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The Production–Morphology Nexus of Research Universities: The Atlantic Split

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Research universities and institutes assume a vital role in domestic economic development. Research universities are assigned the responsibility to train doctoral and post-doctoral students and to form new generations of faculty. Despite their critical role, the effectiveness of institutions regarding research production is rarely studied, particularly in an international, comparative context. Vital information regarding the improvement potential of institutions is generally lacking, as are good criteria by which to judge the relative merit of various types of institutions. The paper presents findings on a performance gradient that separates US and European research universities and submits hypotheses that link productivity and organizational — or structural — aspects of research-oriented institutions.
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Introduction

Cultures of higher education remain quite distinct and exhibit a strong national bent. This observation alone would not cause much concern were it not for the mounting evidence that ties, for example, research output indicators to cultures of higher education and their corresponding systems. While the link between performance and technology — and the concept of technology transfer — is broadly understood, an analogous nexus in the field of higher education management is frequently negated.

The link between performance and the underlying cultures of higher education was apparent to the early reformers of higher education systems (Fichte, 1997 (1804); Von Humboldt, 1964). To improve existing systems or to build new ones, attention had to be paid to a whole array of factors, some of which one finds addressed in old charters (Commonwealth of Massachusetts 1859). These factors were derived from normative notions of higher education institutions, notions that were based on past experiences within a particular culture of higher education or on a comparative analysis of disparate cultures. There was a time when US higher education institutions emulated European institutions (Flexner, 1930, Kerr, 1994b), and this for good reasons. In the 19th century, some US institutions adapted a European — or a German — research focus and new institutions were molded with this model in mind (Schwinges, 2001; Turner, 2001; Bonner, 2002). Generations of aspiring scholars crossed the Atlantic to study at European universities, and they brought back not only the newest scientific concepts and tools but also a deepened notion of research as an enterprise. There can be no doubt that European concepts on science and higher education culture were broadly welcomed within the US and used to shape and to improve higher education there. But the reverse does not seem to be so apparent, irrespective of current reform efforts (Edwards, 1999; Haug, 1999a, b; Committee on Prague, 2000). Despite the fact that the US research university of today has taken on the role of the former German university, and despite the fact that many Europeans study — or have studied — in the US, European universities cannot easily replicate a learning path (Senge, 1990; Duke, 1992) that propelled the US research university to prominence.

The present paper draws and expands on a study that compared two leading research universities and their respective cultural settings, the higher education system of the US and a continental European — 'Humboldtian' — system of higher education (Herbst *et al.*, 2002). The basic premise of that study was that institutions of marked distinctiveness — but similar mission — are hardly equally effective (Ben-David, 1991, Clark, 1998). This position was buttressed by a second observation concerning the restricted significance of science and educational indicators as they pertain to nations (OECD, 1998). Despite many excellent institutional research investigations, cross-cultural, inter-institutional comparisons have been rare, particularly with a focus on issues of effectiveness and productivity in relation to the structure and organization — and what Pierre Bourdieu calls the 'morphology' — of institutions (Bourdieu, 1988 (1984); Hurley, 1997). The study, hence, addressed the questions to what extent morphological — and by implication also cultural — differences of institutions of higher education may account for differences in institutional performance.

A range of hypotheses were underlying this study, three of which I shall illustrate in the present context. The first hypothesis negates, as I indicated above, the easy readability of bibliometric research output measures as they pertain to nations, particularly smaller nations (see the next section); the second hypothesis postulates a functional link between research output on the one hand and the structural setting within which research is undertaken (see the subsequent section); and the third traces current performance patterns to early cultures of higher education and to organizational and structural — that is, morphological — characteristics of the research universities in their infancy (see the last section).

Research Output Assessment

Among American presidents or chancellors of research universities, the preeminence of the US research university of today appears evident (Kerr, 1994a, Kennedy, 1997; Duderstadt, 2000; Rudenstine, 2001). This view is not necessarily shared by their European peers, and national research indicators may be brought into play to challenge this assessment. Data issued by the EC (European Commission, 1997) indicate that, within the period of 1980–1995, the volume of publications originating within the European Union (EU) was roughly equivalent to that of the US and that the gap in the European volume of citations (relative to that of the US) is diminishing, from 40% in 1980 to 32% in 1993.[1] If one looks at publications per inhabitant (during the period of 1981–1995), Switzerland is found in position one, in front of Sweden, Canada, the US and the UK; and if the relative impact of publications is looked at, we find again Switzerland in position one, in front of the US, Sweden, the UK, and the Netherlands (Winterhager and Weingart, 1997).

Recent analyses by the Centre d'études de la science et de la technolgie (CEST) might be used to corroborate a picture according to which US research plays a prominent but by no means dominating role (see Table 1).[2,3] If we look at the reception, at the impact of scientific publications, we notice that smaller countries — like New Zealand, Island, Ireland, Norway or Switzerland — fare amazingly well: they edge out such established scientific nations as France or Germany. In fact, Germany or Japan are absent from this roster of science nations. Faced with such a comparative assessments of research indicators, science ministries of at least some smaller nations might be tempted to conclude that their status regarding research and higher education is above reproach. A range of factors contribute to this odd picture, but one stands in the foreground. In the case of publications and citations, averages are not that decisive, not that telling, because larger nations may have internal variations of significance: individual US states or German Länder, for instance, may fare better than some of the smaller nations listed in a national tabulation.

To shed light on this phenomenon, the CEST started to focus on individual institutions: on universities and colleges, on research institutes and hospitals, as well as on business enterprises and international organizations. The comparative analysis of institutions was chosen to overcome the inadequacies of national comparisons, which are apparent even in the excellent, OECD administered, PISA-study (OECD, 2001). To reduce the number of institutions to a manageable size, the CEST identified close to 1,000 institutions worldwide on the basis of bibliometric selection criteria: 575 universities and colleges (of which 215 — or 37% — are located within the US), 223 research institutes and hospitals (57 US institutions), 132 business enterprises and 25 international organizations. The institutions had to meet two standards to be included in this

Table 1 National rank of OECD member states based on relative citation impact measures, by journal classes (1994–99)

	Rank				
Fields (journal classes)	*1st*	*2nd*	*3rd*	*4th*	*5th*
Multidisciplinary	CH	US	—	—	—
Agricultural Sciences	US	NL	UK	F	CA
Engineering	US	CH	DK, NL	S	CA, IRL
Materials Science	CH	US	CA	NL	F
Computer Science	NZ	CH	UK	NO	US
Mathematics	IRL	DK, US	CH	NO	B
Physics	US	CH	IRL	NL	DK
Astrophysics	US	CA	NL	CH	UK
Geosciences	US	UK	NL	CA	—
Chemistry	US	CH	NL	CA, DK, S	UK
Plant & Animal Science	NL	UK	CA	US	AU
Biology & Biochemistry	CH	DK, US	UK	NL	S
Ecology & Environment	CH	US	NL	DK	S
Microbiology	IRL	US	NL	S	CH
Molecular Biology & Genetics	US	CH	UK	IRL	—
Neuroscience	IS	IRL	UK	US	DK
Immunology	CH	IRL, US	B	NL	—
Pharmacology	NZ	UK	CH	IRL	US
Clinical Medicine	US	IS	UK	CA	IRL
Psychology & Psychiatry	IS	UK	US	DK	IRL
Social Sciences	US	IS	—	—	—
Education	NO	I	US	CA	AU
Economics & Business	US	B	CA	UK	—
Law	US	CA, UK	—	—	—
Arts & Humanities	NZ	TR	EL	AU, NL, UK, US	DK

top stratum of institutions: within the period of 1994–99, any member of this set had to have (i) published a minimum of 50 articles in at least one of the subfields (journal classes) specified by the Institute for Scientific Information (ISI)[4] and (ii) exhibit a Relative Citation Index (RCI) in the corresponding subfields of at least 20 (i.e. 20% higher than the worldwide mean) (Da Pozzo *et al*., 2001a, b, 2002). The 955 institutions thus selected from only 2% of all the institutions worldwide that are listed by the ISI, but they are responsible for 69% of all publications and 79% of all citations worldwide.

In trying to assess research output of institutions within this top stratum of institutions, the CEST focused on four bibliometric indicators: total number of publications; number of publications in (ISI-defined) 'qualified' subfields where the standards (i) and (ii) are met; percentage of institutional publications in qualified subfields; and weighted mean impact of publications. If we assess the performance of institutions within this top stratum on the basis of these four indicators, and the relative performance of institutions located within the US *vs* those located elsewhere, we cannot observe a clear dominance of US institutions, except in the case of colleges and universities. Looking at Table 2, we notice that US institutions dominate higher education institutions of rank 1 to 100. While US institutions comprise only 37% of all institutions under consideration here, they are heavily over-represented among the 100 best rated institutions. If we look at the first 50 institutions (worldwide), the share of US institutions within this subset ranges from 60 to 90% (depending on the bibliometric measure taken); and if we focus on the following stratum of 50 institutions, the corresponding share ranges from 52 to 78%.

An even more lopsided picture can be obtained looking at specific subfields of academic activities and their corresponding sets of institutions that meet the standards (i) and (ii) referred to above. In all but three of 73 subfields assessed, US institutions were over-represented in their respective sets (i.e. their relative share was over 37% — see Table 3). In more than three-quarters of the subfields assessed, the relative share of US universities and colleges amounted to at least 50% of the worldwide number of institutions included in the top stratum of institutions identified by the CEST; and in more than two-fifths of all subfields assessed, the corresponding relative share of US institutions amounted to at least 70%.

An analogous picture can be painted if one takes Nobel Prizes as research output measures instead of bibliometric indicators (Herbst *et al.*, 2002, 200–207). After World War II, the general US dominance regarding Nobel prizes parallels the one of publications and citations. In the field of chemistry, though, where Europe has a long tradition and a strong industrial base, we observe no dominance of the US, particularly because scholars and institutions in two countries (in Germany and the UK) were very successful in attracting such awards. However, in the remaining three fields (physics, physiology or medicine, and economics) the dominance is pronounced, considering the fact that we compare here US institutions against those of the rest of the world (i.e. in Europe, Japan, Australasia, etc.). In physics, we count roughly one-third

Table 2 relative share of US institutions, by rank class (in % of number of institutions included in rank class)

	Rank of institutions		
Bibliometric measure	*1–50*	*51–100*	*101–575*
Total Publications	60	52	33
Publications in Qualified Subfields (Numbers)	88	58	30
Publications in Qualified Subfields (Share)	90	68	29
Weighted Mean Impact of Publications	78	78	29

Table 3 Relative share of us universities and colleges among institutions with qualified subfields, by subfields (1994–99)

Fields	*Subfields (journal classes)*	*Share (%)*	*Institutions (N)*
Multidisciplinary			
	Agriculture, Biology & Environment	84	32
	Life Sciences	78	32
	Physical, Chemical & Earth Sciences	78	49
Agricultural Sciences			
	Agricultural Chemistry	31	13
	Agriculture & Agronomy	61	33
	Food Science & Nutrition	55	40
Engineering			
	AI, Robotics & Automatic Control	68	44
	Aerospace Engineering	100	6
	Civil Engineering	69	29
	Electrical & Electronic Engineering	64	53
	Engineering Mathematics	60	20
	Environmental Engineering & Energy	89	18
	Instrumentation & Measurement	37	41
	Mechanical Engineering	69	70
	Nuclear Engineering	60	10
	Spectroscopy &c Analytical Sciences	39	113
Materials Sciences			
	Materials Sciences & Engineering	51	95
	Metallurgy	43	30
Computer Sciences			
	Computer Science & Engineering	80	40
	Information Tech. & Comm. Systems	69	26
Mathematics			
	Mathematics	61	89
Physics			
	Optics & Acoustics	65	43
	App. Physics, Cond. Matter & Mat. Science	57	115
	Nuclear &c, Theoretical & Plasma Physics	61	127
Astrophysics	Space Science	74	61
Geosciences			
	Earth Sciences	79	63
Chemistry			
	Chemical Engineering	43	75
	Chemistry & Analysis	68	66
	Chemistry	42	155
	Inorganic & Nuclear Chemistry	38	95
	Organic Chemistry & Polymer Science	47	97
	Physical Chemistry & Chemical Physics	45	141
Plant & Animal Sciences:			
	Animal Sciences	47	83
	Aquatic Sciences	49	49

Table 3 (continued)

Fields	*Subfields (journal classes)*	*Share (%)*	*Institutions (N)*
	Entomology & Pest Control	68	22
	Plant Sciences	49	71
	Veterinary Medicine & Animal Health	47	19
	Animal & Plant Science	57	30
Biology & Biochemistry:			
	Biology	66	53
	Biotechnology & Applied Microbiology	33	12
	Biochemistry & Biophysics	43	58
	Endocrinology, Nutrition & Metabolism	81	58
	Experimental Biology	60	45
	Physiology	75	64
Ecology & Environment			
	Environment & Ecology	65	106
Microbiology	Microbiology	70	69
Molecular Biology & Genetics	Cell and Developmental Biology	79	38
	Molecular Biology & Genetics	72	58
Neurosciences			
	Neurosciences & Behavior	73	62
Immunology			
	Immunology	63	43
Pharmacology			
	Pharmacology & Toxicology	51	84
Clinical Medicine	〈not assessed〉	〈n.a.〉	〈n.a.〉
Psychology & Psychiatry			
	Psychiatry	73	37
	Psychology	69	103
Social Sciences			
	Communication	92	12
	Env. Studies, Geography & Develop.	55	42
	Political Science & Public Admin.	76	82
	Public Health & Health Care Science	81	48
	Rehabilitation	91	22
	Social Work & Social Policy	87	30
	Sociology & Anthropology	82	79
Education			
	Education	88	49
Economics & Business			
	Economics	69	98
	Business	75	55
Law			
	Law	97	30
Arts & Humanities			
	Archeology	46	13
	Religion & Theology	100	7

Table 3 (continued)

Fields	*Subfields (journal classes)*	*Share (%)*	*Institutions (N)*
	Art & Architecture	71	7
	Arts & Humanities (general)	83	23
	History	63	60
	Language & Linguistics	71	31
	Literature	75	72
	Performing Arts	87	15
	Philosophy	76	42

more laureates in the US than in Europe, despite CERN's location in Geneva; in physiology or medicine, we observe a similar distribution; and in the field of economics we are confronted with a clear domination of US science: when they received their prize, 60% of all laureates were associated with institutions within the US.

Production–Morphology Nexus

The data presented indicate that findings on research output assessment are highly dependent on the methodology employed to derive these assessments — and dependent on the aim of assessment. National assessments are likely giving a different picture than institutional assessments and if the task is to assess research universities, measures of institutions appear to provide the clearer picture.

The data referred to above suggest that there exists a substantial performance gradient that separates US research universities from those of the rest of the world. This performance gradient is not generally recognized or properly researched, nor are its possible causes. If output differentials are observed or recognized (Glotz, 1996, vom Brocke, 2001), they are often played down.[5] In some cases, they are linked to differences in funding modes or funding levels, the public–private status of institutions (Glotz, 2001), the publish-or perish syndrome, or the form of governance and management (Clark, 1998). In other cases, they are attributed to prejudiced editorial boards, to general language biases (Persson, 2000, van Leeuwen *et al.*, 2000, no date) or to a biased selection of ISI's journals. Some of these claims, no doubt, have merit. It is clear that funding levels have an impact on output. But not all output differentials can be explained by differing funding levels: we observe clear performance differences, that is, higher output at comparable input levels, at least when we measure research output on the basis of bibliometric indicators (Herbst *et al.*, 2002, 195–199). While the publish-or-perish syndrome may be called upon to explain, for example, the standing of US institutions regarding the volume of publications, that is, the first bibliographic measure used by the CEST (see Table 2), it cannot explain the even better standing of US institutions regarding the remaining three measures. The observation that ISI's journal lists are biased towards the English language, and that this bias has particulary negative effects in the case of the Arts & Humanities Citation Index, is voiced with some concern, but a more comprehensive assessment of the situation is lacking. Other claims, such as those referring to biased selection of articles by referees, appear exaggerated and raise difficult epistemological questions pertaining to meta-evaluations; more research will be necessary to form a clearer picture.

A range of factors may affect performance measures. One such factor pertains to the functional link between research output on the one hand and the structural setting within which research is undertaken, the production-morphology nexus. The concept of morphology, as used in the present context, draws on notions developed by Joseph Ben-David (Ben-David, 1991) and Pierre Bourdieu (Bourdieu, 1988 (1984)) and refers to a subclass of organizational matters. If we look at how public universities are governed, we may distinguish three policy levels that refer to the government, the university administration, and the individual faculty, respectively. If one compares US with European institutions on the basis of such a scheme, and if one focuses on the influence that can be exerted on each of these three levels in the respective cultures, we arrive at the 'picture' contained in Table 4: European and US higher education cultures can be seen on different shores of development.[6]

The concept of morphology, as the expression is used in the present context, refers primarily to the 3rd level of Table 4 and is operationalized here in terms of student-faculty and staff–faculty ratios. The implicit hypothesis states that institutional morphology, that is, the 'form' of research groupings and team arrangements, affects institutional performance, and if institutional morphology is culturally based, institutional morphology will affect performance levels by nations as well.[7] The hypothesis is based on the observation of a one-to-one relationship between performance levels of institutions and their corresponding morphology (Herbst *et al.*, 2002), that is:

- high-performance levels go hand in hand with a flat hierarchical setup (of teaching and research), that is, with low student–faculty and low staff-faculty ratios, and
- low-performance levels correlate with more pronounced hierarchies below the level of faculty, that is, with high student–faculty and high staff-faculty ratios.

Table 4 Governance, planning and management influence, by policy level (Actors) and Institutions (US *vs* European), based on (van Vught 1997)

		Institutions	
Level	*Actors*	*US*	*European*
1st	State Government	Low	High
2nd	Presidency (Rektorat), School, Department	High	Low
3rd	Faculty Member	Low	High

Low student-faculty ratios have long been counted among the key quality measures of educational services in general (Astin, 1993) and graduate education in particular. They imply smaller classes, broader curricula or research agendas, and generally a more collegiate culture. In the case of well-funded US research universities, low faculty–student ratios imply that resources are spread over a braod spectrum of — smaller – research teams, while corresponding European institutions are characterized by a narrower spectrum of — larger — teams.[8] These are essentially the morphological or structural differences which may be called upon to explain the Atlantic split in research performance among research universities.

Broader spectra of smaller research teams, that is, flatter hierarchies, have a number of advantages. Faculty members can devote themselves much better to their own research: they have a small — and presumably dedicated — research group to lead, composed of doctoral and post-doctoral students; and the social distance between faculty member and associated students is reduced. In contrast to the setup where large research teams dominate, flatter hierarchies ease the career paths of young academics and will foster 'horizontal' work across research teams and across sub-disciplinary or disciplinary boundaries: faculty have a range of colleagues 'next door' with whom they can engage in scientific discourse or in scientific collaborations; they have easy options to talk 'horizontally' to organizationally independent people, not only 'top-down' to individuals in a dependency position; and junior faculty members are free — not hampered — to pursue their own research agenda. In this way, a broader spectrum of know-how can be covered, and the inherent redundancy, a certain overlap in know-how within a department, eases mutual representations (in various contexts such as teaching, research, administration, etc.) and allows to distribute teaching loads and administrative burdens onto more shoulders.

The advantages of flatter hierarchies regarding research productivity will have yet to be explored empirically in greater detail. The production-morphology nexus can be addressed in a number of ways. One such way pertains to a production function approach (Griliches, 1984; Griliches, 1998, 2000), while other ways may explore the historiography of science under differing morphological conditions and the rate at which knowledge propagates or disciplines are formed (Abbott, 2001).

Historical Roots

This paper set out with the postulate that the production–morphology nexus is generally negated. If output differences are recognized at all, they are normally tied to differences in funding levels or modes, or the form of governance (Braun and Merrien, 1999). Inherent productivity differentials, that is, productivity discrepancies which can be tied to the systemic setup of institutions and its underlying higher education cultures, are rarely standing in the foreground — or even appear repressed.

And yet, higher education cultures play a dominant role when assessing the performance of higher education systems. This notion is understood by students of higher education working in a cross-cultural context (Clark, 1983, 1993, Herbst *et al.*, 1997, Trow, 1997), but more research will be necessary to clarify the particular role of institutional morphology as it affects performance. Morphological differences can be traced to the cradles of the research university systems, and with the formation of ideal-type notions of higher education institutions or systems, the corresponding structures solidified, upheld by laws and institutional regulations, or by contractual arrangements and common expectations or aspirations. Despite evidence of a significant gap in output or performance levels of higher education systems, and in spite of well-based assumptions regarding the role of the respective 'forms' of research arrangements, passed on structures are frequently very difficult to change.

While it is generally recognized that the German research university became the leading model of graduate education around the middle of the 19th century (Altbach *et al.*, 1999, Bonner, 2002, Schwinges, 2001), surpassing the more centralized institutions in France and England in influence, it is doubtful whether the success of the German model ought to be tied so strongly to reforms initiated by Wilhelm von Humboldt (1964), Fichte (1997 (1804)) or Schleiermacher (Winkler and Brachmann, 2000) at the beginning of that century. Although one frequently refers to the German model as the Humboldtian university, Humboldt's own major normative sketch of a university[9] was first published in 1900, perhaps 90 years after the pages were written (Paletschek, 2001); Humboldt's general reception started to take hold around 1920 and became more pronounced perhaps only after World War II (Schelsky, 1963). Hence, when researchers refer to the Humboldtian university, they generally refer to ideals or structures characteristic of the German university of the 19th century.

The raise of the research university in Germany and the spread of the Humboldtian model within the German speaking world[10] was predicated on a new emphasis on research (as opposed to teaching) and a willingness by the authorities to fund this research. The German university prospered because it was in a position to expand. Germany had — in contrast to France and England, the leading science nations in the early 19th century — a decentralized structure and new disciplines, new arts and sciences, could develop competitively through the formation of new chairs at various universities. As late as 1930, Abraham Flexner, one of the early proponents of comparative analysis, sought to fashion the American university on the German model (Flexner, 1930; Kerr, 1994b). He was enchanted by the Humboldtian idea of the university, by the scholarly orientation of faculty and students, by the organizational setup of the institutions, and by the interplay between education ministries and universities.

While Flexner was instrumental in reforms of American higher education and medical schools, particularly as far as the research university was concerned, and while he shall be remembered as an enterprising educator and one the founders and the first director of the Institute of Advanced Studies at Princeton, he appeared to have misread — to refer to Clark Kerr's interpretation of Flexner's stand —both the American and the German university of his time (Kerr, 1994a). Clark Kerr's view regarding the German university model might be seen as a practitioner's corroboration of a stand voiced by Joseph Ben-David, one of the great scholars in comparative analysis of higher education (Ben-David, 1991, 129):[11]

> The usual rule that each discipline was represented by only one professor contributed much […] to the establishment of new chairs, because the expansion of academic staff could take place only in this manner. After the development of institutes, however, the same rule became a veritable strangling noose: research could be conducted only in the Institut, but only one professor, the director, could be professor.

In other words, it was the concept of the Lehrstuhl — that is, a professorship, a chair, dedicated to a particular field of study, having the sole responsibility at an institution to develop such field — which was instrumental in the 19th century for the spreading of science. Expansion in a particular field could only take place through the formation of competing chairs (and associated institutes) at other universities. After this expansion period, saturation had to set in if the rules of ordination remained the same. In fact prior to World War I already, the dominance of German science began slowly to fade (Ben-David, 1991, 107) and structural — or what we call morphological — limitations came to the foreground (Ben-David, 1991, 135):

> The structural limitations of the German university remained latent so long as role differentiation permitted the continued expansion of the academic profession, but once the Institut blocked the path toward professional chairs, the inadequacy of the structure became manifest.

In this view, German science — and the Humboldtian university model — did not primarily lose its prominence because of the Nazi catastrophe and the emigration or destruction of an entire generation of undesirable scientists (Krohn, 1987 (1993)), but due to an insufficient adaptation to a time in flux. While today's Humboldtian universities may have a softer stand on the concept of the Lehrstuhl (chair) and the fields they consider ordinierbar,[12] there can be no doubt that the original concepts still play a role, despite their dysfunction. Joseph Ben-David concludes that 'The European conception of the university is […] woefully out-of-date' (p. 156). Furthermore, he states that

> […] the long term success of university reform in Europe will be dependent on the establishment of much less hierarchic and much more decentralized systems of higher education and research than those existing in England and France and a much less authoritarian and much more flexible university structure than that existing in Germany.

Joseph Ben-David links the deficiencies in European higher education to the former success and dominance of European science (Ben-David, 1991).[13] From this vantage point, the noble heritage prevented adaptations that appear necessary to be truly successful in today's world. Particularly, the once so successful German university appeared unable to adapt properly to the changing conditions of mass higher education. The irony of this traditional orientation is that a basic focus on education, originally adopted because of a possibly poor preparation of US high-school graduates (freshmen) and retained in light of mass higher education (Trow, 1970, 1997; Boyer, 1990), proves now superior, as far as research output is concerned, to the original German approach designed to strengthen research. Indeed, Martin Trow is correct in his 'Praise of Weakness' (Trow, 2003) when he refers to the rise of the US higher education system.

Notes

1 See pp S-49 and S-54 of the European Commission (1997).
2 For a definition of bibliometric measures, see e.g. http://adminsrv3.admin.ch/cest_-css/introduction/method/intro_all.pdf.
3 The country codes in Table 1 1 are as follows: AU=Australia, B=Belgium, CA=Canada, CH=Switzerland, DK=Denmark, EL=Greece, F=France, I=Italy, IRL=Ireland, IS=Island,

NL=Netherlands, NO=Norway, NZ=New Zealand, S=Sweden, TR=Turkey, UK=United Kingdom, US=United States of America.

4 The ISI distinguishes (on the bases of journal classes) 25 disciplinary fields and 107 disciplinary subfields.

5 For instance, Bernhard vom Brocke, at the end of an otherwise fine article, reproaches the 'admirers of US universities' by claiming that there are at most two to three dozens US higher education institutions (of over 3,000) which are characterized by a 'balanced relation between teaching and research'; the remaining US institutions he classifies as 'better high schools' with a teaching focus! See vom Brocke 2001, 400).

6 While the 'picture' is a bit black and white, and dated, perhaps, it still has a great deal of validity, particularly in the case of a retrospective analysis.

7 From a policy — or systems — point of view, all three levels of influence are inter-related and changes within one level will affect decision-making and structures of other levels. While organizational — or structural — matters pertain to all three levels, the present paper focuses on the third level — and hence, the specific use of the term 'morphology'.

8 US research universities are characterized by student-faculty ratios that generally over a range of 10:1–20:1. In contrast, European research universities frequently cover a range of 40:1–80:1 . In the case of comparably funded institutions, these differences imply corresponding differences in staff–faculty ratios: lower ratios for US research Universities (roughly 6:1 or 8:1 in the sciences and engineering) and higher ratios for European institutions (frequently 12:1–36:1 in corresponding fields).

9 'Über die innere und äußere Organisation der höheren wissenschaftlichen Anstalten in Berlin' see Von Humboldt, 1964, 255–266).

10 In the 19th century, German language and culture extended far beyond the current boundaries of Germany, Austria and Switzerland. Consequently, we can find today remnants of such culture in Hungary, Poland, Denmark, The Netherlands, etc.

11 Kerr's criticism, of Flexner and the German university system, goes beyond our focus here. It touches on various aspects that ought to form the focus of a current debate on the university: it touches on the German concept of further education (Volkshochschule) as a complement — and not a part — of a university, a concept that was subject to debate in the Weimar Republic for instance (Scheler 1980 (1925), 385–420); and it touches in general on the universities' roles — and mission — in their respective societies and economic environments.

12 The Humboldtian university has a rather restricted view of 'ordained' fields of study that can be covered by faculty.

13 Although Ben-David's writings cover the period between the 1960s and 1980s of the past century, his analyses and conclusions are still valid today.

References

Abbott, A. (2001) *Chaos of Disciplines*, Chicago: The University of Chicago Press.

Altbach, P.G., Berdahl, R.O. and Gumport, P.J. (eds.) (1999) *American Higher Education in the Twenty-first Century: Social, Political, and Economic Challenges*, Baltimore, MD: Johns Hopkins University Press.

Astin, A.W. (1993) *What Matters in College? Four Critical Years Revisited*, San francisco, CA: Jossey- Bass Publishers.

Ben-David, J. (1991) *Scientific Growth: Essays on the Social Organization and Ethos of Science*, Berkeley, CA: University of California Press.

Bonner, T.N. (2002) *Iconoclast: Abraham Flexner and a Life in Learning*, Baltimorem MD: Johns Hopkins University Press.

Bourdieu, P. (1988 1984) *Homo Economicus*, Stanford: Stanford University Press (Les Editions de Minuit).

Boyer, E.L. (1990) *Scholarship Reconsidered: Priorities of the Professoriate*, Jossey-Bass Publishers: The Carnegie Foundation for the Advancement of Teaching.

Braun, D. and Merrien, F.-X. (eds.) (1999) *Towards a New Model of Governance for Universities? A Comparative View*, London: Jessica Kingsley Publishers.

Clark, B.R. (1983) *The Higher Education System: Academic Organizations in Cross-National Perspective*, Berkeley, CA: University of California Press.

Clark, B.R. (1998) *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*, Oxford: Pergamon.

Clark, BR. (ed.) (1993) *The Research Foundation of Graduate Education*, Germany, Britain, France, United States, Japan, Berkeley, CA: University of California Press.

Committee on Prague. (2000) 'Introduction to the Bologna Process', Board Meeting 38, Vilnius (Lithuania).

Commonwealth of Massachusetts. (1859) http://libraries.mit.edu/archives/mithistory.

Da Pozzo, F., Maye, I., Roulin Perriard, A. and von Ins, M. (2001a) *Die Schweiz und die weltweite Champions League der Forschungsinstitutionen 1994–1999, Ein Beitrag zu einem internationalen Benchmarking: Konzept underste Resultate'*, Berne, Switzerland: Centre d'études de la science et de la technologie (CEST 2001/11).

Da Pozzo, F., Maye, I., Roulin Perriard, A. and von Ins, M. (2001b) *List of the Worldwide 'Champions League' of Research Institutions 1994–1999'*, Berne, Switzerland: Centre d'études de la science et de la technologie (CEST).

Da Pozzo, F., Maye, I., Roulin Perriard, A. and von Ins, M. (2002) *Les institutions du domaine des Ecoles polytechniques fédérales: Profils de Recherche et comparaisons internationales, Indicateurs bibliométriques pour les années 1994–1999'*, Berne, Switzerland: Centre d'études de la science et de la technologie (CEST 2002/1).

Duderstadt, J.J. (2000) *A University for the 21st Century*, Ann Arbor, MI: The University of Michigan Press.

Duke, C. (1992) *The Learning University: Towards a New Paradigm?*, Buckingham, UK: Milton Keynes, The Society for Research into Higher Education (SRHE) & Open University Press.

Edwards, K. (1999) 'The European Space for Higher Education', Paper presented at the University of Bologna to the European Ministers of Education.

European Commission. (1997) *Second European Report on S&T Indicators* 1997 Report, Office for Official Publications of the European Commission, Brussels.

Fichte, J.G. (1997 (1804)) *Schriften zur Wissenschaftslehre*, Berlin: Deutscher Klassiker Verlag.

Flexner, A. (1930) *Universities: American, English, German* in C. Kerr (ed.) Oxford: Transaction Publishers (Oxford University Press), pp. xxxiii–381.

Glotz, P. (1996) *Im Kern verrottet? Fünf vor zwölf an Deutschlands Universitäten*, Deutsche Verlags-Anstalt.

Glotz, P. (2001) 'Die Universität im digitalen Zeitalter Gesellschaft für Hochschule und Forschung', in: G. Latzel and S. Kannan (eds.) *Die Zukunft des Hochschulstandortes Schweiz* Gesellschaft für Hoschschule und Forschung, Z̈urich 2001, pp. 17–24.

Griliches, Z. (ed.) (1984) *R&D, Patents, and Productivity*, National Bureau of Economic Research, Chicago: University of Chicago Press.

Griliches, Z. (1998) *R&D and Productivity: The Econometric Evidence*, Chicago: University of Chicago Press.

Griliches, Z. (2000) *R&D, Education, and Productivity: A Retrospective*, Cambridge, MA: Harvard University Press.

Haug, G. (1999a) 'Trends and Issues in Learning Structures in Higher Education in Europe', Project Report.

Haug, G. (1999b) 'Visions of a European Future: Bologna and Beyond', 11th EAIE Conference, Maastricht.

Herbst, M, Hugentobler, U. and Snover, L. (2002) 'MIT and ETH Zürich: Structures and Cultures Juxtaposed', Centre d'études de la science et de la technologie (CEST 2002/9, www.cest.ch/en/publikationen/-cest_reihe.htm).

Herbst, M., Latzel, G. and Lutz, L. (eds.) (1997) *Wandel im Tertiären Bildungssektor: Zur Position der Schweiz im internationalen Vergleich,* Verlag der Fachvereine (vdf).

Hurley, J. (1997) *Organisation and Scientific Discovery*, New York: John Wiley & Sons.

Kennedy, D. (1997) *Academic Duty*, Cambridge, MA: Harvard University Press.

Kerr, C. (1994a) 'Remembering Flexner: Introduction to the Transaction Edition', in C. Kerr (ed.) *Abraham Flexner: Universities, American, English, German*, Oxford: Transaction Publishers (Oxford University Press), pp. ix–xxxii.

Kerr, C. (ed.) (1994b) *Abraham Flexner: Universities, American, English, German*, Oxford: Transaction Publishers (Oxford University Press).

Krohn, C.-D. (1987 (1993)) *Wissenschaft im Exil*, Amherst, MA: Campus-Verlag (University of Massachusetts Press).

OECD. (1998) *Education at a Glance: OECD Indicators 1998* Centre for Educational Research and Innovation, Paris: OECD Publications.

OECD. (2001) *Knowledge and Skills for Life: First Results from PISA 2000, Programme for International Student Assessment*, Paris: OECD Publications.

Paletschek, S. (2001) 'Verbreitete sich ein 'Humboldt'sches Modell' an den deutschen Universitäten im 19 Jahrhundert?', in R.C. Schwings (ed.) *Veröffentlichungen der Gesellschaft für Universitäts- und Wissenschaftsgeschichte,* Vol. 3, Basel: Schwabe & Co., 75–104.

Persson, O. (2000) 'Decline of Swedish Science?', *Bibliometric Notes* 4(3), www.umu.se/inforsk/BibliometricNotes/BN3-2000/BN3–2000.html.

Rudenstine, N.L. (2001) *Pointing our Thoughts: Reflections on Harvard and Higher Education, 1991–2001*, Cambridge, MA: Harvard University.

Scheler, M. (1980 (1925)) 'Die Wissensformen und die Gesellschaft', *Gesammelte Werke,* Vol. 8, Berne: Francke Verlag.

Schelsky, H. (1963) *Einsamkeit und Freiheit: Idee und Gestalt der deutschen Universität und ihrer Reformen*, Rowohlt.

Schwinges, R.C. (ed.) (2001) 'Humboldt International: Der Export des deutschen Universiätsmodells im 19 und 20. Jahrhundert', *Veröffentlichungen der Gesellschaft für Universitäts- und Wissenschaftsgeschichte,* Vol. 3, Basel: Schwabe & Co.

Senge, P.M. (1990) *The Fifth Discipline: The Art and Practice of Learning Organizations*, New York: Doubleday.

Trow, M. (1970) 'Reflections on the transition from elite to mass higher education', *daedalus* 90: 1–42.

Trow, M. (1997) 'Reflections on Diversity in Higher Education', in M. Herbst, G. Latzel and L. Lutz (eds.) *Wandel im Tertiären Bildungssektor: Zur Position der Schweiz im internationalen Vergleich, vdf,* Chapter 3, pp 15–36.

Trow, M. (2003) 'In praise of weakness: Chartering, the University of the United States, and Dartmouth College', *Higher Education Policy* 16(1): 9–26.

Turner, R.S. (2001) 'Humboldt in North America? Reflections on the Research University and its Historians', in R.C. Schwinges (ed.) *Veröffentlichungen der Gesellschaft für Universitäts- und Wissenschaftsgeschichte,* Vol. 3, Basel: Schwabe & Co., pp. 289–312.

van Leeuwen, T.N., Moed, H.F., Tijssen, R.J., Visser, M.S. and van Raan, A.F. (2000) 'First evidence of serious language-bias in the use of citation analysis for the evaluation of national systems', *Research Evaluation* 9(2): 155–156.

van Leeuwen, T.N., Moed, H.F., Tijssen, R.J., Visser, M.S. and van Raan, A.F. (no date) 'Language biases in the science citation index and its serious consequences for national research evaluation on international comparison: The case of Germany and France', http://sahara.fsw.leidenuniv.nl/cwts/sci_d.html.

van Vught, F.A. (1997) 'Relevant issues for higher education policy-research', in M. Herbst, G. Latzel and L. Lutz (eds.) *Wandel im Tertiären Bildungssektor: Zur Position der Schweiz im internationalen Vergleich, vdf,* Chapter 3, pp 149–157.

vom Brocke, B. (2001) 'Die Entstehung der deutschen Forschungsuniversität, ihre Blüte und Krise um 1900', in R.C. Schwings (ed.) *Veröffentlichungen der Gesellschaft für Universitäts- und Wissenschaftsgeschichte,* Vol. 3, Basel: Schwabe & Co., pp. 367–400.

Von Humboldt, W. (1964) *Schriften zur Politik und zum Bildungswesen*, Stuttgart: Wissenschaftliche Buchgesellschaft.

Winkler, M. and Brachmann, J. (eds) (2000) *Friedrich Schleiermacher, Texte zur Pädagogik: Kommentierte Studienausgabe, Band 1*, Frankfurt am Main: Suhrkamp Taschenbuch Wissenschaft.

Winterhager, M. and Weingart, P. (1997) 'Forschungsstatus Schweiz 1995, Publikationsaktivität und Rezeptionserfolg der schweizerischen Grundlagenforschung im internationalen Vergleich 1981–1995: Daten zu den Natur- und exakten Wissenschaften sowie den Sozial-, Wirtschafts- und Rechtswissenschaften', Berne: Schweizerischer Wissenschaftsrat, FOP 45/1997.