

Higher education and industry in East and West Germany – relationships and problems in technology transfer

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The role of higher education with respect to its contribution to the economy has traditionally been a matter of considerable contention, which intensified throughout the latter half of the 20th century with the increasing cost of providing higher education to ever greater numbers of people. The higher education systems of the two Germanys epitomised radically opposing viewpoints in this regard, although it is fair to say that the governments of both saw higher education and the research carried out within the walls of its institutions, as crucial to the advancement of science and technology and hence, to economic growth. Additionally, the research conducted was expected to inform the teaching provided in the institutions so that *Hochschule* graduates could provide a further boost to the technological standards of the industries and services which later employed them. The transfer of this new knowledge and of technological innovation, however, proved to be anything but smooth and relations between industry and higher education proved extremely problematic in both countries, although for very different reasons. After a short background section, this paper will address firstly the relationship between academic research and industry in both countries. Secondly, it will look at the issue of technology transfer via graduate employment. It will argue that there are a surprising number of parallels in both countries' experience and that a combination of a number of cultural factors and power struggles in entrenched socio-economic networks in both countries were responsible for the problems encountered.

Background

The higher education systems of both countries, then, developed from the same roots – the concept of the Humboldtian university with its emphasis on *Bildung* and the practice of *Lern- und Lehrfreiheit*. In this system, scholarship with practicality and functional applications at its core was to be abhorred as demonstrating a vulgar preoccupation with material gain.¹ Even the inexorable rise in popularity of the *Technische Hochschulen* throughout the 19th and 20th centuries did little to alter this. Despite their very practical orientation, and a consequent deepening rift between *Technik* and *Bildung* in the universities, however, Gispén argues that once having obtained full professional status at university level, the teaching bodies of the *Technische Hochschulen* began to define their sector as simply another variant of classical *Bildung* and displayed the same resistance to the idea of being seen as the handmaidens of capitalist industry.² All this changed with the threat to academia's social status and influence posed by the Weimar government, the self-imposed isolation of a majority of German scientists from the international scientific community and the advent of the National Socialists with their emphasis on applied and military research and development in the institutions of higher education.³

¹ Fritz K. Ringer, *The Decline of the German Mandarins: The German Academic Community, 1890 – 1933*, (Hanover New England, Wesleyan University Press, 1969), pp 29 - 30

² Kees Gispén, *New Profession, Old Order: Engineers and German Society 1815 – 1914*, (Cambridge, CUP, 1989), pp 114 – 119, 223 – 228

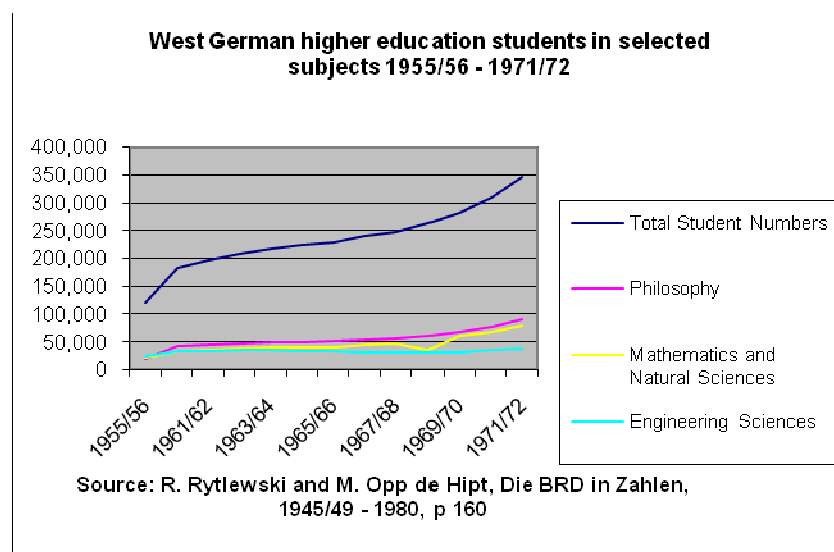
³ Paul Forman, 'Scientific Internationalism and the Weimar Physicists', p 152; Jeremy Leaman, *The Political Economy of West Germany 1945 – 85*, (Basingstoke, The Macmillan Press Ltd., 1988), p 15; Ringer, *The Decline of the German Mandarins*, p 3; Ute Deichmann and Benno Müller-Hill, 'Biological Research at Universities and Kaiser Wilhelm Institutes in Nazi Germany' in Renneberg Walker (ed.), *Science, Technology and National*

Higher education and links to industry

In the West, following WWII, academia attempted to revert to the purported ‘cultural tradition’ of the neo-humanistic university. Heidelberg University, for instance, declared itself “an organic order of spiritual protection and learning ... against the incursion of fanatical masses of students and instructors in the determination of university questions”⁴ for the creation of a new “aristocratic intellectual order”⁵. Despite this, a sharp increase in population following the war, the increasing egalitarianism of society, the perception of large and widening gaps in technology between West Germany and the USA which threatened West Germany’s future international competitiveness and contributed to a ‘brain drain’ of the country’s most talented largely to the USA, and the building of the Berlin Wall in 1961 which cut off the flow of East German engineers to the West,⁶ dictated a very significant expansion of the higher education system.

The expansion, however, created a number of problems. One was funding it. Another was that the vast majority of those admitted to West German *Hochschulen*, opted not to study engineering sciences as the government had hoped, but chose the humanities instead, as the following graph demonstrates:

Fig.1



Socialism, (Cambridge, Cambridge University Press, 1994), p 169; Margit Szöllösi-Janze, ‘National Socialism and the Sciences’, in Margit Szöllösi Janze (ed.), *Science in the Third Reich*, (Oxford, Berg, 2001), p 22; see also Susanne Helm, Carole Sachse and Mark Walker, *The Kaiser Wilhelm Society under National Socialism*, (Cambridge, Cambridge University Press, 2009); Kristie Macrakis, *Surviving the Swastika: Scientific Research in Nazi Germany*, (Oxford, Oxford University Press, 1997)

⁴ Karl Jaspers, Gustav Radbruch and Walter Jellinek, from OSS Field Intelligence Study 41, quoted in Steven P. Remy, *The Heidelberg Myth: the Nazification and Denazification of a German University*, (Cambridge Mass., Harvard University Press, 2002), p 120

⁵ Karl Jaspers quoted in Remy, *The Heidelberg Myth*, p 120

⁶ Dolores Augustine, ‘Frustrated Technocrats: Engineers in the Ulbricht Era’, in Kristie Macrakis and Dieter Hoffman (eds.), *Science under Socialism: East Germany in Comparative Perspective*, (Cambridge Mass., Harvard University Press, 1999), p 185. At its height, Augustine estimates that around 100 highly trained engineers every month were moving to the West

A further problem was the continuing, strongly elitist attitude of much of the professoriate and the persistence of a hierarchical method of organisation which strongly resisted any encouragement by the federal government to orient research in higher education to the needs of the economy. Equally strongly resisted was the idea of undertaking interdisciplinary and cooperative research projects with other departments or faculties, still less other *Hochschulen*, research institutes or industry.⁷ The RWTH Aachen, for example, argued that a new organisational form would have to be created to facilitate such cooperative ventures because “there is no classification for such a thing in the budget”.⁸ The political strength of the professorial body was supported by the highly federated political structure which left responsibility for higher education in the hands of the individual *Länder*. The need for consensus among the numerous professional bodies involved in the decision-making process allowed a disproportionate level of influence to be exercised by the institutions of higher education (represented by the WRK or Committee of West German Rectors), and higher education reform increasingly became used as a political football in inter-*Länder* negotiations.⁹ As one FDP (*Freie Demokratische Partei*) politician noted: “The discrepancy between factual necessity and constitutional possibility in the reorganisation of education is simply unbearable”.¹⁰

Technology transfer also arguably suffered because of the system of rigidly delineated areas of research and its inflexible and hierarchical funding structure which had been created by the Allies after WWII in an attempt to divide up research expertise and disconnect it from direct government control after the war. Basic research was the province of the *Hochschulen* and the Max Planck institutes. The latter, however, were able to select priorities according to perceived scientific needs, while *Hochschulen* were required to sustain a very broad research agenda. Both were funded almost exclusively by the *Länder* governments. Being independent of federal government, corporate or individual industry funding, the *Hochschulen* were accountable to none of them. Moreover, the almost total research autonomy of the institutions and the individual professors resulted in the greater part of the research conducted not being made public and thus, remaining unavailable for potential exploitation by industry.¹¹ Applied research was largely the province of technology transfer institutes, most particularly the *Fraunhofer* institutes, funded on a joint basis by the federal government and industry. Their expertise was inevitably strongest in more traditional areas, with the result that these tended to be reinforced rather than new fields being developed. Ultimately,

⁷ See, for example, ‘Godesberger Rektoren-Erklärung zur Hochschulreform’, 6.1.68, in BArch B 251/1277; letter from Klaus von Dohnanyi to Theodor Heidhues (26.9.72) containing ‘Vorlage zur 13. Sitzung des Planungsausschusses für den Hochschulbau’, pp 4 – 14 in BArch B247/27

⁸ ‘Besuch des Wissenschaftsrates am 21./22. Juni 1971 in Aachen’, pp 1 – 4 in BArch B 247/36

⁹ Robert Geipel and Wolff-Dietrich Webler, ‘Recent Trends in Higher Education and Research into Higher Education in the Federal Republic of Germany’, *Higher Education in Europe*, Vol.12, No.1, 1.1.87, pp 76 – 80; see also Fritz W. Scharpf, ‘No Exit from the Joint-Decision Trap? Can German Federalism Reform Itself?’, Max Planck Institute for the Study of Societies Working Paper 0005/8, September 2005, www.mpifg.de/pu/workpap/wp05-8/wp05-8.html; Helga A. Welsh, ‘Disentangling the Reform Gridlock: Higher Education in Germany’, Working Paper 02.7, Program for the Study of Germany and Europe, Wake Forest University, 2001, www.ces.fas.harvard.edu/publications/docs/pdfs/Welsh02.pdf

¹⁰ Helga Schuhardt, quoted in Erk, ‘Federal Germany and Its Non-Federal Society: Emergence of an All-German Educational Policy in a System of Exclusive Provincial Jurisdiction’, in *Canadian Journal of Political Science*, Vol. 36, No.2, June 2003, p 309

¹¹ ‘Kurzprotokoll über die 2. Sitzung des Unterausschusses zur Förderung der Forschung des Ausschusses für Kulturpolitik des Deutschen Bundestages’, 4.3.53, BArch B 304/312/1

then, research in West Germany was slow to respond to rapidly changing technology, provided little incentive for entrepreneurial activity and supported incremental innovation based on existing technology rather than groundbreaking new innovation. Hence, it has been convincingly argued that West Germany had “historically proven itself resilient to major shifts in techno-economic paradigms”¹² and that it “continues to make the best nineteenth-century products on earth”.¹³

Nevertheless, numerous efforts to promote better technology transfer were initiated in the late 1970s and throughout the 1980s by various federal and *Länder* ministries. These had two main purposes. One was aimed at tackling the lack of communication and interaction between the *Hochschulen* and key production centres of the economy which was leading industry to display an increasing lack of confidence in higher education.¹⁴ The other was to facilitate the transformation of new scientific discoveries into industrial innovations and introduce a more praxis-oriented approach into the *Hochschulen* and other research institutions. Thus, for example, whilst the development of computer hardware originally took place mainly in industry, *Hochschulen* such as the University of Hamburg played a leading role in the development of software and particularly of computer languages which required intensive basic research in the fields of logic, mathematics, linguistics and artificial intelligence.¹⁵

The exchange of personnel between industry and science was considered another particularly efficient form of technology transfer. The creation of a new financial support measure entitled “*Forschungskooperation zwischen Industrie und Wissenschaft*” (Research Cooperation Between Industry and Science) supported the work of scientists from large, medium and small commercial enterprises, who, with the R&D priorities of their employers in mind, were sent to *Hochschulen* and other research institutions to work for a limited time. Other schemes included the creation of the Garching Instrument Society for the industrial use of research results¹⁶ and the establishment of an innovation and technology centre, based around the Ruhr University in Bochum, for the solving of the practical problems of the Ruhr region.¹⁷ This proved a real success in solving smaller cross-disciplinary and multi-dimensional problems. However, larger regional projects were shelved because of government and industry’s reluctance to fund them, and plans to establish similar projects in other *Länder* were abandoned for the same reason.¹⁸ Moreover, as Schimank and Meier have demonstrated, there continued to exist deep, bilateral distrust between the professoriate and

¹² Rebecca Harding and William E. Paterson (eds.), *The Future of the German Economy*, (Manchester, Manchester University Press, 2000), pp 83 – 96

¹³ Bruce Nussbaum, quoted in Gerd Junne, ‘Competitiveness and the Impact of Change: Applications of “Higher Technologies”, in Peter J. Katzenstein (ed.), *Industry and Politics in West Germany: Towards the Third Republic*, (Ithaca, Cornell University Press, 1989), p 249

¹⁴ Bikas C. Sanyal, ‘Higher Education and Employment in Europe: Some Selected Issues’, *Higher Education in Europe*, Vol. 13, No.1, 1.1.88, p 44

¹⁵ Mircea Malita, ‘Universities as Centres of Research’, *Higher Education in Europe*, Vol.5, No.2, 1.4.80, p 36

¹⁶ Probst, ‘Schriftliche Frage mit den in der Woche vom 4. Februar eingegangenen Antworten der Bundesregierung’, Bundestag Drucksache 10/2861, pp 28 – 29; 59 – 60

¹⁷ Valentin von Massow, ‘Organization and Promotion of Research (in particular, University Research) in the Federal Republic of Germany’, *Higher Education in Europe*, Vol. 6, No.2, 1.4.81, p 16

¹⁸ ‘Schriftliche Frage mit den in der Woche vom 30. Januar 1984 eingegangenen Antworten der Bundesregierung’, 3.2. 84, Bundestag Drucksache 10/959, p 31

the state, with the professors accusing ministers of yielding too readily to “alleged financial pressures” and of turning higher education into an economic instrument.¹⁹

In total contrast to the West, the higher education system of East Germany was directed to serve the needs of the economy right from its inception. The training of new cohorts of scientists and technologists was seen as critical in order to create the modernising force necessary to achieve reconstruction and a place among the mostly highly technologically advanced countries of the world. Crucially, however, the solution of economic problems remained subject to the overarching political aims of the new socialist society. As one senior East German politician put it, “economic activity can be nothing but the realisation of political aims. It can never have a purpose in itself”.²⁰ Three major reforms achieved the “political socialisation”²¹ of higher education and the economisation of technical and professional training in higher education,²² whilst establishing complete central control. Additionally, a huge expansion of student numbers was engineered, virtually all in the scientific and engineering disciplines, in order to produce the required number and type of socialist cadres for industry calculated by the central planners.

Bentley, however, has testified eloquently to the unreality of the expectations of the senior party members regarding progress on technological change, born of ignorance or misunderstanding of the complex processes surrounding basic and applied research, creative innovation and the often tortuous course of its incorporation into production.²³ Basic research was performed almost exclusively by the *Akademie der Wissenschaften*. In contrast, research in higher education was tied ever more tightly to the needs of local industry and, importantly, largely paid for by industry. The theory was that this would allow the easy and quick transfer of new technological innovation from laboratory to workplace. Instead, it created a serious dichotomy. Because the enterprises were funding much of the research, they expected to have their short-term requirements prioritised over longer-term government initiatives. They proved markedly disinterested in signing contracts for long-term research projects, or their financing. Moreover, they were unwilling to implement any innovations which were not of immediate, short-term financial benefit, as more radical innovation would have entailed a lengthy hiatus in the production process and potentially endangered the payment of monthly and/or yearly bonuses.²⁴ Many of the *Hochschulen* were also resistant,

¹⁹ Uwe Schimank and Frank Meier, Förderinitiative des BMBF: Science Policy Studies, Expertise zum Thema: ‘Neue Steuerungssysteme an den Hochschulen’, 31.05.02, p 30, <http://www.sciencepolicystudies.de/dok/expertise-schimank.pdf> (accessed 4.12.2005)

²⁰ Heinz Puder, quoted in Horst Betz, ‘East Germany: The Primacy of Dogma over Reform’, *Journal of Economic Issues*, Vol. VIII, No.1, 1974, p 88

²¹ Thomas H. Baylis, *The Technical Intelligentsia and the East German Elite: Legitimacy and Social Change in Mature Communism*, (Berkeley, University of California Press, 1974), p 36

²² For a discussion on this see Eckart Förtsch, ‘Science, Higher education and Technology Policy’, in Kristie Macrakis and Dieter Hoffman (eds.), *Science under Socialism: East Germany in Comparative Perspective*, (Cambridge Mass., Harvard University Press, 1999), chapter 1, and Baylis, *The Technical Intelligentsia*, pp 36 - 38

²³ Raymond Bentley, *Research and Technology in the Former German Democratic Republic*, (Boulder, Col., Westview Press, 1992), p 62; see also Delores Augustine, *Red Prometheus: Engineering and Dictatorship in East Germany, 1945 – 1990*, (Cambridge Mass., MIT Press, 2007), p 88

²⁴ ‘Bericht der SED Kreisleitung, Humboldt Universität zu Berlin’, 28.10.69, p 8, SAPMO DY 30/IV A 2/9.04/35; Harry Tisch, ‘Aktentnotiz über die Konsultation zum Plan ’89 der AdW bei der SPK’, 11.11.88, p 2, SAPMO DY 53/1171

objecting to the idea that they were simply being used to service the needs of industry.²⁵ Moreover, a paper on this subject cannot ignore the issue of the reverse engineering of often smuggled foreign technology demanded of researchers in higher education, which appeared to be the primary research methodology supporting East Germany's unsuccessful micro-electronic industry in the late 1970s and 1980s.

A further problem lay in the Party's frequent failure to allow publication of research results because of excessive secrecy regarding anything which might be considered industrially or politically sensitive, or sometimes because of the purportedly ideologically unsound character of the scientist(s) involved.²⁶ Crucially, though, as the experience of Zeiss demonstrates, yet another reason appeared to lie in the difficulty of persuading some Party officials and planners that there actually was a need to achieve international competitiveness in science and technology.²⁷ Förtsch has highlighted how frequently the failure of the central planners to transmit scientific data and/or come to a decision as to its introduction in the workplace hindered the uptake and exploitation of scientific advance in production processes.²⁸

Finally, exchange of personnel between higher education and industry and agriculture was seen, as in the West, as a particularly efficient form of technology transfer and many attempts were made to organise this. However, it proved considerably easier to get professors to take up placements in industry than to encourage industrial cadres to teach or research in higher education. Additionally, once the professorial staff were aware of the considerably higher salaries on offer in industry, it often proved hard to keep them in academia.²⁹

Technology transfer through graduate employment

The second strand of technology transfer under consideration is the theory that workplace practice would be improved and enhanced by the employment of large numbers of evermore highly technologically educated graduates. In the West, however, the ballooning numbers of students were not matched by a similar increase in the proportion of teaching staff which in itself had serious implications for the standard of teaching and research carried out in the *Hochschulen*. This ultimately gave rise to accusations by industrial employers that levels of skills obsolescence in graduates were increasing over the decades and that higher education was not keeping pace with the rapidity of technological and organisational developments.³⁰ This, therefore, militated against

²⁵ 'Bericht über Untersuchungen an der Karl-Marx-Universität Leipzig (29 – 30 Oktober 1969) und der Universität Rostock (2 – 3 Dezember 1969)', 23.1.70, pp 9 – 21, SAPMO DY 30/IV A 2/9.04/510

²⁶ Bentley, *Research and Technology in the former German Democratic Republic*, pp 95 – 101

²⁷ Bruce Kogut and Udo Zander, 'Did Socialism Fail to Innovate? A Natural Experiment of the Two Zeiss Companies', Working Paper 98-3, Carnegie Bosch Institute, 1998, http://cbi.tepper.cmu.edu/papers/cbi_workingpaper-1998_03.html (accessed 12.9.2007), p 17

²⁸ Förtsch, 'Science, Higher Education and Technology Policy', in Macrakis and Hoffmann (eds.), *Science under Socialism*, pp 33 - 34

²⁹ 'Einige Probleme zum Erfüllungsstand des Sonderprogramms des Ministerrates über Maßnahmen zur Erhöhung des Bestandes an naturwissenschaftlichen und technologischen Hochschulkadern bis 1975/76 13.11.1969', p 5, SAPMO DY 30/IV A 2/9.04/509

³⁰ Blechinger and Pfeiffer (2000), cited in Michael Maier, Friedhelm Pfeiffer and Winfried Pohlmeier 'Overeducation and Individual Heterogeneity', in Felix Büchel, Andries de Grip and Antje Mertens (eds.), *Overeducation in Europe: Current Issues in Theory and Policy*, (Cheltenham, Edward Elgar Publishing Ltd., 2003), p 134

the transfer of advanced knowledge and technology to the workplace in the form of graduate employees.

The mass expansion of the East German system ran into the same, or worse, problems of underfunding as had been experienced in the West. The rapidly worsening professor: student ratio was compounded by the Party's insistence on appointing teaching staff on the basis of political reliability rather than academic ability resulting, arguably, in more poorly educated graduates.³¹ Additionally, progressively narrower specialisation in academic disciplines led, as in the West, to a number graduating with skills which were already obsolete, again negating the graduate's usefulness in terms of bringing the most advanced skills to the workplace.³² There was, in any case, considerable resistance within the firms themselves to the placing of graduate engineers in the more senior positions to which their qualification entitled them. In part, foremen regarded experience as more important than academic qualification, while the older engineers distrusted the quality of training received by the new. Moreover, the almost blanket job security in GDR firms meant that despite a clear need for those with degree-level qualifications in new spheres of technology at senior levels in the workplace, many graduates were given positions well below their abilities and not subsequently promoted, thus wasting a considerable reserve of creative potential. Additionally, in the case of female graduates, there was extremely strong resistance to employing highly qualified women in supervisory roles over men in industry.³³

Conclusion

In conclusion, there are a number of parallels to be drawn with respect to the difficulties encountered in technology transfer from higher education to industry. In both countries, for example, higher education was largely publicly funded, which gave rise to fairly serious problems with respect to paying for the burgeoning growth of the sector. This resulted in a poorer quality of research and teaching, which, arguably, was exacerbated in the East by the requirement to make politically reliable appointments to the professoriate and management of the institutions. A degree of over-specialisation was apparent in both countries, albeit arguably worse in the East, resulting in a degree of technical obsolescence in a number of graduate disciplines, thus compromising the ability of the new technical intelligentsia to bring the most advanced technological know-how into the workplace. Moreover, while the employability of engineering and scientific graduates was rarely a problem in the West, there were considerable difficulties in these graduates finding appropriate-level employment in the East, thus militating against the effective transmission of the most up-to-date technology to the workplace via this route. Finally, the socio-political ethos applying in each country arguably played the strongest part in the problem of technology transfer. In the West, this

³¹ See for example, 'Analyse über die politische-ideologische Situation an der Ernst-Moritz-Arnst Universität (Greifswald) und über das Denken der Wissenschaftler und Studenten in Durchführung der 3. Hochschulreform 30.9.68, SAPMO DY 30/IV A 2/9.04/35; Ralph Jessen, *Akademische Elite und Kommunistische Diktatur: die ostdeutsche Hochschullehrerschaft in der Ulbricht-Ära*, (Göttingen, Vandenhoeck und Ruprecht, 1999), pp 184 – 192; Augustine, *Red Prometheus*, pp 99 – 100; Reinhard Siegmund-Schulze, 'The Shadow of National Socialism', in Macrakis and Hoffmann (eds.), *Science Under Socialism*, pp 71 – 72; John Connelly, *Captive University: the Sovietization of East German, Czech and Polish Higher Education 1945 – 56*, (Chapel Hill and London, The University of North Carolina Press, 2000), p 145

³² Baylis, *The Technical Intelligentsia and the East German Elite*, pp 38 – 39

³³ Augustine, *Red Prometheus*, pp 261, 286; 'Probleme der Qualifizierung und Förderung von Frauen, pp 13 – 14, SAPMO DY 30 IV A 2/9.04/618

took the form of the attitudes of academia towards industry and the political structures which allowed these to be maintained. In the East, the central planning system, frequently guided by ideology and politics rather than economic priorities, resulted in misguided research priorities and tied higher education so closely to enterprise that the longer-term aims of the government with regard to cutting-edge research at international level were unachievable.