories and to interdisciplinary approaches;[10] are there other such examples?

The dramatic decline in the funding of research, coupled with the opening up of international scientific communication, is creating winners and losers in the research system. What of migration and the consequent transfers of skills and knowledge to other sectors and other countries? What will former researchers contribute to the industrial innovative capability of industry? What knowledge flows are occurring through those who currently lead a 'double life', working in both east and west? And what proportion of those who have left their countries but say they wish to return will actually do so? What will be the effect of an ageing research community, and what will it take to tempt the young of C&EE back into careers in S&T? Spatially, the scientific centre for researchers in the region is shifting from Russia to other countries in the west, as world science becomes more accessible. How far will this shift go? Which new scientific centres will emerge (in the west)? Will peripheral countries in the C&EE behave like other such elsewhere, and communicate more strongly with the centre(s) than with each other?

The virtual failure so far of research on the transformation in the research systems to address gender is a glaring omission, and a lamentably missed opportunity. Until now, C&EE has been held up as an example of better opportunities for women in S&T. It seems probable that the transformations we have described in this Special Issue are differentially affecting women and men,[11] but we have no systematic data on this. Nor do we know what processes are shaping the outcome with respect to gender relations. We need to know; are women faring less well than men in terms of contacts and recognition in the international scientific community? Are they on the same informal networks as men? Are wider perceptions of gender changing the attitudes of girls and young women to entering S&T? In short, are women going to find it harder to

succeed in the new institutions of S&T than in the old, or will the relatively egalitarian tradition of the Soviet system be sustained?

Such questions oblige us to consider more generally the forces and processes shaping these uneven outcomes. How is the Matthew Effect we have observed operating in this context? Is it necessarily meritocratic that those researchers who get additional funding through the grant system are those with established international contacts? Are new patterns of scientific communication being established, if so how and on what basis? What kinds of personal networks are shaping the governance of research? Are these new or pre-existing networks? If pre-existing, were they within or outside the communist party? Are they gender linked? Are western ways of operating necessarily being adopted as a result of greater international exposure?

All this points to the need for micro-political investigations of the decision-making processes by which research institutions are currently reorientating themselves and, more generally, struggling to survive. Such studies could reveal the interaction of internal and external factors shaping the fate of research institutions, and the ways in which pre-existing arrangements and values are moulding future developments. In particular, the relationship between formal and informal patterns of networking warrant careful investigation. It would be very interesting to know whether former networks and survival strategies are still operating, and in what ways they have been adapted in the new situation. How much do communist and non-communist party connections still matter in the research system? Can the previously informal and semi-legal arrangements now become formalized and settled?

The importance of networks and communications extends to the emerging system of innovation. How do companies access and make use of external S&T? What knowledge, skills, contacts and assumptions have former researchers brought with them into enterprises? Could this help support the building of industrial R&D capability? More broadly, will new forms of R&D emerge around the growing SME sector? Which of the emerging new arrangements are most likely to facilitate flows of knowledge from the research system into industry? Can the scientific instruments sector be 'saved'? In which sectors is innovation most likely to emerge, and what types of innovation (for example, process or product, improvement or original)? What will be the relation to overseas technology, and in which sectors will technology transfer

be most appropriate? More broadly, given the dominance of the academy within the research system, to what extent will the goals of the research systems become geared to the S&T needs of industry? What will it take to achieve a meeting point between the two sectors?

In this area, and in the social organization of research, there is a pressing need to consider critically to what extent western models are appropriate. Should the countries of C&EE abandon the academy system and fall in line with all other industrial countries bar France?[12] Which areas of the research system should be kept in the public domain and which privatized? Is a new model of industrial and economic development required — perhaps building on the notion of a 'knowledge industry'?[13]

Finally, the political dimension begs further exploration. What is the popular understanding and perception of science? How has the *legitimacy* of S&T changed amongst the wider population? What will it take to gain support for a larger share of limited state funds? How effectively are researchers getting their case across to government decision makers and the wider population? Will the emerging scientific societies behave like professional pressure groups or trade unions? How does a population begin to 'take responsibility' for S&T when the practice of S&T is remote to many and their benefits are long term? More profoundly, how have the distinct political and economic contexts shaped the research system in different countries, and how will the interaction of political and economic change shape individual research systems? How can the role of the state be developed beyond that defined by immediate economic policy?

The list could go on, but whatever direction future research takes, we would highlight the following messages. First, it is vital that we seek fully to understand the 'rich texture' of the transformations currently taking place. As with any major social upheaval, the seeds of change existed long before 1989 and, by the same token, the heritage of the past is shaping the new world emerging in C&EE. Second, we need adequately to locate the transformation of the research system in its wider economic and political context. Amongst other things, this demands that we recognize and take account of the very real differences between the different countries of C&EE. For all that a general picture of the region is valid, we have found that every country is a special case when one looks closely. Finally, our experience highlights the

profound need for mutual understanding between East and West: without knowledge of the lived experience of East Europeans, it will be impossible for Westerners to make sense of the situation; and without knowledge of the lived experience of Westerners, it will be impossible for East Europeans to know what use they may make of western models. As we have repeatedly discovered, the S&T policy issues in East and West are more similar than one might at first assume; we have much to learn from one another.

• NOTES

1. This expression is taken from the New Testament: 'From whosoever hath, to him shall be given, and he shall have more abundance; but whosoever hath not, from him shall be taken away even that he hath' (Matthew 13:12). It was first used in relation to science by R.K. Merton; see his 'The Matthew Effect in Science', *Science*, Vol. 159 (5 January 1968), 56–63.

2. See Katalin Balázs, Wendy Faulkner and Uwe Schimank, 'Transformation of the Research Systems of Post-Communist Central and Eastern Europe: An Introduction', *Social Studies of Science*, Vol. 25, No. 4 (November 1995), 613–32; Nadezhda Gaponenko, 'Transformation of the Research System in a Transitional Society: The Case of Russia', ibid., 685–703. Kostadinka Simeonova, 'Radical and Defensive Strategies in the Democratization of the Bulgarian Academy of Sciences', ibid., 755–75.

3. This already happens in the smaller countries of Western Europe, though there may be difficulties in introducing it in Central and Eastern Europe. Apart from the language or other cultural barriers, there is a danger that this may reinforce the tendency for recognition to go to those who already have contacts with the international scientific community. In any case, it can be difficult to evaluate what the research performance and potential of individuals would be in more optimum conditions on the basis of current work.

4. See, for example, N. Rosenberg, 'Why Do Companies do Basic Research (with their Own Money)?', *Research Policy*, Vol. 19 (1990), 165–74; A. Gambardella, 'Competitive Advantages from In-House Scientific Research: The US Pharmaceutical Industry in the 1980s', ibid., Vol. 21 (1992), 391–407.

5. See K. Balázs, 'Innovation Potential Embodied in the Research Organizations of Central and Eastern Europe', *Social Studies of Science*, Vol. 25, No. 4 (November 1995), 655–83.

6. See K. Balázs, 'Transition Crisis in the Hungarian R&D Sector', *Economic Systems*, Vol. 18 (September 1994), 281–306.

7. The general importance of the scientific instrument sector was eloquently articulated in Derek J. de Solla Price, 'The Science/Technology Relationship, the Craft of Experimental Science, and Policy for the Improvement of High Technology Innovation', *Research Policy*, Vol. 13 (1984), 3–20.

8. Previously, countries had to build their own scientific instruments because

they were unable to import them. This activity became the basis for the development of innovative production units as well as research: see K. Balázs, 'Lessons from an Economy with Limited Market Functions: R&D in Hungary in the 1980s', *Research Policy*, Vol. 22 (1993), 537–52.

9. In this regard, two particularly well-cited papers were S.B. Barnes and R.G.A. Dolby, 'The Scientific Ethos: A Deviant Viewpoint', *Archives of European Sociology*, Vol. 11 (1970) 3–25, and Michael Mulkay, 'Norms and Ideology in Science', *Social Science Information*, Vol. 15 (1976), 637–56. For a brief summary, see Barry Barnes and David Edge (eds), *Science in Context: Readings in the Sociology of Science* (Milton Keynes, Bucks.: The Open University Press, 1982), 13–20.

10. See Richard A. Kerr, 'Earth Science: Contacts with the West Bring Cultural Revolution', *Science* Vol. 264 (27 May 1994), 1277–79.

11. See, for example, Elena Mirskaya, 'Russian Academic Science Today: Its Societal Standing and the Situation within the Scientific Community', *Social Studies of Science*, Vol. 25, No. 4 (November 1995), 705–25.

12. Apart from East Germany, only Latvia and Estonia have abolished their academies and the latter may revert. It is interesting to note that historically, the academies were modelled on Napoleonic France. Some also claim that the model provided a convenient way of separating potentially subversive intellectuals from the countries' youth — though this view is contested.

13. See M. Gibbons et al., *The Production of Knowledge* (London & Thousand Oaks, CA: Sage Publications, 1994).

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