Re-inventing society: state concepts of knowledge in Germany and Singapore

Hornidge, Anna-Katharina

Postprint / Postprint
Zeitschriftenartikel / journal article

SOJOURN: Journal of Social Issues in Southeast Asia Vol. 22, No. 2 (2007), pp. 202–29 DOI: 10.1355/sj22-2c

ISSN 0217-9520 print / ISSN 1793-2858 electronic

Re-inventing Society: State Concepts of Knowledge in Germany and Singapore

Anna-Katharina HORNIDGE[1]

Different concepts of knowledge and the ways they are valued have influence on the politics of research and development, information, arts, and culture in various countries. In a time when knowledge increasingly gains importance for economic and social development, these concepts of knowledge, as they are defined within society, are receiving greater attention. State governments worldwide aim for the creation of "knowledge societies". At the core of these knowledge-based futures lie particular understandings of knowledge in each country, which determine what kinds of knowledge society are constructed. This paper attempts to grasp the dominant concepts of knowledge in Germany and Singapore as reflected in state activities and budgeting. The data suggest that the dominant concepts of knowledge in both countries differed widely in the past, which was in great part due to the structural realities in each country. Yet in recent times, with the common goals of economic growth and the exposure to global competition, these concepts of knowledge seem to increasingly converge.

Keywords: society, knowledge concepts, Germany, Singapore, economy, social development, politics, research and development (R&D), history, structural determinants of knowledge, state governments.

Introduction: Country-Specific Concepts of Knowledge

In different countries, varying concepts of knowledge prevail and structure politics, especially in the fields of research and development (R&D), education, arts, culture, and the media.[2] Yet, the arena in which the decision concerning what type of knowledge is produced, stored and disseminated is made varies within and between countries. The level of pluralism or singularity in conceptualizing knowledge is generally related to the degree of democratic or authoritarian rule exercised by each country's government and its political system. The concept of knowledge is also strongly influenced by structural realities such as the political and legal system, historical experience, and economic situation. Consequently, country-specific concepts of knowledge that are inflexible or archaic face increasing global pressures. For example, manufacturing industries often move out of industrialized countries while knowledge industries form their new value-generating centres in various parts of the world.

For the purposes of this paper, I draw on Berger and Luckmann's sociology of knowledge, which conceptualizes knowledge as everything that is regarded as knowledge in and by society (1984, p. 16). Empirically, I shall focus on the concepts of knowledge inherent in state politics and budgeting, including expenditure for R&D, education, and cultural activities. These quantitative data are counterchecked against qualitative expert interviews with representatives of the government administrative bodies and state-financed research institutes in both countries. The focus on state concepts of knowledge is an empirical restriction necessary when not all subsystems and groups of society can be assessed. Germany and Singapore are two industrialized nations with few natural resources to build on but with the common will to conduct high-level R&D for further development. While Germany is federally organized, Singapore is a centralized city-state. Both countries have ports and historical trading traditions. Both countries have developed into service economies and today increasingly rely on knowledge, the generation of ideas, innovations and creativity for economic growth. Last but not least, both state governments actively promote the construction of knowledge societies.

This paper assesses three main questions. First, what type of knowledge is — in terms of its production and dissemination — financially supported in both countries? This question is structured by (a) the different sectors of knowledge production (e.g., natural sciences, medicine, engineering, arts, fine arts etc.); (b) the varying applicability of knowledge (basic and/or applied research);[3] as well as

(c) the range of knowledge areas (including forbidden knowledge). Secondly, in what way are these concepts of knowledge influenced by the structural realities of those countries as well as global pressures? Thirdly, have different knowledge concepts become increasingly similar in recent times as suggested by the empirical data? The in-depth analysis is structured for assessing the concepts of knowledge in Germany and in Singapore, their history in the past fifty years and structural determination, as well as current understandings. A discussion of the findings concludes the paper.

Knowledge in Germany

History and Structural Determinants of Knowledge

The history of German R&D politics can be divided into (a) the period of construction from 1800 to 1914; (b) the period of extension from 1914 to 1945; and (c) the period of reconstruction after 1945 (Vogel 2000, pp. 155–57). The period of construction was characterized by the establishment of a research infrastructure in order to keep up with England's industrial development. The two world wars affected R&D politics by focusing on marine, aviation, and weapon technology. From 1914 to 1945, research was substantially weakened by the elimination of one third of Germany's university professors. After World War II, the reconstruction of Germany differed between East and West. In West Germany, the Western allies reconstructed the former R&D structure and rebuilt research institutions such as the *Fraunhofer* Society for Applied Sciences (Vogel, 2000, pp. 157–59). As a clear remnant of the experiences under Nazi-rule, the decentralized federal structure installed by the Allies after World War II divides until today the functions of the state on a territorial basis between the constituent states (*Bundesländer*) and the central state, the federation (*Bund*). Education, science, and research fall under the responsibility of the states. Furthermore, the constitution (Article 5, Section 1) guarantees freedom of self-expression, the press, teaching, and research (Heinrich 2003, pp. 7–27; Schäfers 1981, pp. 109–110). Thus, each state government defines independently which knowledge it regards as valuable, resulting in a pluralist concept of knowledge.

When West Germany regained competitiveness, it diversified its research portfolio, increased its research depth and fed its basic and applied research into its export-oriented economy. The federal government took growing interest and responsibility in the field from the mid-1960s onwards (Heinrich 2003, pp. 48–68; Vogel 2000, p. 157). Today, the German economy still relies on a positive balance of trade (exports in 2004: €731 billion, imports: €575.4 billion). Main export goods are cars and car parts, machines and chemical products. Nevertheless, the economic sectors of Germany have shifted their importance over the past few years, with the service sector, but also IT, biotech, renewable energy and environmental protection, having become considerably more relevant. Sector-specific shares of the GDP are as follows: services 69.8 per cent, economy and construction 29 per cent, and agriculture 1.2 per cent (Statistisches Bundesamt Deutschland, 2006). The highly diversified economic structure as well as the degree of global exposure relies on a wide range of basic and applied R&D in manufacturing, design, arts, and creative industries. It stands for a diversified, plural concept of knowledge. According to the Federal Ministry of Foreign Affairs, approximately 90,000 additional jobs have been created in sectors involving intensive R&D and in the knowledge intensive service sector approximately 1.46 million jobs since 1997. It also results in an increase of German patent applications at the European Patent Office. In 2003, the overall number of German applications exceeded 22,700, which corresponds to 19.5 per cent of all applications. This relatively high level of certified creativity is furthermore supported by a high level of civil organization of the German society in associations and non-governmental organizations that independently define which knowledge they regard as valuable (BMFSFJ 2004). The communication between the state and the remaining subsystems of society that are mainly interested in knowledge production and dissemination — economy, scientific community, civil society, media — is characterized by a high level of independence and egalitarianism (Luhmann 1984; Hornidge 2007). The channels of expressing the interests of one subsystem to the subsystem state (e.g., government commissions) are advisory, not decision-making in character.

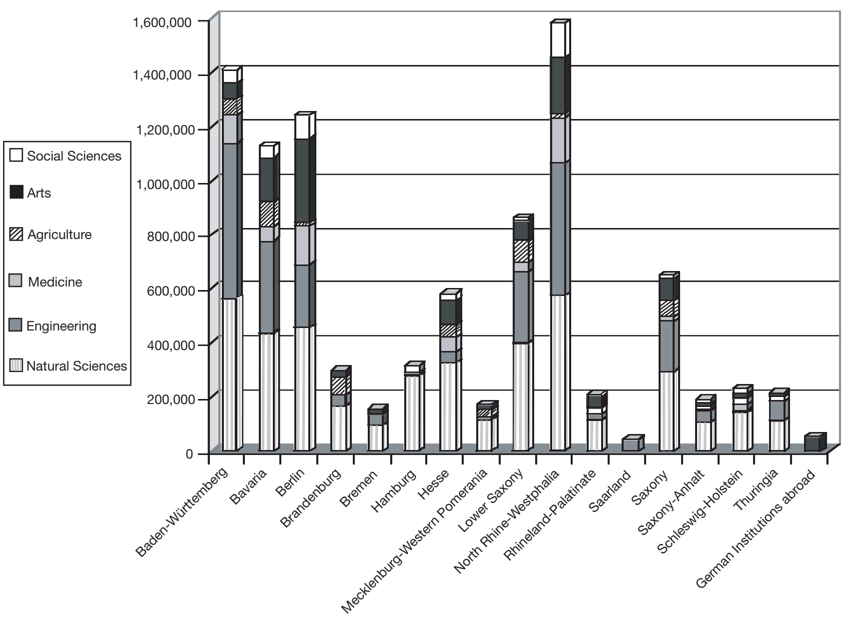
Consequently, a wide range of actors define independently what is considered as valuable knowledge in Germany.[4]

Conceptualizing Knowledge Today

Within the subsystem state the influence is distributed amongst the federal government, state governments, municipalities and special-purpose associations according to their budgets for education, science and culture. The financial splitting is illustrated in Table 1.

Since the end of World War II, the state governments (*Länder*) bear most of the financial burden for education, science and culture. Each state government decides independently which areas of R&D and cultural activities are financially supported and to what degree. The different emphasis on specific subjects among the states is expressed in the state budgets as illustrated in Figure 1:

Figure 1
Expenditure of Public Research Institutions in 2002 — by States and Research Areas (thousand Euro)



Source: Compiled by the author based on *Statistisches Bundesamt*, 2004, p. 19.

Table 1
Expenditure (Basic Funds) of Public Budgets — on Education, Science and Culture

Central, regional and local authorrities sectors/indicators	2003 Actual	2004 Actual	2005 (Preliminary, Actual)	2006 (Target)
By central, regional and local authorities – EUR mn –				
Total	90 571 800	90 315 532	91 428 060	93 323 640
Federal government	10 546 509	10 627 406	11 112 045	12 182 180
Länder	65 318 122	65 195 733	65 390 789	66 547 115
Communities and special-purpose associations	14 707 169	14 492 393	14 925 226	14 594 345
Indicators of education, science and culture, total				
EUR mn	90 571 800	90 315 532	91 428 060	93 323 640
EUR per inhabitant	1 097.57	1 094.72	1 108.70	1 132.95
Shares in the public sector budget (%)	19.65	19.51	19.23	19.12
Shares in the gross domestic product (%)	4.19	4.08	4.07	4.05
Indicators of education				
EUR mn	74 031 350	74 115 566	75 106 572	76 283 115
EUR per inhabitant	897.13	898.36	910.78	926.08
Shares in the public sector budget (%)	16.06	16.01	15.80	15.63
Shares in the gross domestic product (%)	3.42	3.35	3.34	3.31
Indicators of science and research outside institutions of higher education				
EUR mn	9 235 638	9 090 312	9 201 545	9 951 337
EUR per inhabitant	111.92	110.18	111.58	120.81
Shares in the public sector budget (%)	2.00	1.96	1.94	2.04
Shares in the gross domestic product (%)	0.43	0.41	0.41	0.43
Indicators of culture and church affairs				
EUR mn	7 304 812	7 109 654	7 119 944	7 089 187
EUR per inhabitant	88.52	86.18	86.34	86.06
Shares in the public sector budget (%)	1.58	1.54	1.50	1.45
Shares in the gross domestic product (%)	0.34	0.32	0.32	0.31

Source: *Statistisches Bundesamt*, 2007, last updated on 12 April 2007.

Apart from Baden-Württemberg, all states regard natural sciences as the field of research and education that is worth the most R&D funding. This can be partly explained by the high costs of specialized R&D in these fields. Yet, the differences in R&D funding per field of research amongst the states clearly illustrates differences in valuing a research area other than natural sciences in one or the other state. In Berlin and Hesse for example, arts receive the second-highest funding, whereas most other states identified engineering as the second most important field. The reasons for these differing foci are mainly historical, economical and political in nature. One historical reason, for example, is the long tradition of knowledge production in certain fields. An economic reason is the indirect support of local industries with public R&D funding in the fields of knowledge production of immediate interest to local industries. Political reasons evolve from the party-political orientation of each state government and the resulting support of certain lobby groups and their interests. Berlin, for example, looks back on a long tradition as a capital-city where arts, fine arts and architecture have been cultured and attracted tourism. Baden-Württemberg, in contrast, is Germany's centre of car manufacturing and therefore continues its long tradition of engineering. Hence, the federal structure of Germany fosters differing concepts of which knowledge production is regarded as valuable. This heterogeneity of knowledge concepts does not exist in a centralized system, where one state budget decides on the ranking of research and educational areas. The wide range of financed knowledge production and preservation practised in Germany is also illustrated in Table 2.

The financing of knowledge production and preservation includes research centres such as the *Fraunhofer-* and *Max-Planck*-Institutes, which focus mainly on natural sciences, as well as the *Max-Planck*-Institutes and the *Leibnitz*-Association that also conduct research in the arts and social sciences. Additionally, libraries and museums are financially supported. This support of a wide range of knowledge production and dissemination stands for an integrative concept of knowledge, generally seen as something positive and worthy of support. The question whether this knowledge pays off shortly after, and whether it is profitable, has traditionally not been a prime aspect in deciding on the budget for R&D and education. The valuing of basic as well as applied research was also emphasised by several interview partners as characteristic for German knowledge politics. The Head of the Department Information, Publication & Editing of the Federal Ministry of Health and Social Security in Germany argues:

> Politics and industry have to produce results that are graspable and marketable. The academia is far away from this. For the academia, no result is also a result (J. Zweig, 30 September 2004, interview with and translation by the author).

Emphasising the role of the state in providing a necessary framework for basic R&D, the Head of the Centre for Advanced Media Technology (CamTech), a collaborative project between the Nanyang Technological University in Singapore and the *Fraunhofer* Institute for Computer Graphics in Germany, states:

> It is definitely important that the state creates an environment in which companies can develop; meaning that basic research can be conducted without having to justify it with economic success. In Germany, this is still possible (W. Müller-Wittig, 3 February 2005, interview with and translation by the author).

Nevertheless, there are some categories of knowledge that are not supported, even forbidden by law, in Germany. They include fields such as stem cell research and other areas of life science, as well as the research with radioactive materials. The Executive Director of the Genome Institute of Singapore, a research institute belonging to A*STAR argues:

> Germany has a somewhat schizophrenic view of science. Because Germans enjoy science and at the same time they are suspicious of science. In America, the people are on the whole ignorant of science: scientists are sometimes considered nerdy whereas the athlete is popular. In Germany, the schism is not uncool versus cool, but it is good versus bad (E.T. Liu, 4 February 2005, interview with the author).

Table 2
Expenditure of Public Research and Academic Institutions in 2002 — by Institutional Group and Research Area
(thousand Euro)

Institutional Group Institutional Form	Natural Sciences	Engineering	Medicine	Agriculture	Arts	Social Sciences	Total
Public R&D-Institutions of the Federal Gov.	815 622	336 153	190 728	461 549	151 096	48 236	2 003 384
of the State and Municipal Gov. (without	706 638	290 687	—	213 382	95 801		1 527 409
Leibniz-Society)	108 984	45 467	—	248 167	55 295		475 975
Public R&D-Institutions financed by Federal & State Gov.	2 986 208	1 694 505	395 660	70 627	218 338	186 507	5 551 844
Helmholtz-Centres	1 261 683	863 982	206 881	—	—	13 872	2 356 756
Institutes of Max-Planck-Society	893 762	—	88 370	—	96 221	43 148	1 132 057
Institutes of Fraunhofer-Society	308 044	700 430	15 348	—	—	13 108	1 046 878
Leibniz-Association ("Blue List")	495 312	119 203	84 299	52 412	72 521	113 468	937 214

Academies	27 407	—	761	—	47 527	2 911	78 939
Other publicly financed organisations w/o financial reward f. R&D	320 371	387 859	41 141	21 403	128 541	168 075	1 067 391
Academic Libraries and Museums (without Leibniz-Society)	50 157	12 410	8 613	8 412	698 677	29 806	808 074
Public Libraries, Archives, Centres for information & documentation	272	—	—	3 964	249 964	3 416	259 326
Publicly sponsored Libraries, Archives, Centres for information & documentation	21 398	7 928	—	4 448	114 476		177 790
Museums	28 487	—	—	—	334 237		370 958
Total	**4 172 358**	**2 430 927**	**636 141**	**561 991**	**1 196 653**	**432 623**	**9 430 693**

Source: *Statistisches Bundesamt*, 2004, p. 18. Translation by the author.

Furthermore, a shift in focus can be assessed towards increasingly supporting the production of knowledge that contributes to economic growth. The Head of the Information Science Department of the University of Constance is concerned about this increasing commercialization of knowledge and argues:

> The strong commercialisation of knowledge and information reduces the emancipative aspect of the information society (R. Kuhlen, 26 November 2004, interview with and translation by the author).

A senior employee of the politically social democratically oriented Friedrich-Ebert-Foundation sees globalization as a main reason for the increasing conceptualization of knowledge along the needs of the market:

> The ongoing globalisation and worldwide competition forces countries to regard knowledge increasingly as an economic rather than a social resource (P. Oesterdijkhoff, 26 October 2004, interview with and translation by the author).

The Head of the division "Knowledge Society" of the politically green oriented Heinrich-Böll-Foundation heavily criticizes the current German politics with regard to software patents and intellectual property rights:

> Publicly the chancellor demands the support of small and medium-sized industries but the policies released with regard to software patents aim at the exact opposite. They cement the market power of big players and foster cartels rather than competition. Such strengthened market positions of few big players will massively hinder the development of a knowledge society. Knowledge society can only take off when people, meaning every person on the street, are willing and happy to enter their knowledge, their creativity and spirit of innovation into the value chain (A. Poltermann, 18 October 2004, interview with and translation by the author).

For Poltermann the core question of the knowledge society is not how to make formalized knowledge and information accessible but rather how to make unformalized knowledge, i.e., knowledge that is not captured in publications or databases but that merely exists in the abilities and memory of a person, tacit knowledge available:

> The main problem is how to make inaccessible knowledge accessible. This is not formalised knowledge, meaning experience, autonomy, organisational skills, self-motivation etc. It is not substitutable knowledge, nearly impossible to store and difficult to pass on. For us the central idea is: If people don't want to pass on their un-formalised knowledge to the work place, they won't. But seeing that it is exactly this knowledge that increasingly gains importance in the value chain we are expecting new forms of bargaining processes (A. Poltermann, 18 October 2004, interview with and translation by the author).

Overall, one can identify two country-specific traits of the German politics of knowledge production. First, a wide sectoral range of knowledge is supported. Second, both basic and applied R&D are conducted, mutually enriching each other. These two characteristics point to an integrative concept of knowledge: generally all kinds of knowledge are regarded as something positive and worthy of support with the exception of knowledge that is explicitly qualified as 'unethical'. Nevertheless, this concept of knowledge has been quite open until recently, but is now increasingly overshadowed by a commercialization of knowledge. The ongoing economic downturn and the perceived need to compete with the educational systems of other countries have led to a restructuring of the German education system and R&D along the demands of the market. New university courses are constructed in direct preparation either for a certain job or a scientific, academic career. Humboldt's theory of the unity of teaching and research is neglected in a time in which critical thinking and the ability of decision-making becomes increasingly the best job qualification (Nida-Rümelin 2005, p. 3). *Diplom* and *Magister*, the traditional German university degrees which include training for a certain job as well as research, are being replaced by bachelor and master courses in which the transfer of job-oriented knowledge in a modular system is common practice. Knowledge is measured in patents and copyright laws,[5] which neglect difficult-to-grasp knowledge outputs such as social sciences, philosophy or tacit knowledge such as creativity, experience or organizational skills. Consequently, it is questionable whether the German concept of knowledge, characterized by the support of a wide range of knowledge production as well as basic and applied research, remains valid.

Knowledge in Singapore

History and Structural Determinants of Knowledge

After gaining independence in 1965, the Singaporean politics of knowledge production seem to focus on applied research in selected fields of R&D identified by the government as future areas of economic growth. This focus goes back to the decision to rapidly develop after independence, in line with the construction of a Singaporean culture by the government based on values of merit, performance, efficiency, and pragmatism (Chan and Evers 1978). Traditionally, Singapore's economy was based on the port (Evers 1991). Around this port, numerous small manufacturing sites were established, producing wigs, kitchenware and other low skill manufacturing items. As the low-skilled manufacturing sites began moving to neighbouring countries, the Singaporean government identified new economic sectors, such as computer and disk drive production in the early 1980s (Ang 1992). However, the neighbouring countries developed as well and Singapore realized in the late 1980s that it had to increase local content production and the local development of advanced technologies in order to move up the value chain further (Anwar and Zheng 2004; Evers and Gerke 2003; Evers and Gerke, et al. 2004; 2005). The then chairman of A*STAR describes the different phases of Singapore's economy as follows:

> Our economy went through many different stages. We started in 1965 at high unemployment and worked ourselves up to full employment. We started with manufacturing industry, low-skill, labour-intensive, then steel and cotton industry, then chemical industry, then microchip and semi-conductor industry, then knowledge based industry. Knowledge is the key and the most important for knowledge is education, especially higher education (Philip Yeo, 11 February 2005, interview with the author).

Traditionally, the degree of economic exposure to the world economy is high with exports and imports amounting to S$303,476 million and S$276,894 million respectively in 2004. According to the Department of Statistics (2005), major export goods are oil, crude materials, manufactured goods, machinery, and transport equipment.

The highly diversified economic structure is characterized by rapid development from a less developed to an industrialized economy (Yap 2000, p. 110). Traditionally a strong focus on knowledge applicable in the (low-skilled) manufacturing industry can be observed (Evers and Hornidge 2007). The educational system looks back on a short history with the first tertiary educational institution being established at the end of the 19th century. Education was and is until today very much focused on qualifying for certain professions. This traditional focus on applied R&D in "marketable" knowledge areas is today increasingly shifting towards a more diverse R&D structure including arts, creativity and design. The total public and private R&D spending as a percentage of the GDP increased from 0.85 per cent in 1990 to 2.15 per cent in 2003. The public R&D spending as percentage of the GDP was responsible for 0.39 per cent in 1990 and 0.84 per cent in 2003.[6] The yearly increase in the R&D funding resulted in a steady increase of research scientists and engineers. The total number of research scientists and engineers (RSEs) holding a Ph.D. degree rose from 970 (of 4,329) in 1990 to 3,791 (of 17,074) in 2003.[7]

This conscious push for particular, though over time changing, knowledge areas for the economic development of the nation was facilitated by the centralized organization of the city-state, making the spear of one dominant knowledge concept possible. Furthermore, the legal infrastructure until today strengthens the position of the state in defining which knowledge is produced and transmitted. Besides the Criminal Law (Temporary Provisions) Act and the Internal Security Act which allow the government to detain citizens without trial, laws such as the Societies Act, the Charities Act, the Public Entertainments Act and the Public Lotteries Act for raising public funds, the Newspaper and Printing Presses Act (for the licensing of newsletters) and the Penal Code for unlawful assembly, obscene or other speech subject to criminal sanction restrict free speech and opinion (Masterton 1996; Ooi 2000, pp. 183–84; Yap 2000, p. 109). The legal infrastructure is not deeply scrutinized by civil society groups. Rather, a low level of civil organization leaves room for the state concept of knowledge to mushroom (Lyons and Gomez 2005; Gomez 2000; Ibrahim 2004). This is further supported by the existing structures of communication between the state and the remaining subsystems of society mainly interested in the production and dissemination of knowledge. As outlined in detail by Hornidge (2007), communication is characterized by permeable boundaries between the state and the remaining subsystems. This is clearly different from the German model of communication between the subsystems. The channels of expressing the interests of one subsystem to the state (e.g., final reports of government commissions, boards of directors in statutory boards) allow the participation of selected members of this subsystem in political decision-making. Yet, in reverse, the state heavily influences the remaining subsystems in their decision-making by controlling the media, developing school curricula and deciding on research foci of publicly financed R&D-institutes. Consequently, the subsystems of Singapore do not act fully independent but largely in accordance with the interests of the state.

Conceptualizing Knowledge Today

Government statistics on the sectoral splitting of the R&D funding could only be found with regard to science and technology. Information on the R&D expenditures regarding the humanities, arts, social sciences and fine arts are neither part of the yearly published "National Survey of R&D in Singapore" of A*STAR,[8] nor stated in the yearly budget of the government (Government of the Republic of Singapore 2005). Apparently, humanities, arts and social sciences in Singapore are not yet fully assessed as part of the R&D infrastructure of the economy although enormous action has been taken towards their development in recent years. Concerning science and technology, Table 3 illustrates the spending by type of R&D and research areas.

Besides the focus on science and technology, or research areas regarded as directly contributing to the economy, the table also indicates a strong focus on applied rather than basic research. While the total R&D expenditure for basic research amounts to S$765.05 million, applied research was supported with S$1,209.98 million and experimental development with S$2,086.86 million. Hence, the two types of research regarded as directly leading to economic growth — applied research and experimental development — are provided with the strongest state support.

In 1985, Singapore's economy was hit by recession for the first time since independence. Low skilled, labour intensive industries moved out of Singapore to neighbouring countries and raised the awareness within the Singapore government for the need for sustainable growth. In 1986, the Singapore government set up the Economic Review Committee (ERC). It advised the government to emphasise the production of scientific knowledge as well as bio and life sciences which eventually resulted in the founding of A*STAR.[9] As a statutory board of the Singaporean government, A*STAR oversees twelve research institutes working in the areas of biomedicine, science and engineering (Menkhoff and Evers 2005). The Chairman of the Intellectual Property Office and Professor at the National University of Singapore describes the conclusion drawn by the ERC:

> The committee identified that for Singapore to get out of the recession and continue to grow we had to move up the technological ladder because our cost structure is such that we can't do the things we used to do. Our neighbours caught up with us (Hang C.C., 22 February 2005, interview with the author).

Dr Tan Chin Nam, permanent secretary of MICA points to the developing of a service industry, besides the traditional manufacturing:

> The ERC of 1986 redefined what Singapore wanted to be from the economic point of view and therefore had to go through a restructuring and reinvention of the Economic Development Board. That we see total business as a function and a mission was defined: Singapore as a global city with total business capabilities. Not just manufacturing but manufacturing plus services! (Tan Chin Nam, March 2005, interview with the author).

In 2002, Singapore's President S.R. Nathan explains the increased emphasis on science and technology at the opening of

Table 3

R&D Expenditure by Type of R&D and Field of Science and Technology

$ million

Field of Science & Technology	Private Sector			Government Sector				Higher Education Sector				Public Research Institutes				Total		
	Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Basic Research	Applied Research	Experimental Development
Agricultural & Food Science	1.04	24.66	9.95	0.00	0.00	4.76	0.65	0.04	2.85	0.91	0.27	0.00	0.00	0.00	0.00	3.93	30.33	10.87
Biomedical & Relate Sciences	37.52	134.46	60.75	2.77	11.96	75.25	26.71	9.51	58.42	33.29	10.28	161.07	39.72	67.85	9.31	320.98	310.84	107.06
Basic Medicine	4.75	14.53	3.40	0.00	1.77	2.01	1.88	0.39	9.16	6.03	0.71	0.00	2.72	0.00	0.00	18.80	22.57	5.99
Biological Sciences	26.18	50.55	12.38	2.77	8.95	10.22	0.00	4.69	26.76	9.60	3.97	161.07	33.58	43.51	9.31	264.01	113.89	25.66
Clinical Medicine	0.00	8.41	15.79	0.00	0.28	45.13	2.05	4.33	21.12	15.48	5.60	0.00	2.06	6.00	0.00	27.79	75.03	23.44
Health Sciences	0.00	0.79	2.19	0.00	0.96	0.85	0.85	0.09	1.38	2.15	0.00	0.00	0.00	0.00	0.00	2.43	3.79	3.04
Pharmaceutical Sciences & Manufacturing	0.55	13.19	22.68	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	18.33	0.00	0.55	31.52	23.59
Other Related Biomedical Sciences	6.04	46.98	4.31	0.00	0.00	17.04	21.03	0.00	0.00	0.03	0.00	0.00	1.36	0.00	0.00	7.40	64.05	25.34
Engineering & Technology	102.39	406.94	1,338.15	0.00	1.72	65.03	180.13	20.70	49.59	69.74	51.31	1.55	94.35	112.40	9.41	270.29	654.11	1,579.01
Aeronautical Engineering	0.06	2.27	7.01	0.00	0.00	0.00	11.70	0.00	0.01	0.01	0.00	0.21	0.43	1.49	0.00	0.73	3.77	18.71
Biomedical Engineering	0.00	4.76	0.63	0.00	0.00	0.00	0.00	1.68	3.96	4.15	3.62	0.00	2.72	0.00	0.00	8.36	8.91	4.26
Civil & Architecture Engineering	0.23	1.75	3.50	0.00	1.72	13.44	9.89	0.83	5.02	9.21	7.01	0.00	0.00	0.00	0.00	7.80	24.39	20.39
Computer Engineering	7.61	20.45	84.05	0.00	0.00	0.00	0.00	3.07	6.35	2.68	1.16	0.00	0.00	0.00	0.00	17.03	23.13	85.21
Electrical & Electronics Engineering	55.73	201.45	950.04	0.00	0.00	36.53	92.57	6.09	13.62	20.11	14.79	0.36	30.28	36.10	1.98	106.09	294.20	1,059.38
Infocommunication & Media Technology	10.38	42.66	87.00	0.00	0.00	0.00	0.00	0.04	1.42	5.56	2.82	0.00	20.47	24.55	0.00	32.31	72.77	89.82

Marine Engineering	0.13	7.58	2.00	0.00	0.00	0.26	6.82	0.05	0.55	1.84	1.68	0.25	0.50	1.74	0.00	1.47	11.42	10.50
Material Sciences & Chemical Engineering	5.71	28.26	46.80	0.00	0.00	4.86	1.54	4.58	8.84	9.93	6.75	0.00	31.71	39.92	6.56	50.85	82.97	61.65
Mechanical Engineering	21.84	94.03	148.06	0.00	0.00	9.95	57.61	4.36	9.22	14.40	11.85	0.73	8.23	8.59	0.87	44.38	126.96	218.39
Metallurgy & Metal Engineering	0.68	3.74	9.07	0.00	0.00	0.00	0.00	0.00	0.61	1.84	1.63	0.00	0.00	0.00	0.00	1.29	5.58	10.71
Natural Sciences (excluding Biological Sciences)	43.37	80.19	105.67	0.00	0.00	21.14	41.44	7.94	34.28	31.50	16.96	1.23	45.33	21.74	0.00	132.14	154.57	164.07
Chemical Sciences	6.02	25.97	36.21	0.00	0.00	8.55	0.00	0.80	13.79	3.63	0.30	0.23	36.20	15.09	0.00	57.04	53.24	36.51
Computer & Related Sciences	36.84	53.62	63.72	0.00	0.00	7.10	41.19	1.52	4.95	8.19	4.42	0.66	5.05	6.65	0.00	49.02	75.57	109.33
Earth & Related Environmental Sciences	0.08	0.26	3.33	0.00	0.00	0.04	0.25	0.00	7.97	13.60	9.64	0.00	0.00	0.00	0.00	8.05	13.90	13.22
Physical Sciences & Mathematics	0.42	0.34	2.41	0.00	0.00	5.45	0.00	5.62	7.57	6.08	2.60	0.34	4.08	0.00	0.00	18.03	11.87	5.01
Other Areas	7.87	50.50	186.53	0.00	4.28	0.00	6.33	0.84	24.60	1.24	0.43	0.04	0.07	8.39	32.56	37.70	60.13	225.86
Total	192.19	696.74	1,701.06	2.77	17.96	166.17	255.27	39.03	169.74	136.69	79.25	163.88	179.47	210.38	51.29	765.05	1,209.98	2,086.86

Source: *A*STAR 2005*, p. 15.

the 25th Singapore Youth Science Festival at the Singapore Science Centre:

> But what is clear is that the future will favour nations which are best able to innovate, create new knowledge, and upgrade human skills to exploit the economic opportunities that science and technology makes available for us. There is no dispute that embracing and harnessing science and technology is the way forward for our nation (Singapore Science Centre, 2002).

Besides the founding of A*STAR, R&D conducted by Singaporean universities moves into the centre of attention. The Director of Temasek Laboratories, a research institute of the National University of Singapore (NUS) explains that Singapore's universities were only granted regular budgets for R&D fifteen to twenty years ago. Before, they were mainly producing skilled manpower (Lim H., 17 February 2005, interview with the author). Today's R&D conducted by universities as well as A*STAR institutes is basic as well as applied research, with the latter forming the main focus. The Director of Temasek Laboratories outlines:

> Before 1990s, people tended to believe that technologies can be bought, and it was not necessary for Singapore to undertake R&D. Yet, as Singapore strived to move up the technology ladder, it learned that leading-edge technology with high commercial value cannot be bought, and without strength in R&D, it would have difficulty attracting high-tech investment to Singapore. This led to a change of mindset, and A*STAR was founded to undertake R&D in a range of topics of "economic relevance". This was to develop a local R&D capability and to demonstrate to potential investors our commitment to support high-tech investment (Lim H., 2 June 2006, email to the author).

Nevertheless, basic research forms the smaller share of R&D conducted in Singapore. Its high costs and little direct financial pay-offs are the topic of continuous debate in Singapore while the quest for applicable research, rather than basic research, has yet been resolved.[10] The Dean of the School of Communication and Information, Division of Journalism of the Nanyang Technological University, describes this emphasis on applied research by relating to

Germany in the 1940s when theoretical physics enabled the USA to build the atomic bomb:

> Singapore is still where Germany was in the 1940s, asking: what is the point in knowing how many atoms are in somewhere [sic.]. The Singaporean approach is how can we make economic value of certain knowledge, and ideally, fast. This mentality is very pervasive. (…) There isn't the idea of producing knowledge just for the sake of knowledge. So a lot of research in Singapore is applied research. This might change slowly, but I think Singapore will be very cautious and you probably will need some basic output at least (Ang P.H., 21 February 2005, interview with the author).

The change indicated by this statement is also expressed by the founding of a Ministerial Committee on R&D, chaired by the Deputy Prime Minister and Coordinating Minister for Security and Defence, Dr Tony Tan in October 2004. Its aim is to review the national R&D strategy and to identify new areas of growth. On 11 August 2005, Dr Tony Tan recommends that Singapore be transformed into "a R&D-driven innovative knowledge-based enterprise economy" (*People's Daily Online*, 12 August 2005). Furthermore, the government should increase its R&D funding to at least 3 per cent of the GDP in the next five years with the clear focus "on selected areas of economic importance where Singapore can be internationally competitive". Consequently, the change towards increasing basic research as a sustainable foundation for economic development is focused on R&D fields that potentially ensure Singapore's competitiveness.

Although the high costs of basic research are difficult to legitimize on a short-term basis, the Singaporean government is aware of the need for basic research to create a knowledge depth that contributes to applied research. The motivation to support basic research, as for applied research, is national economic prosperity. Therefore, basic research is only supported in fields such as science, technology and biomedicine that are expected to be of economic importance. Consequently, the attitude change towards increasing basic research does not signify a shift in the overall concept of knowledge. Knowledge in Singapore is still very much weighted according to the financial profit and economic growth generated by it. This can also be observed in the government's turn towards creative industries in 2002. Here, the government formulated the aim to develop the arts, design and media as economic sectors which contribute to GDP. The Director of the Educational Technology Division in the Ministry of Education describes:

> The one who has made the most compelling and convincing argument in terms of supporting the creative industries is Dr. Tan Chin Nam. As Permanent Secretary in the Ministry of Information, Communication and the Arts (MICA), he cleverly positioned the whole thing not as "art for art's sake" but art as the foundation for a new industry, the creative industries (Koh T.S., 30 March 2005, interview with the author).

This rather recent development of supporting the arts and culture expresses the Singapore government's realization that the focus on a few areas of knowledge production and dissemination hampers the long-term sustainable development of an industrialized country. It is based on the awareness that Singapore as a developed economy can no longer rely on ideas coming from overseas, but has to increase its local knowledge production. The government wants to make Singapore innovative and "creative". This poses an immense change in the concept of which knowledge is regarded as valuable. The former stringent focus on natural sciences and engineering is dissolved and instead the arts, humanities, social sciences, theatres, museums, and libraries are discovered as attractive fields of knowledge production and dissemination. Government programs such as Library 2000, Library 2010, and the Creative Industries Development Strategy aim at the fostering of a creative society, with libraries acting as centres of knowledge exchange, fruitful discussion, and critical thinking (Library 2000 Review Committee 1994; NLB 2005; Workgroup on Creative Industries 2002). Yet, it is not the experimental arts that get actively fostered by the government, but "money-making" arts such as movie production, design, and media. Experimental arts are merely respected as potential contributors to commercial arts. The Director of Creative Industries Singapore in the Ministry of Information, Communications and the Arts describes this as follows:

> We will not promote experimental arts, but we also don't draw a distinctive line between commercial and experimental arts. We should improve the commercial, marketing infrastructure of the non-commercial sector to help it become more financially successful. (…) The arts-infrastructure has to allow for the initial spark of creativity to happen. Then some company could market this intellectual property for the artist and exploit it commercially (Baey Y.K., 30 March 2005, interview with the author).

The concept of knowledge in Singapore opens up for a wider range of knowledge creation and dissemination. Nevertheless, this opening up is very much market oriented and market driven. Basic research as well as experimental, non-commercial arts is respected as long as there is potential that the knowledge created enriches applied research or the commercial arts. They are not respected as art for art's sake or knowledge for knowledge's sake. But the statement above shows that the following conclusion of Cordeiro and Al-Hawamdeh of the Nanyang Technological University Singapore (2001) has been heard by the government: "Singapore cannot simply produce managers and engineers as it has been doing for the last 30 years. Today, it needs a convincing nucleus of inherent and intrinsic entrepreneurial talent".

Discussion: A Convergence of Knowledge Concepts?

While Germany's decentralized and traditionally integrative concept of knowledge is today hampered by an increasing focus on marketable knowledge, Singapore's focus on the generation of profitable knowledge is increasingly on the fields of arts, human, and social sciences. What were once two vastly different concepts of knowledge in Germany and Singapore are becoming increasingly similar. The main driver behind these focal changes in both countries is the aim for sustainable economic growth.

The data illustrated above clearly show that neither of the two knowledge concepts — plural, extensive knowledge with width and depth versus centrally defined knowledge based on market needs — are static or regarded as the ultimate contributor to sustainable economic and social development by the two state governments. Rather, the illustrated changes in conceptualizing knowledge argue that both countries are until today searching for a concept of knowledge that contributes to long-term development. German state actors identified the applicability of knowledge as a weakness of German knowledge politics and are tackling it by focusing on 'marketable' knowledge. Singaporean state actors identified a lack of knowledge depth and width in terms of subjects fostering critical thinking and creativity as a weakness of Singaporean politics. This is sought to be counterbalanced by substantial investments into basic R&D as well as knowledge areas such as arts, humanities and social sciences since the early 1990s. Furthermore, English is increasingly becoming the standard scientific language in both countries, slowly replacing German and Chinese. This adaptation of the codes of knowledge communication to a globally used standard facilitates the applicability of locally produced knowledge on an international level.

Nevertheless a complete convergence is prevented by the legal infrastructures and organization (central versus decentral) of the two states. In Singapore, the vast library system and the investments in arts, human sciences, and museums provide grounds for an increasingly versatile concept of knowledge, supported by the attempt to use libraries as centres for building social capital and fostering creative ideas (Hornidge 2006). However, social capital and critical thinking are closely related to social and political criticism. As long as the freedom of opinion and speech are not part of the Singaporean constitution, knowledge production and sharing will be guarded and guided by the state. In Germany, the current commercialization of knowledge is counterbalanced by the heterogeneity of actors who define the type of knowledge that is regarded as valuable. It is secured by the right of free speech and opinion, as well as the decentralized system, where education comes under the jurisdiction of the states rather than the federal government. Due to these contrasting structural realities, the differences between the concept of knowledge in Singapore and Germany remain. This prompts the need for further in-depth research on country-specific concepts of knowledge. Obviously, in different countries differing concepts of knowledge prevail depending on the local political, legal, economic, and historic conditions as well as global economic and political pressures. Furthermore, it seems that a rather plural concept of knowledge, incorporating a great knowledge depth and width, is most promising for sustainable economic and social development in industrialized societies. The two countries discussed above, explicitly address the issue of using knowledge for development and their governments seem to be actively looking for the concept of knowledge that fits the local conditions, answers global pressures and successfully leads to long-term development. Yet, no perfect recipe for a successful knowledge society seems to exist. Questions for further research are: Can the findings be transferred to other countries? In different stages of economic development, which concepts of knowledge contribute best to long-term growth? Is the development strategy of Singapore — a continuous and primary focus on applied research, natural sciences, and engineering after gaining independence, opening up only to other areas of knowledge once its economy is highly developed — applicable in other developing economies? And finally, how much of an interdisciplinary character must a concept of knowledge communicated by the German and Singaporean governments have in order to reach sustainable long-term growth?

NOTES

1. I would like to thank Prof Dr Hubert Knoblauch, TU Berlin, Prof Dr Tong Chee Kiong, National University of Singapore as well as my colleagues at the Center for Development Research, University of Bonn, Prof Dr Solvay Gerke, Prof Dr Hans-Dieter Evers and Verena Christmann for important inputs and constructive criticism while writing this paper.
2. In 1962, for example, Machlup described the country-specific understanding of knowledge in the United States by pointing to the "idiosyncrasy in favour of the immediately practical and against the general theoretical" (1962, p. 202). Lane, in 1966, picked this up and concluded: "The United States has been slow to recognise the importance of scientific knowledge (…). Although, in

some ways, science grows out of technology, it is often the other way around; even in technology the United States in the 19th Century tended to lag behind Europe" (1966: 652).

3. The Commission of the European Union defines "basic research" as follows: "Basic research can be defined in a combining manner: by reference to its ultimate purpose (research carried out with the sole aim of increasing knowledge); its distance from application (research on the basic aspects of phenomena); or the time frame in which it is situated (research in a long-term perspective)" (2004, p. 4). Applied research stands in opposition to basic research and is characterized by its intention to directly contribute to a certain application. It generally is research on a short-term basis. The results are often regarded to contribute directly to the economy.
4. Examples of groups representing directly opposing definitions of knowledge are abortion critics versus advocates, punks versus neo-nazis and advocates of renewable energies versus advocates of nuclear energy.
5. This was also discussed during the UN-World Summit for the Information Society in 2003 (Geneva) and 2005 (Tunis) (WSIS, 2003*a*, 2003*b*).
6. Private R&D funding traditionally exceeds the public. It therefore contributes to the concept of knowledge prevalent in society. Nevertheless, it does not influence the concept of knowledge given by the state and expressed in the public R&D funding (A*STAR 2005, p. 26).
7. The yearly increase is illustrated in A*STAR 2005, p. 26.
8. Referring to the concept of R&D published by OECD (OECD, 2002), the National Survey of R&D in Singapore 2004 assesses the government spending for basic research, applied research and experimental development. Regarding the R&D-subjects covered, it states: "The scope of the concept of R&D for this survey extends to R&D in science and technology only and excludes the social sciences and humanities" (A*STAR 2005, p. 30).
9. The Director of Temasek Laboratories in Singapore describes the process leading up to A*STAR's founding: "The government realised, that all industrialised countries were investing more than 2% of GDP into R&D, while Singapore invested 0.85%. So it was decided to aim for 2% of GDP and the National Science and Technology Board (NSTB), which later was renamed into A*STAR, was formed" (Lim H., 17 February 2005, interview with the author).
10. The Director of the School of Information Systems at the Singapore Management University describes: "'Technopreneurship' became a commonly used term, describing the need for research but also the need for this research to be applicable and marketable" (A.D. Narasimhalu, 29 March 2005, interview with the author).

REFERENCES

Agency for Science Technology and Research (A*STAR). *National Survey of R&D in Singapore 2004*. Singapore: A*STAR, 2005.

Ang, P.H. *Singapore's Disk Drive Initiative*. The 42nd Annual Conference of the International Communication Association, Miami, Florida, 1992.

Anwar, S. and M. Zheng. "Government spending on research and development and industrial production in Singapore". *International Journal of Asian Management* 3 (2004): 53–65.

Berger, P. and T. Luckmann. *Die gesellschaftliche Konstruktion der Wirklichkeit — Eine Theorie der Wissenssoziologie*. Frankfurt a.M: Fischer Taschenbuch Verlag, 1984.

Bundesministerium für Familie, S., Frauen und Jugend (BMFSFJ) and TNS Infratest. *2. Freiwilligensurvey 2004 — Ehrenamt, Freiwilligenarbeit, Bürgerschaftliches Engagement*. Berlin: BMFSFJ, 2004.

Chan Heng Chee and Evers, H.D. "National Identity and Nation Building in Singapore". In S*tudies in ASEAN Sociology: Urban Society and Social Change*, edited by P.S.J. Chen and H.D. Evers. Singapore: Chopmen Enterprises, 1978.

Commission of the European Communities (EC). "Europe and Basic Research". *Communication from the Commission* COM (2004) 9. Brussels, EC: 14 January 2004.

Cordeiro, C.M. and S. Al-Hawamdeh. "National Information Infrastructure and the Realization of Singapore IT2000 Initiative." *Information Research* 6, no. 2 (2001).

Department of Statistics. "Annual Economic Indicators". Retrieved on 19 July 2005 <http://www.singstat.gov.sg/keystats/annual/indicators.html#Economic%20 Indicators>.

Evers, H.-D. "Traditional Trading Networks of Southeast Asia". In *Asian Trade Routes, Continental and Maritime* edited by K.R. Haellquist, pp. 142–52. London: Curzon Press: 1991.

Evers, H.-D. and S. Gerke. "Local and Global Knowledge: Social Science Research on Southeast Asia". Southeast Asian StudiesWorking Paper No. 18. Bonn: Department of Southeast Asian Studies, University of Bonn, 2003.

Evers, H.-D., S. Gerke, et al. *Malaysia, Singapur, Indonesien: Wege zur Wissensgesellschaft*. Bonn: University of Bonn, 2004.

———. "Wissen als Produktionsfaktor: Südostasiens Aufbruch zur Wissensgesellschaft." *Soziale Welt* 56, no. 1 (2005).

Evers, H.-D. and A.-K. Hornidge. "Knowledge Hubs along the Straits of Malacca". *Asia-Europe Journal* 5, no. 3 (2007): 417–33.

Gomez, J. *Self-Censorship: Singapore's Shame*. Singapore: Think Centre, 2000.

Government of the Republic of Singapore. "The Budget For the Financial Year 1st April 2004 to 31st March 2005" <http://www.mof.gov.sg/budget_2004/budget_speech/downloads/FY2004_Fiscal_Overview.pdf>. Singapore: Ministry of Finance, 2005.

Heinrich, O. *Die rechtliche Systematik der Forschungsförderung in Deutschland und den Europäischen Gemeinschaften unter Beachtung von Wissenschaftsfreiheit und Wettbewerbsrecht*. Münster: Lit Verlag, 2003.

Hornidge, A.-K. Singapore: The Knowledge-Hub in the Straits of Malacca. Bonn: Zentrum für Entwicklungsforschung, 2006.

_______. *Knowledge Society. Vision & Social Construction of Reality in Germany and Singapore*. Münster: LIT Verlag, 2007.

Ibrahim, Z. "Next Step for Civil Society: Daring to Walk the Talk". *Straits Times*, 21 June 2004.

Lane, R.E. "The Decline of Politics and ideology in a Knowledgeable Society". *American Sociological Review* 5, no. 31 (1966): 649–62.

Library 2000 Review Committee. *Library 2000: Investing in a Learning Nation*. Singapore: Ministry of Information and the Arts, 1994.

Luhmann, N. *Soziale Systeme — Grundriß einer allgemeinen Theorie*. Frankfurt a.M.: Suhrkamp, 1984.

Lyons, L. and J. Gomez. "Moving Beyond the OB Markers: Rethinking the Space of Civil Society in Singapore". *SOJOURN: Journal of Social Issues in Southeast Asia* 20, no. 2 (2005): 119–31.

Machlup, F. *The Production and Distribution of Knowledge in the United States*. Princeton, New Jersey: Princeton University Press, 1962.

Masterton, M., ed. *Asian Values in Journalism*. Singapore: Asian Media, Information, and Communication Centre, 1996.

Menkhoff, T. and H.-D. Evers. *Strategic Groups in a Knowledge Society: Knowledge Elites as Drivers of Biotechnology Development in Singapore*. International Conference on Strategic Groups, Essen, 2005.

National Library Board (NLB). *L2010 — Our Vision for the Future (Overview)*. Singapore: National Library Board, 2005.

Nida-Rümelin, J. "Das hat Humboldt nie gewollt". *Die Zeit*, 2005.

Ooi, G.L. *Singapore — Country Report*. Singapore: Asian Media Information and Communication Centre, 2000.

Organisation for Economic Co-operation and Development (OECD). *Frascati Manual — Proposed Standard Practice for Surveys for Research and Experimental Development*. Paris: OECD, 2002.

People's Daily Online. "Singapore Deputy PM Recommends Measures for R&D Strategy" 12 August 2005.

Schäfers, B. *Sozialstruktur und Wandel der Bundesrepublik Deutschland*. Stuttgart: Deutscher Taschenbuch Verlag, 1981.

Singapore Science Centre. Speech by President S.R. Nathan, at the Opening of the 25th Singapore Youth Science Festival, Singapore Science Centre, 23 May 2002).

Statistisches Bundesamt Deutschland. *Ausgaben und Einnahmen der öffentlichen und öffentlich geförderten Einrichtungen für Wissenschaft, Forschung und Entwicklung*. Wiesbaden: Statistisches Bundesamt, 2004 (Berichtszeitraum 2002).

———. Bruttowertschöpfung nach Wirtschaftszweigen, Statistisches Bundesamt Deutschland, 2006.

———. Education, Science and Culture, 12 April 2007.

Vogel, C. *Deutschland im internationalen Technologiewettlauf — Bedeutung der Forschungs- und Technologiepolitik für die technologische Wettbewerbsfähigkeit*. Berlin: Duncker und Humblot GmbH, 2000.

Weltgipfel über die Informationsgesellschaft (WSIS). *Aktionsplan*. United Nations/ International Telecommunications Union, 2003*a*.

———. *Grundsatzerklärung*. United Nations/International Telecommunications Union, 2003*b*.

Workgroup on Creative Industries. *Creative Industries Development Strategy*, Singapore: ERC-Subcommittee Service Industries/Ministry of Trade and Industry, 2002.

Yap, M.T. "Identitätskonstruktionen in Singapur". In *Singapur — Metropole im Wandel* edited by M. Kieserling, pp. 105–29. Frankfurt am Main: Suhrkamp, 2000.

Anna-Katharina Hornidge is Senior Researcher at the Center for Development Research, Zentrum für Entwicklungsforschung (ZEF), University of Bonn, Germany.