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THEMA:

Bibliometrics:

Nr. 18
Apr. 2003

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Preface

Evaluating the quality of research is evidently a very difficult issue in which no standard approach exists. Beside peer review, bibliometrics is a widespread methodolgy used in research evaluation. However, it has its own strengths and weaknesses in capturing the benefits and trends of scientific research.

Tibor Braun, Editor-in-Chief of Scientometrics and a well known expert in this field, opens this Newsletter 18 with a sound overview on quantitative science policy and management by using scientometrics and scientometric indicators. He points out, that scientometrics can offer some measure of guidance for research and technology policies and management and tries to give some examples in this respect. Braun also presents some selected scientometric indicators and their use in revealing the Austrian science position in international comparison.

Grant Lewison, professor at the City University, London, gives an example in using bibliometrics as a measure of guidance in Austrian research policy. „Austrian Biomedical Research: A Bibliometric Evaluation" reveals useful information about the outputs of Austrian researchers in this field. According to Lewison, his study has shown that Austrian biomedical research is increasing steadily in output, especially from the universities, and becoming more international. It has also revealed the subjects of Austrian strength – still mainly the clinical ones – and of weakness.

Birgit Baumann (TIG) presents projects on the management of complex RTDI-Programmes, so-called MAPs, dealing with development and implementation of MAPs but also having a special focus on project-monitoring and evaluation of MAPs best management practices for complex RTDI-Programmes: MAP-TN, StarMAP, DiscoMAP.

The Centre for European Economic Research (ZEW), Joanneum Research, the bm:bwk and the Platform Research & Technology Policy Evaluation are jointly organizing an international conference on the evaluation of government funded R&D activities.
This conference will take place in Vienna, Austria, 15–16 May 2003.
We cordially invite researchers and policy makers worldwide with an interest in the general field of evaluation of R&D policies to participate in this conference in the capital of Austria. In line with the focus of our conference, these two days will consist of a balanced
combination of contributions by scientists as well as policy makers.
The organizing committee looks forward hosting a unique and high quality conference attracting evaluation experts as well as users for two days of discussing the state of the art in evaluation sciences and lessons learned for the field of R&D policies in Vienna.

You will find more details in this Newsletter and in the internet www.fteval.at/conference .

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This Newsletter was produced in co-operation with the Federal Ministry for Education, Science and Culture (bm:bwk)

Tibor Braun

Quantitative Science Policy and Management by using Scientometrics and Scientometric Indicators

Szilard: „I am going to write down all that is going on these days in the project. I am just going to write down the facts – not for anyone to read, just for God."

Bethe: Don't you think God knows the facts?

Szilard: „Maybe he does, but not this version of the facts."

(Weart, S.R., Weiss-Szilard G. (eds), Leo Szilard: His Version of the Facts. Selected Recollections and Correspondence, MIT Press, Cambridge, MA, 1978

Introduction

There are many proofs indicating that economic growth in the modern era has been grounded on the exploitation of scientific knowledge. The sphere of human activities, which can be identified as „The Republic of Science" has grown too important for the rest of society to leave alone. Most of the industrial nations and many among the LDC's acknowledge this today, and virtually all societies in which modern science is practiced pay at least lip service to the belief that it is important to pursue some form of science and technology policy. Many papers are dealing indeeply with qualitative features of the abovementioned issue. Although most of the readily observed features are familiar to managers and decision makers, it is symptomatic of the relatively underdeveloped status of science and technology policy that many of its implications remain unexplored and untested against systematic models based on quantitative data. Furthermore, as is generally the case when new theoretical perspectives are gained, new questions and puzzles arise. The agenda for future research in this field, therefore, remains both extensive and varied. Nevertheless, even in their present nascent state, quantitative science studies, including scientometrics, can offer some measure of guidance for science and technology policies and management. In the present paper I will try to present some examples in this respect.
For starting, I will use a very simple, even primitive, input-output model of the working mechanism of science R and D (Fig. 1).

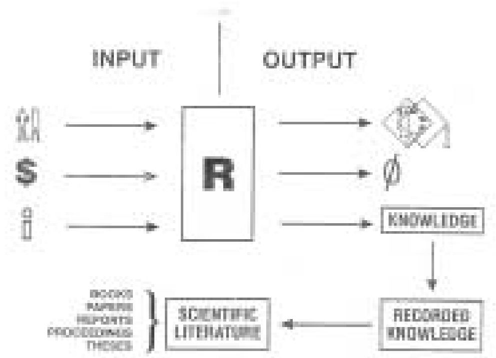

Figure 1. Flow chart of the model of working mechanism of basic research (simplified version)

As visible, the mechanism works in time from left to right with some input „ingredients" to be fed into the science R and D „black box" for having some outputs. Here I will deal only with the R in the black box and will concentrate on „knowledge" as an output component. It is well known that knowledge has a real value only as so called „recorded knowledge", because when not recorded, knowledge disappears together with its holder when the holder dies. It is also clearly visible in Fig. 1 that the components of recorded knowledge taken all together represent in fact the formal literature of science.
The literature of science is the body of knowledge on a subject, the prime means of communication in any subject, the only genuine representation and record of the knowledge, activities and scientific achievement in the subject.
It is an open question on whether, as seen in Fig. 1, the recorded knowledge and its components, i.e., „the literature of science" can be considered as a perfect mirror of the activities of R in the science R and D black box?
Our postulate is that although not being a Belgian mirror, the literature of science can be considered a fair output reflection of worldwide R activities and its careful statistical processing by scientometric methods can provide meaningful approaches to science policy and decision making.1–3

Scientometrics[4]

Figure 2. Scientometrics as a research field and evaluative scientometrics

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Roughly divided we can distinguish two different major approaches of the scientometric field. One which is theoretical and the other pragmatic, as shown in Fig. 2. The first approach is self-explaining, the second one is shortly discussed in what follows.

Evaluative scientometrics [4,5]

The systematic use of Scientometric Indicators, the basic pillars of evaluative scientometrics, was first implemented in the US in the seventies. (Fig. 3 and 4)

Figure 3. The beginnings of the Science Indicators movement in the US


TOWARD A METRIC
OF SCIENCE:

The Advent of
Science Indicators

Figure 4. Cover page of the bi-annually published Science and Engineering Indicators volume of the US National Science Board

In its Preface, the Science and Engineering Indicators volume of the National Science Board of the United States which are published bi-annually contains a „Letter of Transmittal" written by the President of the Board, which mentions: „I and my colleagues on the National Science Board trust that this report will be of value to your Administration, to the Congress, and to those concerned with science and technology policy". The addressee of the letter is the President of the United States (Fig. 5).

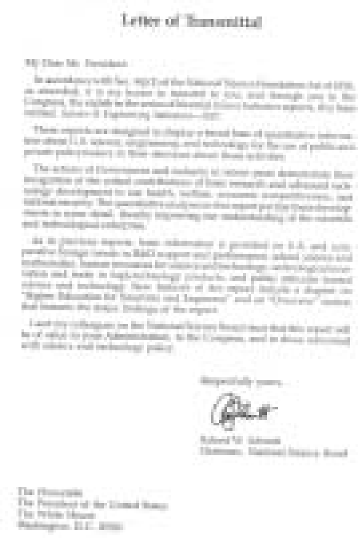
Letter of Transmittal

Figure 5. The reprint of the Letter of Transmittal of the Science and Engineering Indicators volume

This is a quite convincing proof of the importance of scientometric indicators.
Figure 6 presents a schematic view on the various indicators which can be built on the quantification of the scientific literature. The use of some of them will be outlined in what follows in this paper.

Indicators built on the Quantification of the Scientific Literature

Absolute Figures
– Number/percentage of publication
– Number/percentage of citations
– Number/percentage of authors
– Number/percentage of journals

Specific Figures
– Papers/population
– Citation/population
– Papers/authors
– Citation/authors

Relative Indicators
– Publications (national, regional, world average)
– Citations (national, regional, word average)

Correlations
– Science vs. Economy
– Science vs. Manpower

Dimensions
One Dimensional
– Linear rankings
– Specific rankings
– Scales

Mulitdimensional
– Two dimensions: mapping, relational charting
– Three dimensions: mapping, relational charting
– Several dimensions: Chernoff faces

Figure 6. Some indicators which can be built on the quantification of the scientific literature.

Another very important topic is the object of evaluation and the number of the population of processed scientometric data. Figure 7 presents a scheme in this respect. As scientometric indicators are based on the statistical analysis of the different populations of journal papers and/or citations, it is a self-explaining fact that the confidence level of

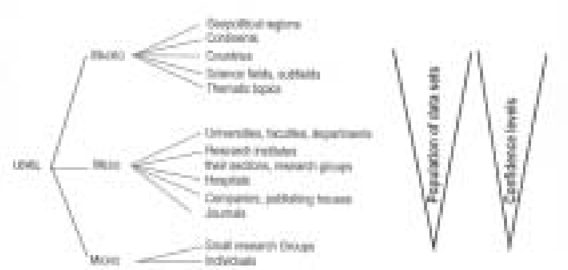

Figure 7. Levels of quantification and objects which can be evaluated b … erature

Figure 8. Confidence levels of indicators derived from the processing of literature data sets

As the examples which will follow in this paper are dealing with large data sets (nations) and with basic sciences, according to Fig. 8, the results will have to be considered of high confidence.
In his 1997 book entitled Pasteur's Quadrant, Donald E. Stokes provides a new paradigm — a revolt against the linear model — of the relationship between basic and applied research, as shown here in Figure 9.
Stokes contends that a large part of the important research being done today lies in the Pasteur quadrant; that is, it is driven by, and justified by, both a desire for basic knowledge per se and the intention of serving a predetermined, practical end use. The diagram in Fig. 9 nicely shows that the Pasteur quadrant is contiguous with both the Bohr quadrant (essentially pure basic research) and the Edison quadrant (essentially applied or engineering research).

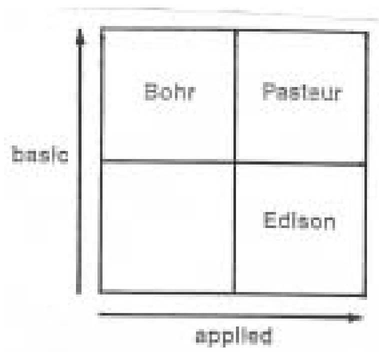

Figure 9. The Pasteur quadrant

The general topic of this paper spins mainly around the Bohr quadrant, with some overlapping with the Pasteur quadrant. When used in a correct and believable way, scientometric indicators have to be implemented hand in hand with „classical" peer review, basic research is already making use for centuries. The objective of evaluation are, of course, objectivity and relevance. Their characteristics in evaluation are revealed in Fig. 10 which is self-explaining.

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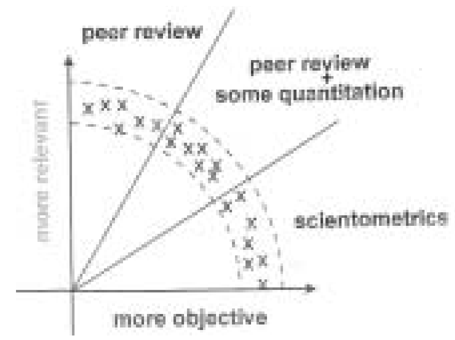

Figure 10. Objectivity and relevance of evaluation. x : procedures

The methodologies dealt with in this paper are based on ISSRU's Scientometric Indicator Datafiles5 which represent a carefully cleaned and reprocessed version derived from the Institute of Scientific Information (ISI, Philadelphia) Science Citation Index (SCI) database, which by its basic function, is a literature retrieval tool.

Quantitative science policy

Our aim is to deal with the whole sequence of the scientometric evaluation process. A simple model of the sequences as visible in Fig. 11, reveals an analogy between decision making in medical diagnosis and science policy.

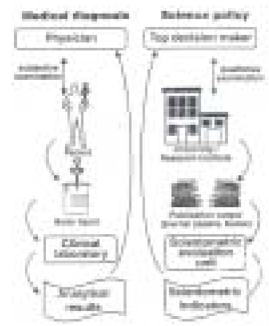

Figure 11. A model on the analogy of medical diagnosis and scientometrics-based science policy

In the model, science is compared to a patient in medical examination. The patient, as seen in the figure, is first exposed to a subjective examination by the physician. Paralelly, a body liquid is extracted and sent to the clinical laboratory. The output here are analytical results which go back to the physician. The diagnosis and therapy are a result of a combination of conclusions from the subjective exam and the results of analytical tests.
In science policy, the decision maker first examines qualitatively the object concerned (a country, an institution, etc.). This is usually done by peer review, expert assessment, etc. Parallely, the publication output of the same object is examined by a scientometric evaluation unit. Scientometric indicators are then sent back to the top decision maker for a combination of qualitative (e. g., peer review), and quantitative (scientometric) data (as illustrated in Fig. 10).

Some selected scientometric indicators and their use in revealing the worldwide position of Austrian science

Liniar rankings: Austria's position in the ranking of journal papers productivity of the top 50 countries during the 1990–1998 period is shown in Table 1.

Rank	Country	Total number of science papers, 1990–1998
1	USA	1,763.421
2	UK	468.660
3	Japan	454.302
4	Germany	394.409
5	France	307.733
6	Canada	234.620
7	Italy	188.313
8	Russia	159.652
9	Australia	125.666
10	Netherlands	124.478
11	Spain	117.001
12	Sweden	98.928
13	India	95.885
14	Switzerland	87.901
15	Peoples R C	80.486
16	Israel	59.930
17	Belgium	59268
18	Poland	50.572
19	Denmark	49.907
20	Taiwan	42.790
21	Finland	41.896
22	Brazil	39.064
23	Austria	38.988
24	South Korea	36.014
25	Norway	29.874
26	New Zealand	25.779
27	South Africa	25.004
28	Ukraine	24.201
29	Hungary	23.022
30	Greece	22.580
31	Argentina	21.053

Table 1. Total number of science papers, 1990–1998

Rank	Country	Total number of science papers, 1990–1998
1	USA	9,744.445
2	UK	2,043.618
3	Germany	1,719.469
4	Japan	1,552.932
5	France	1,246.160
6	Canada	979.339
7	Italy	806.473
8	Netherlands	601.706
9	Switzerland	543.033
10	Australia	447.773
11	Sweden	447.043
12	Spain	369.353
13	Belgium	260.795
14	Israel	228.426
15	Denmark	228.311
16	Russia	227.269
17	Finland	181.958
18	Austria	154.051
19	India	140.870
20	Peoples R C	132.140
21	Poland	116.297
22	Norway	106.047
23	Brazil	89.018
24	Taiwan	88.007
25	South Korea	79.780
26	New Zealand	78.071
27	Hungary	65.157
28	Greece	55.649
29	South Africa	52.812
30	Argentina	47.324

Table 2. Total number of citations, 1990–1998

The same type of ranking is presented for citations in Table 2. As visible, the ranking is in general size dependent with the big, developed countries on the top of the list. A somewhat different situation is visible in Tables 3 and 4, where the number of journal papers and citations are appearing specified with the population of the countries in question. This seems to fortify the old saying according to which „small is beautiful".

Rank	Country	Total number of science papers, 1990–1998
1	Switzerland	12265,555
2	Israel	11296,634
3	Sweden	11209,442
4	Denmark	9537,699
5	Finland	8205,631
6	Netherlands	8052,135
7	UK	7995,704
8	Canada	7921,266
9	New Zealand	7229,129
10	Australia	6936,676
11	Norway	6853,248
12	USA	6703,910
13	Belgium	5843,904
14	France	5292,085
15	Austria	4848,087
16	Germany	4830,578
17	Japan	3626,081
18	Ireland	3587,175
19	Italy	3288,540
20	Singapore	2966,744
21	Spain	2943,334
22	Hong Kong	2411,588
23	Slovenia	2352,012
24	Hungary	2236,041
25	Greece	2152,656
26	Taiwan	2010,595
27	Czech Republic	1890,444
28	Slovakia	1789,206
29	Bulgaria	1494,378
30	Poland	1310,040

Table 3. Number of papers per million of population

As our main aim in this paper is to give a general picture on the topic of the paper's title I am using Austria's performance only as an illustration, and I am leaving the reader to decide whether Austria's situation satisfies his/her expectations.

Rank	Country	Total number of science papers, 1990–1998
1	Switzerland	75773,893
2	Sweden	50654,037
3	Denmark	43632,386
4	Israel	43057,650
5	Netherlands	38922,864
6	USA	37044,974,
7	Finland	35637,776
8	UK	34865,712
9	Canada	33064,551
10	Belgium	25727,501
11	Australia	24716,757
12	Norway	24327,723
13	New Zealand	21893,219
14	France	21430,215
15	Germany	21059,433
16	Austria	19155,962
17	Ireland	12422,193
18	Japan	12394,963
19	Italy	12337,251
20	Spain	9291,622
21	Singapore	7317,316
22	Hungary	6328,457
23	Slovenia	6024,838
24	Hong Kong	5948,869
25	Greece	5305,277
26	Czech Republic	4497,104
27	Taiwan	4135,230
28	Slovakia	3489,074
29	Portugal	3209,999
30	Poland	3012,611

Table 4. Number of citations per million of population

Relative scientometric indicators[6]

A classical indicator for measuring the impact of a set of publications is their mean citation rate, i.e., the citations/publications ratio. If, particularly, the set represents the two years publication output of a science journal and citations in the subsequent year are counted, the mean citation rate is called the impact factor of the journal in question. This indicator is widely used as a measure of journal significance. Mean citation rates depend heavily on subject fields. This is due to field differences in citations practices. Citations rates are also strongly influenced by the journals quality and aims, such as size and character of the target group (e.g., the use of national languages). Anyway, the mean citation rate is a useful scientomeric indicator, but does not permit direct comparison between different fields. Let consider a set of papers published in one and the same journal in a given time period. The impact factor of the journal, i.e., the expected citation rate of an average paper, seems to be a proper standard for the mean citation rate of the papers in question. More generally, for any set of publications in different journals, the mean impact factor (the weighted average of impact factors, the weights being the number of the given journal's paper in the set) can be used as reference standard for the mean observed citation rate. The indicator we have suggested in the 60ties and is now used worldwide is defined as mean citation rate/mean impact factor, we call relative citation rate. This indicator can be used in cross-field comparisons, since journals can be regarded as scientometrically homogeneous units: most journals represent a specialized subject field, a certain quality level and are addressed to a particular target group. The relative citation rate relates observed to expected citation rate. If the relative citation rate is approximately 1.0, the citation rate of the publications in question coincides with the expected one, if they received more or less citations than expected, the relative citation rate is greater or less than 1.0, respectively. Relative citation rate actually measures the citation impact of a given set of publications (e.g., the publication output of countries or research institutions) as related to the respective world average.

For being more explicit, it is worth mentioning that the Mean Expected Citation Rate (MECR) is the average expected citation rate per publication, i.e., (expected number of citations)/(number of publications), where the expected number of citations is calculated on the basis of the average citation rates of the publishing journal, i.e., each paper is expected to receive the citation rate of an average paper of the same age in the same journal.

The Mean Observed Citation Rate (MOCR) represents the average citation rate per publication, i.e., (number of citations)/(number of publications). Accordingly, the Relative Citation Rate (RCR) is the MECR/MOCR value.

Liniar rankings of MECR, MOCR, and RCR indicators for the abovementioned 50 countries for the 1990–1998 period are presented in Table 5.

RANK	Country	MOCR	Country	MECR	Country	RCR
1	Switzerland	6,18	USA	5,09	Switzerland	1,24
2	USA	5,53	Switzerland	4,99	Finland	1,18
3	Netherlands	4,83	Netherlands	4,18	Denmark	1,18
4	Denmark	4,57	Israel	4,10	Netherlands	1,16
5	Sweden	4,52	Canada	3,98	Sweden	1,15
6	Belgium	4,40	Sweden	3,94	Belgium	1,14
7	UK	4,36	UK	3,94	Germany	1,12
8	Germany	4,36	Germany	3,88	UK	1,11
9	Finland	4,34	Denmark	3,87	USA	1,08
10	Canada	4,17	Belgium	3,87	Austria	1,07
11	France	4,05	France	3,87	Ireland	1,07
12	Austria	3,95	Italy	3,77	Norway	1,06
13	Israel	3,81	Austria	3,68	Canada	1,05
14	Italy	3,75	Finland	3,68	France	1,05
15	Australia	3,56	Spain	3,49	New Zealand	1,04
16	Norway	3,55	Japan	3,48	Australia	1,02
17	Ireland	3,46	Australia	3,48	Italy	0,99
18	Japan	3,42	Norway	3,36	Japan	0,98
19	Spain	3,16	Ireland	3,23	Singapore	0,95
20	New Zealand	3,03	Hungary	3,22	Slovakia	0,94
21	Hungary	2,83	Portugal	3,16	Czech Republic	0,93
22	Portugal	2,79	Mexico	3,04	Israel	0,93
23	Thailand	2,06	Brazil	2,99	Russia	0,92
24	Slovenia	2,56	Argentina	2,99	Thailand	0,92
25	Chile	2,52	Slevenia	3,95	Spain	0,90
26	Hong Kong	2,48	New Zealand	2,93	Hong Kong	0,90
27	Singapore	2,47	Chile	2,88	Poland	0,89
28	Greece	2,46	Venezuela	2,88	Portugal	0,88
29	Czech Republic	2,38	Greece	2,88	Hungary	0,88
30	Mexico	2,33	Thailand	2,83	Chile	0,87

Table 5. Country rankings by MOCR, MECR and RCR in all fields of sciences, 1990–1998

Relational charts and zoning

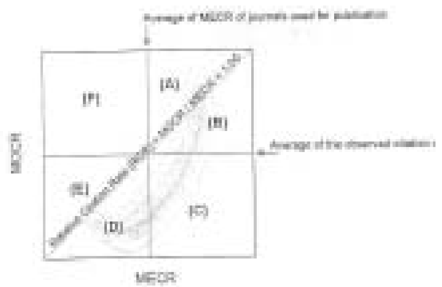

Figure 12. Prototype of a Relational Chart and its zones

Figure 12 is a prototype of „relational charts" (RC) as defined e.g., in References 6 and 7. The Mean Expected Citation Rate (MECR) indicator on the horizontal axis characterizes the average citation impact of the journals, in which the researchers of a given country publish their papers. The higher this value, the higher the impact of the journals they used for publication. (Citation impact of journals is calculated in this study as mentioned above: citation received in the year of publication plus in the subsequent two years were considered.) Mean Observed Citation Rate (MOCR) on the vertical axis characterizes the actual citation rate per publication (counted according to the same standards as the expected citation rates) for papers of researchers from the countries under study. The diagonal MOCR — MECR has particular significance: it divides objects (countries, in our case) with citation rates above expectation from those below expectation. The indicator Relative Citation Rate, RCR = MOCR/MECR numerically characterizes the measure of deviance from expectation. The RCR has a value of 1.00, if the mean citation rate of the paper published by researchers of a given country exactly equals to its expected value. If it is lower or higher than expected, the RCR indicator is lower or higher than 1.00, respectively. Two other auxiliary lines on Fig. 1 are the world average MECR and MOCR values. These values are, by definition, identical. The points follow a typical „banana shape" pattern which is discussed in Reference 7.
Three lines divide the RC into six „zones" marked in Fig. 12 by the letters A to F.

Zone A: Scientists of countries in this zone publish in scientific journals having higher citation impact than the world average and receive higher citation rate than expected.

Zone B: Scientists of countries in this zone publish in scientific journals having higher citation impact than the world average and receive higher citation rate than the world average but lower than expected.

Zone C: Scientists of countries in this zone publish in scientific journals having higher citation impact than the world average, but receive lower citation rate than the world average and than expected.

Zone D: Scientists of countries in this zone publish in scientific journals having lower citation impact than the world average and receive lower citation rate than expected.

Zone E: Scientists of countries in this zone publish in scientific journals having lower citation impact than the world average and receive lower citation rate than the world average, but higher than expected.

Zone F: Scientists of countries in this zone publish in scientific journals having lower citation impact than the world average, but receive higher citation rate than the world average and than expected.

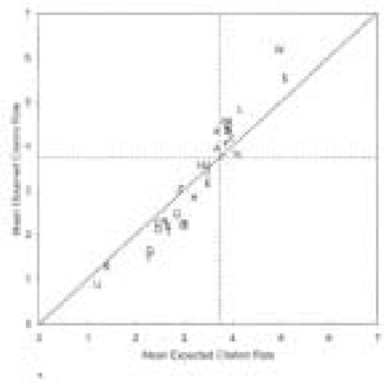

Figure 13. Relational Chart for 32 countries in all fields of science (combined). See legend in Table 6

Figure 13 shows the position of 32 countries on a RC based on total science data.
Table 6 gives the relative position (rank) of the 32 countries by their Relative Citation Rate (RCR) indicator in all science fields combined and in the 12 main science fields separately, as well as their zone code (A to F) in the corresponding RC.

Conclusions

1. The journal literature can be used for comparison of the publication activity of countries in quantitative form, in any scientific field and subfield, if the used sources and methods are characteristic for all the countries investigated and the number of processed items (journal articles, citations) is statistically significant.
2. We must, however, accentuate that all results and conclusions of this work are related only to the 1990–1998 period.
3. An interesting phenomenon we have already an explanation for, is we call the „banana shape" pattern of the points which appears on all our relational charts. This means that Zones E and F are totally unpopulated, Zones B and C are scarcely populated, Zone A is reasonably populated and the mass is concentrated in Zone D.
4. Preliminary conclusions would attest that at a statistical significant level of publications and citations, the publication in high impact journals will attract many citations. This causes a certain „magnetic effect" which results in a higher citation rate for author who have published in highly cited journals even in cases they publish in low impact ones. On the other hand it seems that the striving to publish in high or higher impact journals although in some cases not rewarded by high citation rates, has at least a promise for a positive change in the zoning on the relational charts (RCs).
5. Table 6 shows many surprising facts regarding the competitive aspects of world science at the end of the second millenium. The excellent relative position of some small West-European countries, including Austria, is not surprising in the light of our earlier similar results.8–11

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Country	Code	Rank/Zone												
		TOT	AGRI	BIOL	BIOS	BIOM	CL11	CL12	NEUR	CHEM	PHYS	GEOS	ENGN	MATH
Switzerland	W	1 A	3 A	1 A	2 A	1 A	4 A	3 F	2 A	1 A	1 A	1 A	1 A	3 A
Finland	#	2 F	8 A	9 F	6 F	8 F	2 A	4 F	10 E	9 E	2 A	16 C	8 A	9 A
Denmark	M	3 A	2 A	5 F	5 E	3 F	1 F	1 F	6 F	2 A	3 A	5 A	2 A	1 A
Netherlands	L	4 A	1 A	2 A	4 F	11 A	6 A	7 A	13 D	3 A	4 A	2 A	7 A	7 A
Sweden	S	5 A	6 A	4 A	8 E	5 F	3 A	2 F	3 F	4 A	9 A	10 A	4 A	10 A
Belgium	B	6 A	9 A	3 A	3 E	2 F	5 A	5 A	11 E	10 A	11 A	12 D	6 A	4 A
Germany	D	7 A	7 F	8 A	7 A	9 F	8 F	8 E	7 A	8 A	6 A	3 A	5 A	12 A
UK	&	8 A	5 F	7 A	1 A	4 A	11 F	9 F	4 A	7 A	8 A	4 A	10 A	2 A
USA	$	9 A	15 A	12 A	9 A	10 A	12 A	11 A	8 A	5 A	7 A	9 A	9 A	8 A
Austria	A	10 F	14 F	11 E	10 A	6 A	17 E	10 F	1 F	6 F	5 A	18 D	3 A	5 A
Norway	N	11 E	4 A	6 E	17 D	15 D	9 F	6 F	5 F	17 D	19 B	7 E	12 A	6 A
Canada	X	12 A	12 A	14 E	11 F	13 B	10 A	12 A	12 E	11 A	16 A	11 F	17 E	16 B
France	F	13 A	11 A	13 A	14 D	12 F	13 E	13 F	14 B	13 B	10 A	$ A	11 A	11 A
New Zealand	Z	14 E	10 F	15 E	15 D	7 D	7 E	15 D	9 E	18 B	12 A	15 D	22 D	22 C
Australia	V	15 E	13 F	10 E	12 E	16 C	15 E	14 F	15 D	12 A	24 C	6 A	15 A	19 B
Italy	I	16 B	17 B	19 D	18 D	14 D	16 F	16 D	18 D	15 B	13 A	13 B	16 A	17 B
Japan	J	17 D	16 D	18 D	13 D	17 D	24 D	23 D	17 D	14 D	18 F	23 C	18 B	21 D
Israel	%	18 B	20 D	22 C	16 B	19 C	27 D	27 D	19 D	20 B	15 A	17 B	14 A	14 A
Czech Republic	C	19 D	23 D	16 D	19 D	23 D	14 E	17 D	26 D	16 D	20 D	26 D	19 B	20 D
Russia	R	20 D	22 D	20 D	23 D	21 D	28 D	24 D	28 D	21 D	21 D	22 D	24 D	18 D
Spain	E	21 D	18 B	24 D	22 D	22 D	25 D	28 D	23 D	19 B	14 A	19 B	13 A	13 E
Poland	P	22 D	24 D	26 D	24 D	27 D	21 D	19 D	25 D	26 D	22 D	20 C	21 B	26 D
Hungary	H	23 D	25 D	17 D	20 D	24 D	31 D	29 D	16 D	25 D	17 A	24 D	20 B	28 D
Greece	G	24 D	31 D	27 D	28 D	28 D	23 D	25 D	31 D	22 D	23 B	28 D	23 D	25 D
South Africa	O	25 D	19 D	21 D	21 D	25 D	22 D	18 D	21 D	23 D	27 D	14 B	25 C	23 D
South Korea	K	26 D	27 C	23 D	25 D	18 D	20 D	20 D	20 D	24 D	25 D	31 D	29 C	29 D
Taiwan	T	27 D	21 C	25 D	29 D	29 D	29 D	31 D	29 D	27 D	29 D	27 D	27 D	30 D
Brazil	+	28 D	26 C	28 D	27 D	30 D	30 D	26 D	24 D	28 D	28 C	25 C	26 C	24 C
Argentina	@	29 D	29 D	30 D	31 D	31 D	26 D	30 D	27 D	32 D	26 C	29 D	28 C	31 C
Ukraine	U	30 D	26 D	31 D	26 D	26 D	19 D	21 D	30 D	29 D	31 D	21 D	32 D	15 D
P.R. China	Q	31 D	30 C	29 D	30 D	20 D	18 E	22 D	22 D	30 D	32 D	30 D	30 D	27 D
India	Y	32 D	32 D	32 D	32 D	32 D	32 D	32 D	32 D	31 D	30 D	32 D	31 D	32 D

Table 6. The ranking of the 32 most prolific countries by their RCR values and their position in the Relational Chart Zones in all science and the 12 main fields of science, 1990–1998. TOT: All Science Fields Combined; AGRI: Agriculture & Environment; BIOL: Biology (Organismic & Supraorganismic Level); BIOS: Biosciences (General, Cellular & Subcellular Biology; Genetics); BIOM: Biomedical Research; CLI1: Clinical and Experimental Medicine I (General & Internal Medicine); CLI2: Clinical and Experimental Medicine II (Non-Internal Medicine Specialties); NEUR: Neuroscience & Behavior; CHEM: Chemistry; PHYS: Physics; GEOS: Geosciences & Space Sciences; ENGN: Engineering; MATH: Mathematics

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Grant Lewison

Austrian Biomedical Research: A Bibliometric Evaluation

Introduction

Bibliometric studies have been increasing both in number and, perhaps, in quality in recent years and they are being used to reveal useful information about the outputs of researchers. In some fields, such as engineering, the counting of publications in peer-reviewed journals does not afford a good indicator of research output as the creation of more efficient structures or innovative industrial products is the intended outcome and papers are only a secondary indicator of research success. However in biomedicine, which comprises both clinical medicine and biological research intended to support it (biomedical research), researchers have traditionally regarded publications in the serial literature as the prime measure of their achievements. There is, nevertheless, a long and tortuous route from such publications to the twin goals of better patient care and less illness, and Figure 1 shows some of the main pathways (Lewison, 2003a). It illustrates the importance of government policy, which has a central role in the process, and that there are multiple measures, or indicators, that can be used to evaluate the research.

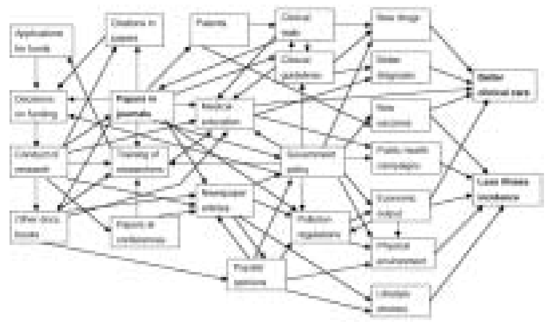

Figure 1. The links between biomedical research and better health

Most of these will involve tracing the links between one document and another through the medium of references, or citations.

Moreover, we know that different types of research show to advantage depending on which indicator is used. For example, patents cite primarily to basic research as the science that underpins them (Narin, 1994) but clinical guidelines cite almost exclusively to clinical work (Grant , 2000; Lewison and Wilcox-Jay, 2003). Conventional bibliometrics uses citations of papers by other scientific papers as a measure of impact, and a simple surrogate measure of this is the citation impact factors of the journals in which they are published (Lewison, 2001) although individual papers may depart substantially from the mean (Seglen, 1997). Journal impact factors are published and are available immediately without the need to wait several years until the peak of citations occurs.

Austria has a long tradition of excellence in clinical research, with Ignaz Semmelweis (1818–65) and Sigmund Freud (1856–1939) being perhaps the best known doctors internationally. It has, perhaps, less renown in basic research. The current study was conducted for the Austrian Federal Ministry for Education, Science and Culture, and looked back over just 10 years to see what Austria was currently achieving in biomedical research and to make a comparative evaluation of the different actors involved in its support and its conduct. It was restricted to conventional bibliometric measures but used some innovative techniques to identify areas of strength and weakness, in particular the definition of 32 subject areas by means of complex „filters" based on title words in papers as well as the names of specialist journals. Comparisons were made of Austrian outputs with those of five other countries: Germany, Israel, Sweden, Switzerland and the UK. It also used a multiple regression analysis to identify the relative importance of various input factors on output measures, here limited to actual and potential citations.

Construction of the database

The study depended on a database of biomedical papers, each of which had at least one Austrian address, extracted from the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) © The Institute for Scientific Information (ISI). This source was chosen because it is multidisciplinary and, importantly, contains all the addresses on each paper so that all Austrian papers could be identified and the extent of Austrian co-authorship with other countries could be determined. The database was restricted to articles, notes and reviews, and was formed of all papers in biomedical journals and papers in other journals with a biomedical address word. This allowed papers in multi-disciplinary journals like Nature and Science to be collected, as well as those in purely medical journals such as Wiener klinische Wochenschrift. After removal of duplicates from the two indexes, there were 26 757 papers in the database, of which only 2% came from the SSCI alone.

The papers were classified in several ways. First, each one was assigned a research level (RL) from 1 = clinical observation to 4 =basic research on the basis of the journal in which it was published, using the classification system developed by CHI Research Inc. for the US National Science Foundation (Narin, 1976). On this system, about one quarter of Austrian papers were at each of the four levels. Next, the journals were assigned to a potential impact category (PIC; from 1 = low to 4 =high) based on their five-year mean citation scores. The critical scores were 6, 11 and 20 citations, chosen so that approximately 10% of journals would be in the top category (PIC = 4, with a mean of 20+ citations per paper), 20% in the next (PIC = 3, between 11 and 20 citations), 30% in the third (PIC = 2, between 6 and 11 citations) and 40% in the bottom category (PIC = 1, fewer than 6 citations). Actual citation counts were determined over a five-year period (starting with the year of publication) for papers published from 1991–97.

Papers in each of 32 sub-fields were identified by means of „filters", based largely on title words and the names of specialist journals (Lewison, 1999) and marked in an individual column of the spreadsheet in which the database was formed. Not all papers were assigned to a sub-field but some were in more than one, e.g., gastroenterology and cancer, or gerontology and mental health. The addresses of the papers were coded by staff of the Austrian Science Ministry: this was a huge job as there were over 44 000 Austrian addresses and each was coded in a complex, five-part, system that allowed analysis at different levels, e.g., Länder, individual universities and their departments, hospitals and companies. Finally, the papers were all looked up in London libraries by recorders who examined their acknowledgements in order to add details of their funding sources to the database, using a procedure well established for UK papers (Dawson, 1998). Funders were recorded both individually as trigraph codes, e.g., FFW = Austrian Fund for Scientific Research, and with their sector (government, private-non-profit, industry, foreign, international) and country.

Results: outputs overall and in different sub-fields

Austria spends relatively little on biomedical research, about 0.9% of GDP or _1.6 billion per year, less than 10% of the expenditures in Germany and the UK, and less than a quarter of that in Sweden, which has a population only 10% larger. Nevertheless, it published 1.0% of world biomedical papers during the 1990s and its share has been rising rapidly. Most papers are in English, the proportion in German having fallen from 20% in 1991–92 to only 8% in 1999–2000. An increasing number are internationally co-authored, over 40% in the last five years, and the leading partner countries are Germany, the USA and the UK.

Sub-field	Code	Paps/yr	RC	Basic	HIJ	CC3+
anatomy, morphology & physiology	ANAPH	44	0.66	99	19	22
anaesthesia	ANEST	108	1.61	13	19	19
arthritis	ARTHR	66	0.94	40	26	31
biochemistry & molecular biology	BCMBI	242	0.74	99	63	52
bioengineering	BIENG	43	1.18	37	13	21
cardiology	CARDI	350	1.17	43	28	25
paediatrics & neonatology	CHILD	164	0.99	28	17	18
cell biology	CYTHI	97	1.00	85	60	53
dentistry	DENTA	27	0.65	16	8	6
dermatology & venereology	DERMA	120	1.26	36	29	31
endocrinology	ENDOC	322	0.94	59	33	31
gastroenterology	GASTR	184	0.89	37	29	27
genetics	GENET	240	0.67	81	55	49
gerontology	GERON	91	1.04	41	23	32
haematology	HAEMA	253	1.45	60	41	37
human genetics	HUGEN	14	1.25	69	49	57
immunology & allergology	IMMAL	295	1.25	67	44	42
infectious disease	INFEC	264	0.69	64	38	36
mental health	MENTH	91	1.29	24	17	22
neuroscience	NEUSC	191	0.71	83	41	40
obstetrics & gynaecology	OBSGY	177	1.14	30	17	16
oncology	ONCOL	386	1.22	43	33	31
ophthalmology	OPHTH	54	0.78	35	16	16
otorhinolaryngology	OTORH	60	1.10	21	8	17
pathology	PATHO	218	1.25	62	33	34
pharmacology & toxicology	PHATO	126	0.71	77	31	28
public health & epidemiology	PUBEP	92	0.89	32	24	28
radiotherapy, radiology & nuclear med.	RADIO	102	1.40	8	12	16
renal medicine	RENAL	88	1.18	52	32	25
respiratory	RESPI	121	0.98	25	25	24
surgery	SURGE	193	1.16	10	10	16
tropical medicine	TROPM	22	0.46	30	19	31

Table 1. Outputs of Austrian papers in 32 biomedical sub-fields, 1991–2000. Mean annual output, commitment relative to biomedical research (RC), percent of papers classed as basic (RL = 3 or 4), percent of papers in high impact journals (HIJ; PIC = 3 or 4) and percent of papers receiving 11 or more cites in five years (citation category 3 or higher).

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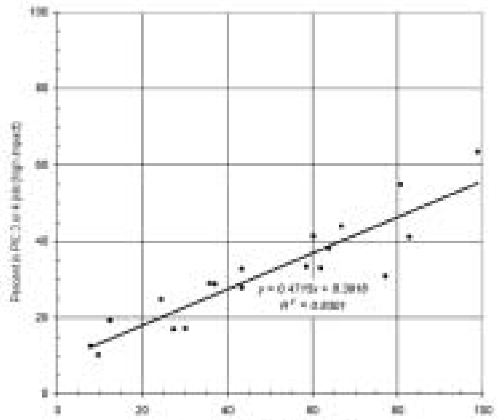

Figure 2. Correlation between percentage of Austrian papers in high impact journals (PIC = 3 or 4) and percentage in basic journals (RL = 3 or 4) in sub-fields with 100+ papers per year.

Austrian papers have on average 5.4 authors, the mean team size having risen from 4.7 to 5.8 over the decade. There are also more addresses on each paper. A „typical" Austrian biomedical paper has 1.7 Austrian and 1.0 foreign addresses and both of these numbers have increased since 1991.

Austrian outputs in each of the 32 defined sub-fields were determined, and the country's share of world papers in each was divided by its share of biomedical papers (1.0%) to give its „relative commitment" to each subject. Table 1 lists the sub-fields, Austrian mean output (papers per year) and its relative commitment compared with biomedicine. The table also shows the percentage of Austrian papers in each sub-field that are in the more basic journals (RL = 3 or 4). It can be seen that Austrian biomedical research is relatively concentrated on the clinical subjects, such as anaesthesia and haematology rather than the basic ones, such as genetics and anatomy, in keeping with the traditional view of Austrian strengths in clinical diagnosis and treatment. This table also shows that, with some exceptions (notably anatomy & physiology), sub-fields with large amounts of basic research are also ones with many papers in high-impact journals (HIJ; PIC = 3 or 4). The correlation between the two indicators for the sub-fields with over 100 papers per year is remarkably high, and is shown in Figure 2.

Citation scores

Citations to Austrian papers over five years were determined and put into six categories: zero (no cites), 1 (1–5), 2 (6–10), 3 (11–19), 4 (20–39) and 5 (40+). A few papers received many more than this: the highest was 476, given to a 1993 paper in EMBO Journal, and 29 others received 200 or more. The percentages of papers in categories 3 and higher, overall 28%, are also listed in Table 1 against the sub-fields, and it can be seen that citation rankings follow closely those given by the PIC values, with the basic sub-fields showing to advantage over the clinical ones.

To investigate the relative standing and impact of Austrian research, comparisons of PIC distributions were made with the corresponding indicators for the other five countries. Data on citations to papers from these countries were also obtained, but to only a random sample of 200 papers in each of the 32 sub-fields published from 1991–97 in order to limit costs. This analysis enabled us to see in which sub-fields Austria was doing well, and conversely. The results showed that, overall, the clinical focus of most Austrian research meant that it was ranked only fourth or fifth out of six countries in terms both of PIC and of citations, but it was the clear leader in one sub-field, dermatology & venereology, on both indicators, and was second in two (genetics and infection) on PIC and in three (biochemistry & molecular biology, cell biology and human genetics) on citations.

Austrian research sectors and institutions

The coding of Austrian addresses allowed the contributions of the different sectors (universities, hospitals, companies, etc) to be seen. Table 2 shows their contributions, with the ratio of their output in 1996–2000 to that in 1991–95.

The universities, especially the three medical faculties, dominate Austrian biomedical output and their share has grown, whereas that of hospitals has declined and the output of big pharma companies has shrunk in absolute terms. The biotech company sector is tiny, but it is growing quite rapidly, as are medical technology companies. As would be expected, Wien is the Land with the greatest output (60% of the total), followed by Tyrol (18%) and Styria (17%). None of the others has more than 5%.

We noted earlier that international collaboration has grown strongly. This is particularly marked among companies, with 55% of their papers having a foreign co-author, but much less for hospitals (29%). This may be because international collaboration occurs much more frequently in basic science than in clinical subjects. Thus the three medical faculties work with foreign scientists less than the science faculties, and they tend to favour as partners countries that are neighbours: Innsbruck with Switzerland and Italy, Vienna with the Czech Republic and Slovakia, and Graz with Croatia, Slovenia and Hungary. All, of course, collaborate most with Germany.

There are marked differences between the different Austrian sectors and institutions in terms of their performance as measured by potential citations (PIC values) and actual citations (citation categories). These are conveniently shown as a scatter plot of „mean citation category" against „mean PIC" for 1991–97 publications, see Figure 3.

Sector/institution	Papers	%	Ratio
All Austria	26757	100.0	1.43
Universities	22220	83.0	1.49
Med. faculties	17451	65.2	1.48
Vienna	10437	39.0	1.55
Innsbruck	4259	15.9	1.40
Graz	3258	12.2	1.44
Science fac's	3771	14.1	1.50
Vienna	1703	6.4	1.60
Graz	1026	3.8	1.43
Innsbruck	586	2.2	1.30
Salzburg	544	2.0	1.62
Hospitals	4054	15.2	1.24
City	1957	7.3	1.23
Länder	1098	4.1	1.25
Religious hosp's	554	2.1	1.23
Private	499	1.9	1.55
Insurance comp.	431	1.6	1.00
Companies	1780	6.7	1.07
Big pharma	1559	5.8	0.98
Start-up/biotech	106	0.4	2.12
Med technology	45	0.2	3.09
Other	90	0.3	1.57
Lud. Boltzmann	1749	6.5	1.43
Academic hosts	977	3.7	1.46
Hospital hosts	684	2.6	1.36
Other hosts	110	0.4	1.57
Austr. Acad Sci	697	2.6	1.33
Other institutions	970	3.6	1.48

Table 2. Outputs of Austrian biomedical papers from main sectors and sub-sectors, 1991–2000, and ratio of output in 1996–2000 to that in 1991–95.

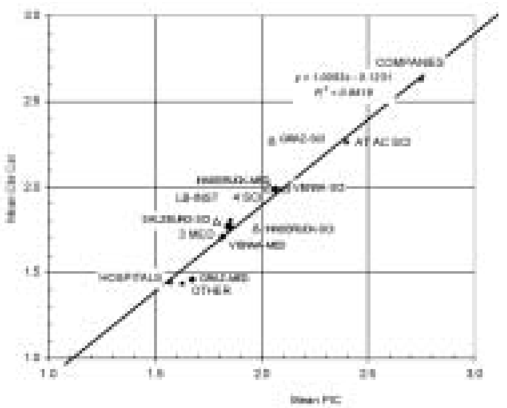

Figure 3. Scatter plot of „mean citecat" against „mean PIC" for biomedical papers from different Austrian sectors and institutions, 1991–97.

This plot shows that companies, followed by the Austrian Academy of Sciences, publish the work with the highest impact, and hospitals and „other" institutions that of the lowest, on both criteria. There is also apparently a clear hierarchy among the three leading universities: Innsbruck medical faculty performs the best, followed by Vienna and Graz; but in science the order is reversed, at least in terms of actual citations.

Funding acknowledgements

We looked up the papers in libraries to determine their funding sources and identified them for 97% of the publications. Of those found, 45% had no financial acknowledgement; this is much higher than the 33% found in the UK (Dawson, 1998) and reflects the more clinical nature of Austrian biomedical output as it is known that the more basic sub-fields receive more explicit funding. Figure 4 shows that the amount of funding has grown between 1991–92 and 1999–2000, with fewer unfunded papers and the mean number of acknowledgements per paper having risen from 0.99 to 1.29. The numbers of funding bodies acknowledged has a major influence on both the PIC distribution of the papers and on the numbers of citations received (Lewison and Dawson, 1998). Figure 5 shows the latter effect and that it is progressive up to six funders and more. This is plausible if the funding results from a rigorous peer-review process: research that is funded by several different sources is likely to be better than unfunded research in that it has been approved in a competitive process (Lewison and van Rooyen, 1999).

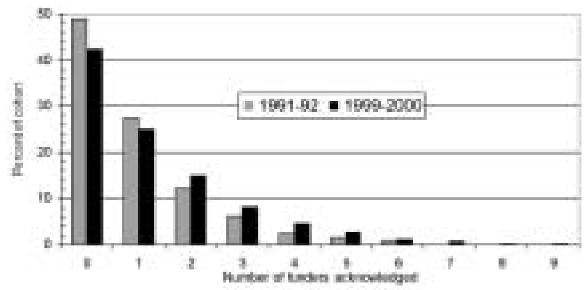

Figure 4. Numbers of funders acknowledged on Austrian biomedical papers, 1991–92 and 1999–2000.

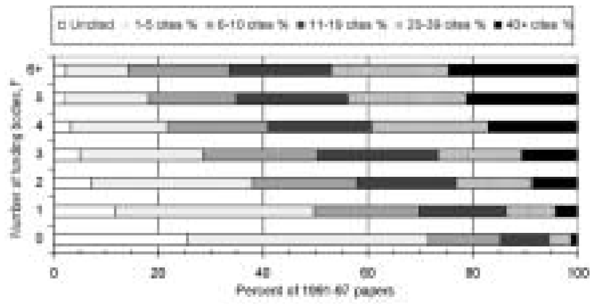

Figure 5. Citation category distribution for a five-year window for Austrian biomedical research papers with different numbers of funding acknowledgements, F; 1991–97.

The leading individual funders of Austrian biomedical research are shown in Table 3.

Sector/institution	Papers	%	Ratio
All inspected	25969	100.0	1.43
Austrian govern't	7693	29.6	1.52
Aust Fund Sci R	5477	21.1	1.47
Aust Nat'l Bank	1460	5.6	2.36
Aust Acad Sci	859	3.3	1.43
Min'y / Science	857	3.3	2.00
Vienna Mayor F	487	1.9	1.22

Table 3. Outputs of Austrian biomedical papers from main funding sectors and sub-sectors, 1991–2000, and ratio of output in 1996–2000 to that in 1991–95.

The European Union has increased its funding greatly and in 2000 was acknowledged on 5% of Austrian biomedical papers and an even higher percentage (11%) of those classified as basic research. Basic research sub-fields receive more specific funding, with biochemistry & molecular biology, and genetics, having over 80% funding, whereas clinical sub-fields such as dentistry and surgery have fewer than 25% of their papers with funding. The exception to this pattern is the Vienna Mayor's Fund, which emphasises patient-oriented sub-fields such as obstetrics and cancer, in its portfolio.

Parametric analysis of inputs and outputs

A clear pattern has emerged from the above results, with some institutions concentrating on basic sub-fields such as genetics whose papers tend to be receive a lot of external funding, get published in high-impact journals and receive many citations. Others, notably hospitals, do clinical work, which attracts little funding and is published in low-impact journals and in turn is relatively poorly cited. Any ranking of institutions, or funders, must take account of this finding and allow the confounding effect of these variables to be removed. It is a problem familiar to epidemiologists, who frequently discover that the incidence of illness is higher among poor people, who smoke a lot, eat a poor diet and take little exercise. But which of these factors is mainly responsible for the incidence of the disease? They must be separated out by means of a multiple regression analysis. For each case, here a paper, there are many different input variables, either numerical (e.g., number of funding bodies), categorical (e.g., research level) or yes/no (e.g., in a particular sub-field or not). Since there are almost 27 000 papers for which PIC, which can be considered as the dependent variable, has been determined, we can deploy large numbers of independent or input variables in the analysis in order to separate out their effects. [A parallel analysis was also undertaken of citation category as the dependent variable, with very similar results to those for PIC, but is not given here.]

The output of the regression analysis is a table showing the coefficients of each of the independent variables, and its statistical significance. These coefficients measure how much PIC would change in response to a unit change in each variable, with all others held constant. The results are presented in Table 4.

Parameter	Papers	%
DE (lang)	-0.508	0.0%
Year	0.005	0.7%
A	0.027	0.6%
A2	0.002	0.6%
D	-0.062	0.0%
D2	0.006	0.1%
F	0.229	0.0%
F2	-0.016	0.0%
CYTHI	0.312	0.0%
GENET	0.301	0.0%
NEUSC	0.138	0.0%
CARDI	0.101	0.0%
DERMA	0.073	0.4%
ONCOL	0.068	0.0%
OPHTH	-0.106	0.4%
CHILD	-0.142	0.0%
DENTA	-0.167	0.1%
OTORH	-0.215	0.0%
EU (addr)	0.054	0.8%
CC (addr)	-0.384	0.0%
US (addr)	0.215	0.0%
Ind'y (addr)	0.271	0.0%
Other (addr)	-0.240	0.0%
U Salzburg	-0.298	0.9%

Table 4. Regression equation coefficients for potential impact category (PIC) for different input variables for Austrian biomedical papers, 1991–2000 (A = authors, D = addresses, F = funders).

EU = other European Union member state address; CC = candidate countries from Eastern Europe; DE = German language paper.

Only a selection of the 22 sub-fields that made a difference to the mean PIC of the journals in which their papers were published are shown in this table. The effects of varying numbers of authors, addresses, funding bodies and research level are shown graphically in Figure 6. Perhaps surprisingly, the effect of multiple addresses is negative. The reason that it appears to have a positive effect is that it is closely associated with more authors and more funding, and both of these have a strongly positive effect on PIC. But it is plausible: if the same team is gathered together in one institution, it is easier for them to exchange ideas and co-operate than if they were separated by distance and needed to rely on telecommunications, however good these have now become. As expected, basic research papers have a decided advantage over clinical ones: the difference in PIC of 0.48 is one of the largest effects other than large numbers of funders.

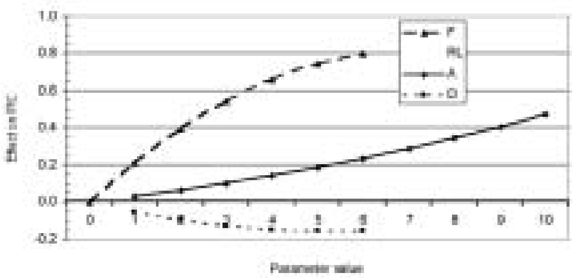

Figure 6. Effects of funding (F), authorship (A), addresses (D) and research level (RL, compared with clinical observation, RL = 1) on potential impact category (PIC) of journals in which Austrian biomedical papers are published, 1991–2000

The table shows that collaboration with other EU member states and with the USA has a positive effect on PIC, but working with the candidate countries from Eastern Europe (e.g., Poland, Hungary) has a negative effect. The coefficient for year is small but positive, indicating a steady improvement in PIC with time, independent of the increase in authorship and funding; this has been seen elsewhere (Lewison, 2003b) and may indicate that higher-impact journals are expanding at the expense of low-impact ones.

Absent from this table is any mention of the three medical faculties and the three large science faculties. This is because their coefficients were not statistically significant. So the apparent ranking of the universities noted above disappears when account is taken of their choice of research sub-fields: Innsbruck medical school has chosen to work in more basic ones whereas the focus of Graz is more clinical, but the PIC distributions of the journals in which they publish are more or less what would be expected as a result of these choices. (However, there is evidence from the analysis of citations that Innsbruck and Vienna medical schools' papers are somewhat more highly cited than expected.)

Conclusions

This study has shown that Austrian biomedical research is increasing steadily in output, especially from the universities, and becoming more international. It has revealed the subjects of Austrian strength – still mainly the clinical ones – and of weakness. It has shown once more the importance of competitive funding for the production of work of high potential or actual citation impact. Austria has an active governmental funding sector, although the absence of support from the Ministry of Health is surprising, and industry is also contributing a fair (15%) share of support, but in comparison with some other European countries, the private-non-profit funding sector is very small. Measures to encourage the formation of medical charities and the creation of endowed foundations might be considered: they would provide alternative sources of funding for Austrian biomedical researchers. However additional sources are now being provided from abroad, notably the European Commission in Brussels, and this trend seems likely to continue with the increased internationalisation of all research. It must be repeated that this study has been carried out using conventional bibliometric measures and these give only a very partial view of the likely utility of the research to the provision of better healthcare and the avoidance of illness. Further indicators of these effects will need to be created, and they will need to be developed in Austria. For example, the research underlying clinical guidelines used in Austrian hospitals, or advice to doctors on which drugs to prescribe, will need to be investigated locally if the effects of such research on clinical practice are to be demonstrated. It would also be worth investigating the reporting of biomedical research in Austrian newspapers to see if they cover work carried out nationally or are more concerned with international studies.

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Birgit Baumann

Best Management Practices for Complex RTDI-Programmes: MAP-TN, StarMAP, DiscoMAP

Introduction

Since January 2002 respectively November 2003 the first EU-Projects managed by TIG started. These projects are financed by the programme STRATA (= Strategic Analysis of Specific Political Issues) within the 5. EU-RTDI-Framework Programme.

All 3 Projects are dealing with the Management of complex RTDI-Programmes, so-called MAPs (see „Characteristics of MAPs"), dealing with development and implementation of MAPs but also having a special focus on project-monitoring and evaluation of MAPs.

Characteristics of MAPs

MAP is the abbreviation of „Multi Actors Multi Measures Programmes" and stands for complex RTDI Funding Programmes addressing not an individual firm or research institution but whole (sub-)systems of innovation (e.g. science-industry cooperation, etc.)

The characteristics of „Multi Actors Multi Measures Programmes" are:

- Multi-Measure, e.g. RTDI funding activities, Start-ups, awareness-raising, networking, etc.
- Multi Actors, e.g. universities, research institutes, industry, etc.
- System-orientation
- Programme character
- Public calls and competitive approaches
- External programme managers (running the MAP on behalf of a ministry)
- Evaluations (ex ante, monitoring, ex post)
- Accompanying Measures and special learning mechanisms and feedback loops

The Projects

The commonness of these EU-projects is that they deal intensively with questions of MAP-management: with development, implementation, evaluation and adaptation of MAPs, so with all phases of the policy cycle of these complex RTDI funding programmes:

Policy Cycle for RTDI Funding Programmes

The following 3 EU-projects are all situated around MAP-management but with a different approach.

- MAP-TN (= Acronym for the Thematic Network on „Best Practices for Multi Actors and Multi Measures Programmes (MAP) in RTDI policy, with a focus on co-operation science-industry")
- StarMAP (= Acronym for „STudy About Relevant MAPs in selected countries, focussing on MAP management)
- DiscoMAP (= Acronym for „DISsemination activities and Final COnference for the MAP Thematic Network and StarMAP)

Just MAP-TN will be described in more detail later as the project already can offer preliminary results:

Aims of MAP-TN

The main objective of the MAP-TN is to bring together MAP-managers, MAP-experts from complementary organisations and policy-makers to exchange experience and to create common and codified knowledge on the specific challenges connected with the complexity of these programmes.

In 9 Workshops a series of well defined questions are discussed among the MAP-TN partners, dealing with development, implementation and evaluation of MAPs. Best practices will be developed and will be compiled in a handbook, the so-called „roadmap".

The final aim is to advise EC and, other RTDI policy-makers and RTDI programme managers on good practice in MAP development, implementation and evaluation which would lead to increased efficiency and comparability of the whole management.

State-of-the-Art von MAP-TN

The first 2 Workpackages were completed in 2002. In 5 Workshops „tacit knowledge" was exchanged by experienced MAP-Managers and codified in 2 reports (the first is already available on the MAP Homepage: www.map-network.net). The Workshops covered the following issues:

Workshop 1: „State-of-the-art" and special features of MAPs

Workshop 2: Development of MAPs

Workshop 3: Selection procedures, in particular competitive approaches (Strategy)

Workshop 4: Selection procedures (operational)

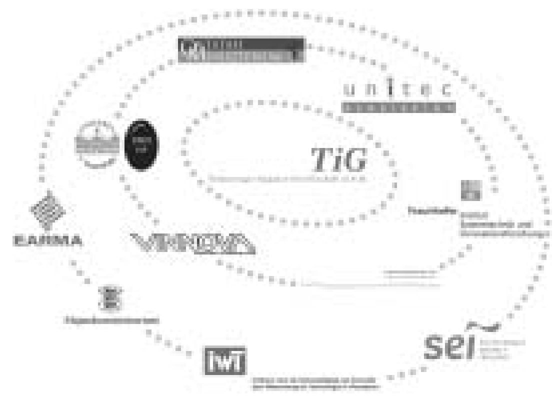
Workshop 5: contract negations and funding principles, consortia and „public-private-partnership"

Preliminary results will be presented on 5 June 2003 in Brussels at the MAP-TN Symposium for a target group of MAP-managers and MAP-makers.

The 3rd workpackage will start in June 2003 with a workshop on „project monitoring" and will end with a workshop on project- and programme-evaluation in September which will be held together with evaluators. Results from these workshops are to be expected for the end of 2003.

4. Consortium

TIG coordinates all 3 STRATA projects. Partners are MAP-managers and/or MAP-experts from funding organisations or complementary institutions from Germany, Spain, UK, Sweden, Hungary, Slovenia, Estonia, Ireland and Flanders. The European Association of Research Managers and Administrators (EARMA) is also involved.



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Upcoming Conference

„Evaluation of Government funded R&D Activites", May 15th – 16th 2003, Vienna

The Centre for European Economic Research (ZEW), Joanneum Research, the bm:bwk and the Platform Research & Technology Policy Evaluation are jointly organizing an international conference on the evaluation of Government funded R&D activities.

This conference will take place in Vienna, Austria, 15 – 16 May 2003.

We cordially invite researchers and policy makers worldwide with an interest in the general field of evaluation of R&D policies to participate in this conference in the capital of Austria. In line with the focus of our conference, these two days will consist of a balanced

combination of contributions by scientists as well as policy makers.

The organizing committee looks forward hosting a unique and high quality conference attracting evaluation experts as well as users for two days of discussing the state of the art in evaluation sciences and lessons learned for the field of R&D policies in Vienna.

Focus on the Conference

Recently, the impact on innovation, structural change and technology leadership in European Economies of R&D policy instruments is widely discussed. Various evaluation studies have attracted increasing attention of researchers and policy makers. At the same time, the evaluation methods used to analyse the impacts of R&D policies have been improved and become more sophisticated. The aim of this conference is to discuss recent scientific contributions to the understanding of effects and implications of government funded R&D activities. It will focus on recent theoretic, qualitative and quantitative studies and the exploration of different approaches to evaluate their effects. An applied workshop with policy makers will be organized on „What we know and what we should know about evaluation of research and technology policy" at the end of the conference.

Sessions

- Government funding R&D in private business
- Start-ups, SMEs and Spin-Offs – Funding Gap in Innovation?
- Collaborations, Networks and Spatial dimension
- Methodology and Rationales: International experiences
- Spillover effects, Externalities and Productivity
- Infrastructure and Institutions

Panels

- The Status Quo of Evaluation Sciences in R&D
- RTD Policy Trends. Experiences from the US and Europe
- What we know and what we should know about evaluation of RTD policies

Venue

Tech Gate Vienna
Donau-City-Straße 1. A-1220 Wien
www.techgate.at

Contact

You will find more details in this Newsletter and in the internet www.fteval.at/conference or contact the organizing team: office@fteval.at
Klaus Zinöcker klaus.zinoecker@joanneum.at
Andreas Fier fier@zew.de

www.fteval.at/conference

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Evaluation of Government funded R&D Activites Programme

May 15th –16th, Tech Gate Vienna, Austria

Thursday, May 15th, 2003: „Scientific State-of-the-Art"

8.30 – 9.00	Registration
9.00	Welcome and Introduction Elisabeth Gehrer, Federal Minister for Education, Science and Culture (Austria) Wolfgang Franz, President of ZEW (Germany) Bernhard Pelzl, Managing Director, JOANNEUM RESEARCH (Austria)
9.00 – 10.30	Keynote Speech Irwin Feller (Irwin Feller, Senior Visiting Scientist, AAAS and Prof. Emeritus, Penn State University) Discussion
10.30 – 11.00	Coffee Break
11.00 – 12.30	Parallel Sessions I Parallel Session Ia: Government funding R&D in privat-business Chair:Pierre Mohnen (MERIT, NL) Session Organizer: Spyros Arvanitis (ETH-KOF, CH) Public support to innovative firms – a quantitative assessment of potential effects Lars Bager-Sjörgen (Swedish Institute for Growth Policy Studies –ITPS) Discussant: NN Matched-pair analysis based on business survey data to evaluate the policy of supporting the adoption of advanced manufacturing technologies by Swiss firms Laurent Donzé (ETH-KOF, CH) Discussant: Isabel Busom (Universitat Autonoma de Barcelona, ESP) Publicly Funded R&D Collaborations and Patent Outcome in Germany Dirk Czarnitzki (ZEW Mannheim, D) Discussant: Lasse Braein (Møre Research – Norway)

Parallel Session Ib:
Start-ups, SMEs and Spin-Offs Funding Gap in Innovation?
Chair: Nikolaus Franke (University of Economics and Business Administration Vienna) Session Organizer: Philippe Mustar (CSI - Centre de Sociologie de l'innovation, F)

Impact of Government Support Programs on Innovation Petr Hanel (Université de Sherbrooke & CIRST, CA) Discussant: David Audretsch (Indiana University Bloomington, USA)

Finnish Industry Investment LTD: An International Evaluation Gordon Murray (LBS - London Business School, UK) Discussant: NN

Italian Public Support to NTBFs: An Empirical Investigation Luca Grilli (CIRET-Politecnico di Milano, I Discussant: Rosa Grimaldi (CIEG, University of Bologna, I)

Parallel Session Ic:
Collaborations, Networks and Spatial dimension
Chair: Nick Vonortas (George Washington University, USA) Session Organizer: Robin Cowan (MERIT, NL)

E.U. sponsored versus „spontaneous" R&D collaborations – Towards a micor-analysis and revisited policy rationales Sandrine Wolff (Uni Louis Pasteur, F) Discussant: NN

Knowledge transfer and innovation in subsidized regional networks – empirical evidence of a German promotion scheme Alexander Eickelpasch (DIW, D) Discussant: Giuseppe Scellato (Università degli studi di Torino, I)

	Unveiling the texture of a European Research Area: Emergence of oligarchic networks under EU Framework Programmes Lucia Cusmano (CESPRI – Università L. Bocconi, I) Discussant: Silke Stahl-Rolf (VDI-Technology Center, D)
12.30 – 14.00	Lunch Break
14.00 – 15.30	Parallel Sessions II
	Parallel Session IIa: Methodology and Rationales: International experiences Chair: Saul Lach (Hebrew University, IL) Session Organizer: Wolfgang Polt (Joanneum Research, A)
	Do public subsidies complement business R&D? A meta-analysis of the econometric evidence Jose Garcia-Quevedo (University of Barcelona, ESP) Discussant: Soile Kuitunen (VTT, FI)
	Evaluation of the articulation of an Innovation System: coherence between policy formulation and policy implementation Fernando Jiménez Sáez (Universidad Politécnica de Valencia, ESP) Discussant: Joost Heijs (Complutense University of Madrid, ESP)
	Does Qualitative Inquiry Imply Confirmation Bias in Evaluation Studies? What Evaluation Studies Reveals about Core Issues in Economics and other Social Sciences: The Qualitative versus Quantitative Methods Debate Revisited Olav A. Kvitastein (SNF – Institute for Research in Economics, N) Discussant: NN
	Parallel Session IIb: Spillover effects, Externalities and Productivity Chair:Jacques Mairesse CREST–Centre de Recherche en Économie et Statistique, F) Session Organizer: Bruno Van Pottelsberghe (lUniversité Libre de Bruxelles, BE)
	Subsidies, Human Capital and Business R&D Guntram B. Wolff (Zentrum für Europaeische Integrationsforschung, D) Discussant: NN
	Spillovers from Publicly Financed Business R&D: Some Empirical Evidence from Germany Werner Bönte (University of Hamburg, D) Discussant: Kim Won-Joon (Seoul national University, Süd Korea)
	Evaluation of WBSO (Promotion of Research and Development Act) Erik Brouwer (Illinois State University – Dept. of Economics) Discussant: Diègo Legros (Universite Pantheon-Assas Paris II, F)
	Parallel Session IIc: Infrastructure and Institutions Chair: Stefan Kuhlmann (Fraunhofer ISI, D & University of Utrecht) Does Public Scientific Research Complement Industry R&D Investment? The Case of NIH supported Basic and Clinical Research and Pharmaceutical Industry R&D Andrew A. Toole (Illionois State University, USA) Discussant: NN A Missing Variable?
	Evaluating the Institutional Impact from Participating in Government Supported Cross Sector R&D Programs Tim Turpin (University of Western Sydney, AUS) Discussant: Barend van der Meulen (University of Twente, NL)
	The Evaluation of Public Research Institutions in Italy: Comparing Different Approaches Emanuela Reale (Cnr-ISPRI, I) Discussant: Cristiane Joerk (Leibniz Gemeinschaft, D)
15.30 – 16.00	Coffee Break
16.00 – 17.30	Conclusions and Challenges „The Status Quo of Evaluation Sciences in R&D“Moderator: Jonathan Eaton (Boston University, USA) Saul Lach (IL) Pierre Mohnen (NL) Nik Vonortas (USA) Gordon Murray (GB) Jacques Mairesse (F) Stefan Kuhlmann (D)
20:00	Conference Reception – by invitation of the mayor and governor of Vienna, Dr. Michael Häupl. City Hall Vienna

Friday, May 16th, 2003: „Policy Issues“

8.30 – 9.00	Registration
9.00	Welcome and Keynote speech Paul A. David (Stanford Institute for Economic Policy Research, USA) RTD Policy Trends. Experiences from the US and Europe
9.30 – 11.00	Panel I: Experiences from US Evaluation Moderator: Giorgio Sirilli ((Istituto di studi socio-economici sull'innovazione e le politiche della ricerca, I) Charles Wessner (NRC, USA) David Audretsch (Indiana University Bloomington, USA) Nick Vonortas (George Washington University, USA) Susan Cozzens (Georgia Institute of Technology, USA) Mark Stanley (Advanced Technology Program, USA)
11.00 – 11.30	Coffee Break
11.30 – 13.00	Panel II: Evolving practices and lessons learned in the evaluation of European RTD policies Moderator: Michael Stampfer (Plattform Forschungs- und Technologieevaluierung) John Barber (Department of Trade and Industry – DTI, UK) Jerry Sheehan (Organisation for Economic Co-operation and Development – OECD, F) Rainer Jäkel (Federal Ministry of Economy and Labour – BMWA, D) Ken Guy (Wise Guys, UK)
13.00 – 14.30	Lunch Break
14.30 – 16.30	Workshop What we know and what we should know about evaluation of RTD policies Moderator: Wolfgang Polt (Joanneum Research, Austria) „Scientists“ Jonathan Eaton (Yale University, USA) Paul David (Stanford Institute for Economic Policy Research, USA) Terttu Luukkonen (Research Institute of the Finnish Economy – ETLA, FIN) Georg Licht (Centre for European Economic Research – ZEW) N.N. (Mitsubishi Research Institute Inc., Tokyo, J) „Policy Makers“ John Barber (Department of Trade and Industry, UK) Engelbert Beyer (Federal Ministry of Education and Research – BMBF, D) Timo Roelandt (Ministry of Economic Affairs, NL) Dorothea Sturn (TIG, A)
16.30	Final Remarks End of Conference

Evaluation of Government funded R&D Activites: Invited Speakers
Status: April 2003

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Spyros Arvanitis holds a Ph.D. in Chemistry and in Ph.D. in Economics, University of Zurich. From 1989 on, he is Senior Research Economist, Swiss Institute for Business Cycle Research (KOF), Swiss Federal Institute of Technology Zurich (ETHZ), Since 1998 Head of the Industrial Economics Research Group (together with Dr. H. Hollenstein). At this time, he also lectures in economics in the ETHZ; and is Consultant to several agencies of the Swiss Federal Government in the fields of evaluation of technology diffusion programmes and international competitiveness.
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PROF. DAVID AUTRETSCH
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David B. Audretsch is the Ameritech Chair of Economic Development and Director of the Institute for Development Strategies at Indiana University. He is also a Research Fellow of the Centre for Economic Policy Research (London). Audretsch's research has focused on the links between entrepreneurship, government policy, innovation, economic development and global competitiveness.. His research has been published in over one hundred scholarly articles in the leading academic journals.. He is founder and editor of the premier journal on small business and economic development, Small Business Economics: An International Journal.
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JOHN BARBER
Department of Trade and Industry (DTI), UK
John is an economist by profession. In addition to being Director of TESE (Technology, Economics, Statistics & Evaluation) at the Department of Trade and Industry, United Kingdom, he is Chairman of the OECD Committee on Scientific and Technological Policy and is a member of several academic steering committees. Based in London, TESE is an interdisciplinary unit of Economists, Statisticians, Scientists and Engineers within the Innovation Group (IG) of the DTI.
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PROF. ROBIN COWAN
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Susan E. Cozzens is Professor and Chair of the School of Public Policy at the Georgia Institute of Technology. Her current research is on science, technology, and inequalities, and she is active internationally in developing methods for research assessment and science and technology indicators. She is incoming chair of the Committee on Science, Engineering, and Public Policy of the American Association for the Advancement of Science.
Dr. Cozzens has a distinguished record of publication and service in the fields of science policy and science and technology studies. She is past editor of Science, Technology, & Human Values, the journal of the Society for Social Studies of Science (4S), and has served on councils and committees for several professional societies. Her work has appeared in Issues in Science and Technology, Policy Studies, The Journal of Technology Transfer, Evaluation and Program Planning, Neuroscience, Social Studies of Science, Knowledge: Creation, Diffusion, Utilization, Scientometrics, Science and Public Policy, and Research Policy, and she has contributed chapters to a dozen books. She is co-editor of Research Evaluation.
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Dr. Feller's current research interests include the economics of academic research, the university's role in technology-based economic development, and the evaluation of federal and state technology programs. He is the author of Universities and State Governments: A Study in Policy Analysis (Praeger Publishers, 1986) and over 75 refereed journal articles, final research reports, book chapters, and reviews, as well as of numerous papers presented to academic, professional, and policy audiences.
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Dr. oec. publ. Andreas Fier studied political sciences and business administration at the University of Mannheim in Germany. From 1995 he is working as a research fellow in the department of Industrial Economics and International Management at the Centre for European Economic Research, Ltd. (ZEW) in Mannheim. From 1997 to 1999 he has been co-opted to work on policy based analyses for the strategy division of the German Federal Governments' Ministry of Research and Education (BMBF) in Bonn. Dr. Fier is working as an international policy consultant for German Ministries, the EU and the OECD. His work as a professional economist has focused on research, innovation and technology, particularly on effects of public grants for high-tech firms and state-of-the-art technology. In 2002 he finished his Ph.D. in economics on „Government Funded R&D Activities in Industry" (magna cum laude) at the University of Munich. Afterwards he moved to Vienna and works at Joanneum Research, Ltd. Dr. Fier returned to the ZEW in 2003 as a project leader and focus his research on public and private innovation activities.
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Professor Franz was born in 1944 and studied economics at the University of Mannheim. Afterwards he worked as a research associate at the University of Mannheim and got a doctoral degree in 1974 on a macroeconometric analysis of the German labour market. As a research fellow Professor Franz spent two years at Harvard University and at the National Bureau of Economic Research, USA. In 1981 he habilitated on the problem of youth unemployment.
Professor Franz accepted a professorship at the University of Mainz and then a chair at the University of Stuttgart in 1984. In 1988 he accepted a chair at the University of Konstanz. Although he received appointments from the Technical University of Zürich (ETH Zürich) and the Humboldt University in Berlin Professor Franz stayed in Konstanz until April 1st, 1997 when he was appointed President of the Center for European Economic Research (ZEW), Mannheim, and professor of economics at the University of Mannheim.
Professor Franz is a member of various scientific councils including the Scientific Advisory Board of the Federal Ministry of Economic Affairs. He is member of the German Council of Economic Experts. His main research areas are macroeconomics, labour economics, and empirical methods in economics. Professor Franz has published numerous books and scientific articles on these topics.
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Ken Guy holds an MA degree in Natural Sciences from the University of Cambridge and an MSc in Science and Technology Policy from the University of Manchester. After leaving Manchester in 1974, Ken Guy held a SCOPE Research Fellowship at Clark University, Massachusetts prior to appointments at the SCOPE/UNEP Monitoring and Assessment Research Centre in London and the Department of Geography, Leicester University. His work focused on evaluations of government policy in fields as diverse as drug safety, nuclear power and environmental protection, and on industrial strategies in a wide range of economic sectors. In 1982 he joined the Science Policy Research Unit (SPRU) at Sussex University, where he founded and led the EGIST (Evaluation of Government and Industry Strategies for Technology) group. Then, in 1989, he founded Technopolis Ltd, an innovation policy consultancy which, by the time of his departure in January 2000, had grown to be a leader in its field, with offices in Brighton, Amsterdam, Paris and Vienna.
At the start of the new millennium, Ken Guy launched Wise Guys Ltd. as a vehicle to explore different ways in which innovation policy specialists can work together collaboratively to perform policy-relevant work and deliver high quality advice to innovation policymakers and administrators.
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und inhaltlicher Evaluierungsfragen in der Forschungs- und Technologiepolitik.

ISSN: 1726-6629

Herausgabe und Versand:
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Für den Inhalt dieser Ausgabe verantwortlich:
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