

Measuring Research Excellence by Bibliometric Methods

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Leiden University*



Universiteit Leiden
The Netherlands



This lecture presents the state-of-the-art of an advanced bibliometric methodology, fine-tuned to the specific demands of the evaluation of academic research



Citing Publications

networks leading, possibly, to different dynamics, e.g., for the initiation and spread of epidemics. In the context of network growth, the impossibility of knowing the degrees of all the nodes comprising the network due to the filtering process—and, hence, the inability to make the optimal, rational, choice—is not altogether unlike the “bounded rationality” concept of Simon [17]. Remarkably, it appears that, for the description of WWW growth, the preferential attachment mechanism, originally proposed by Simon [10], must be modified along the lines of another concept also introduced by him—bounded rationality [17].

We thank R. Albert, P. Ball, A.-L. Barabási, M. Buchanan, J. Camacho, and R. Guimerà for stimulating discussions and helpful suggestions. We are especially grateful to R. Kumar for sharing his data. We thank NIH/NCRR (P41 RR13622) and NSF for support.

Weight?

- [1] S. H. Strogatz, *Nature (London)* **410**, 268 (2001).
- [2] R. Albert and A.-L. Barabási, *Rev. Mod. Phys.* **74**, 47 (2002).
- [3] S. N. Dorogovtsev and J. F. F. Mendes, *Adv. Phys.* **41**, 107 (2002).
- [4] R. Albert, H. Jeong, and A.-L. Barabási, *Nature* **400**, 351 (1999).
- [5] B. A. Huberman and S. H. Strogatz, *Phys. Rev. E* **54**, 4703 (1996).

- [6] G. Bianconi, *Phys. Rev. E* **62**, 016110 (2000).
- [7] A. F. J. Van Raan, *Scientometrics* **24**, 319 (1991).
- [8] We consider a modification to the network growth rule described in the previous paper: at each time step t , the new node establishes m new links, where m is drawn from a power law distribution with exponent γ .
- [9] For $n(l) = \text{const}$, one recovers the scale-free model of Ref. [9].
- [10] It is known [11] that, for an exponential or fat-tailed distribution of fitness, the structure of the network becomes much more complex; in particular, the in-degree distribution is no longer a power law. Hence, we do not consider in this manuscript other shapes of the fitness distribution.
- [11] L. A. N. Amaral, A. Scala, M. Barthélemy, and H. E. Stanley, *Proc. Natl. Acad. Sci. U.S.A.* **97**, 11 149 (2000).

Cited Publications

All calculations are corrected for self-citations!

What do citations measure?

- Many studies showed positive correlations between citations and qualitative judgments
- In principle it is valid to interpret citations in terms of intellectual influence which is an important aspect of scientific quality
- Thus, the concepts of citation impact and scientific quality do not coincide 'automatically'

Total publ universe

non-WoS
publ:
Books

LI

.....Google

*CWTS h

Reuters

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WoS cov

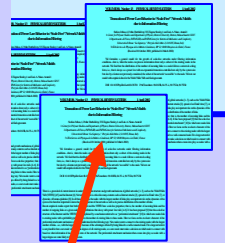
*CWTS b

to

Google Scholar, Google Book
Search

within 5 years
leading player?

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WoS coverage of fields

Internal Coverage Percentage

80-100%	60-80%	40-60%	<40%
Biochem & Mol Biol	Appl Phys & Chem	Mathematics	Other Soc Sci
Biol Sci – Humans	Biol Sci – Anim & Plants	Economics	Humanities & Arts
Chemistry	Psychol & Psychiat	Engineering	
Clinical Medicine	Geosciences		
Phys & Astron	Soc Sci ~ Medicine		

Example: Leiden 2000-2005

INTERNAL COVERAGE OF THE CITATION INDEX BY MAIN FIELD							
<i>Main Field</i>	<i>P 00-05</i>	<i>Avg Nr Refs</i>	<i>Refs <1980</i>	<i>%Refs <1980</i>	<i>Refs Non-CI</i>	<i>Refs CI</i>	<i>%Refs CI</i>
CLINICAL MEDICINE	3,893	33.3	6,950	5%	11,637	110,945	91%
BIOL SCI: HUMANS	2,421	39.0	4,449	5%	6,447	83,588	93%
BIOL SCI: ANIMALS & PLANTS	754	41.2	5,638	18%	6,611	18,805	74%
MOLECULAR BIOLOGY & BIOCHEM	1,257	40.5	2,930	6%	3,968	44,001	92%
PHYSICS AND ASTRONOMY	1,492	36.7	4,898	9%	7,555	42,320	85%
CHEMISTRY	871	34.5	3,608	12%	3,717	22,693	86%
MATHEMATICS	233	21.5	957	19%	1,680	2,375	59%
GEOSCIENCES	134	40.4	578	11%	2,169	2,673	55%
APPLIED PHYSICS AND CHEMISTRY	514	24.7	1,382	11%	2,081	9,256	82%
ENGINEERING	373	21.5	686	9%	3,151	4,185	57%
MULTIDISCIPLINARY	126	30.5	215	6%	339	3,291	91%
ECONOMICS	55	38.9	160	12%	593	608	51%
PSYCHOLOGY, PSYCHIATRY & BEHAV SC	633	40.3	2,789	11%	7,296	15,406	68%
SOCIAL SCIENCES RELATED TO MEDICINE	292	28.9	597	7%	2,153	5,698	73%
OTHER SOCIAL SCIENCES	291	34.9	1,469	14%	5,649	3,047	35%
HUMANITIES & ARTS	220	38.7	2,477	29%	5,063	973	16%

journal coverage, in particular for engineering

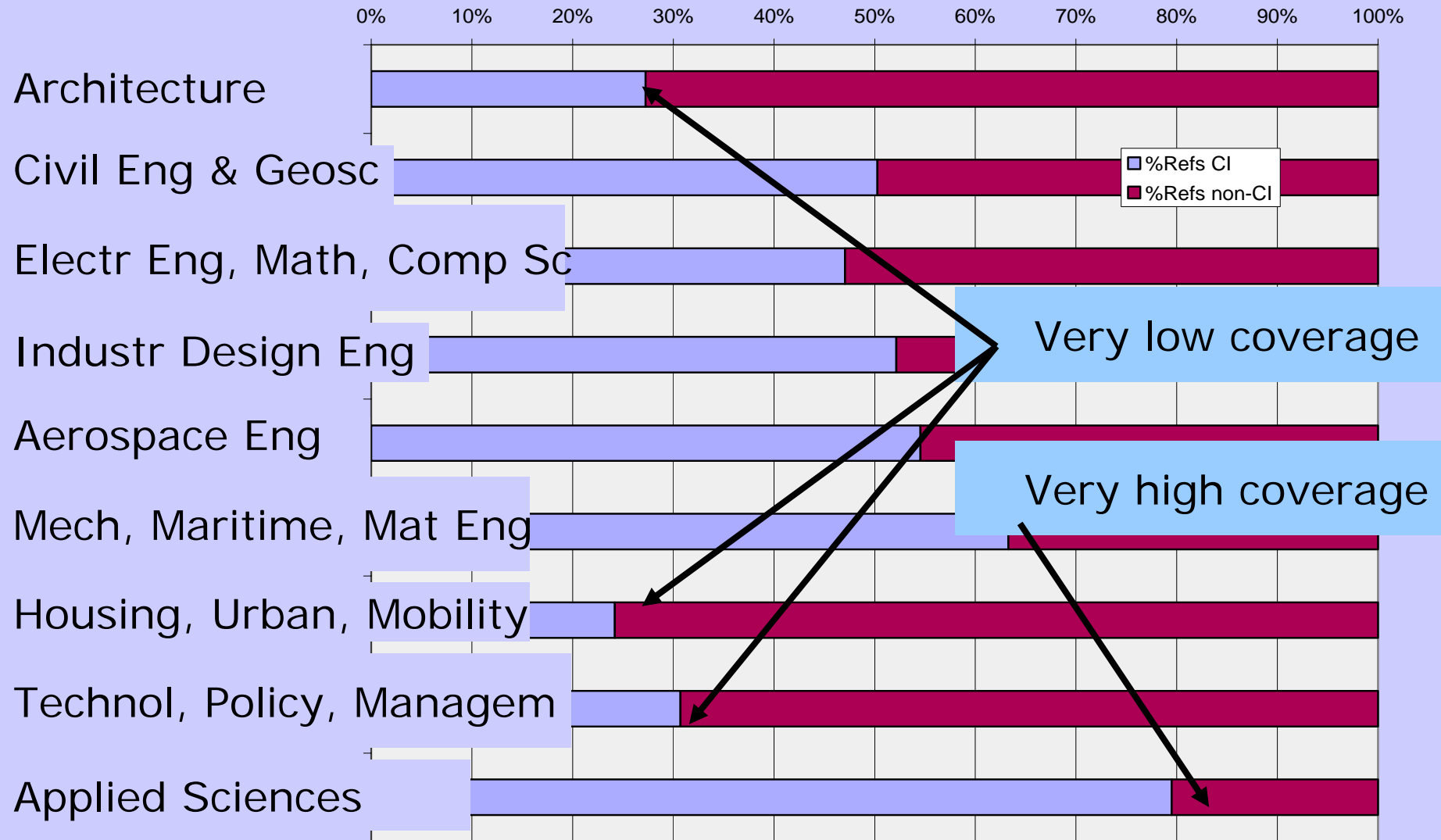
Field	1991	1998	2001	2008
MEDICAL & LIFE SCIENCES				
AGRICULTURE AND FOOD SCIENCE	66%	66%	73%	75%
BASIC LIFE SCIENCES	87%	89%	93%	93%
BASIC MEDICAL SCIENCES	76%	75%	80%	84%
BIOLOGICAL SCIENCES	72%	74%	80%	82%
BIOMEDICAL SCIENCES	86%	87%	90%	90%
CLINICAL MEDICINE	82%	82%	85%	85%
HEALTH SCIENCES	50%	47%	57%	62%
NATURAL SCIENCES				
ASTRONOMY AND ASTROPHYSICS	75%	79%	82%	86%
CHEMISTRY AND CHEMICAL ENGINEERING	77%	80%	86%	88%
COMPUTER SCIENCES	38%	37%	42%	43%
EARTH SCIENCES AND TECHNOLOGY	60%	60%	69%	74%
ENVIRONMENTAL SCIENCES AND TECHNOLOGY	46%	46%	55%	62%
MATHEMATICS	58%	57%	58%	64%
PHYSICS AND MATERIALS SCIENCE	75%	78%	81%	84%
STATISTICAL SCIENCES	49%	46%	52%	58%
ENGINEERING SCIENCES				
CIVIL ENGINEERING AND CONSTRUCTION	37%	33%	34%	45%

ENGINEERING SCIENCES

CIVIL ENG & CONSTRUCTION	37%	33%	34%	45%
ELECTRICAL ENG & TELECOMM	54%	52%	52%	53%
ENERGY SCIENCE & TECHNOLOGY	54%	48%	53%	59%
GENERAL & INDUSTRIAL ENG	42%	37%	44%	54%
INSTRUMENTS & INSTRUMENTATION	67%	62%	71%	69%
MECHANICAL ENG & AEROSPACE	58%	53%	57%	64%

LAW, ARTS AND HUMANITIES				
CREATIVE ARTS, CULTURE AND MUSIC	17%	14%	16%	14%
HISTORY, PHILOSOPHY AND RELIGION	24%	23%	25%	27%
LAW AND CRIMINOLOGY	27%	32%	32%	31%
LITERATURE	14%	12%	11%	11%
MULTIDISCIPLINARY JOURNALS	78%	83%	87%	87%

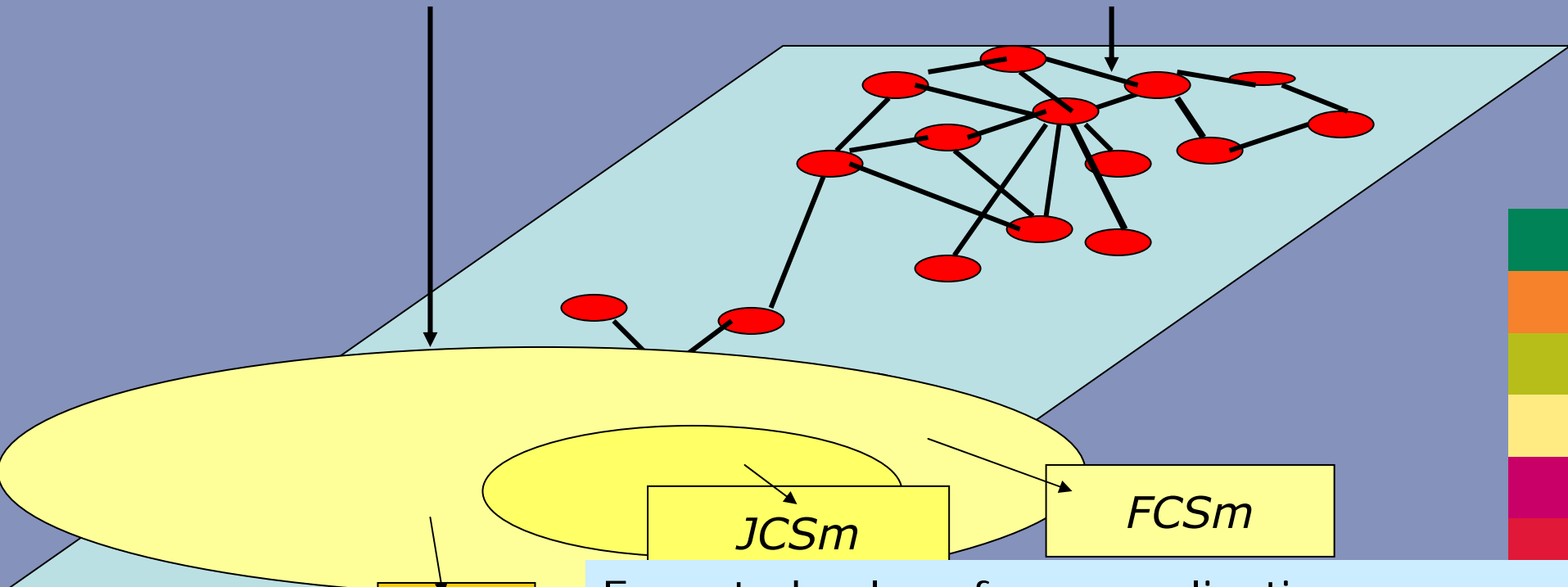
Coverage: Schools (Faculties) TUD



Network of publications (nodes) linked by citations (edges)

Lower citation-density
*e.g., applied research,
social sciences*

Higher citation-density
*e.g., basic natural
medical research*



Expected values for normalization
Absolutely necessary but.....are they
appropriate?

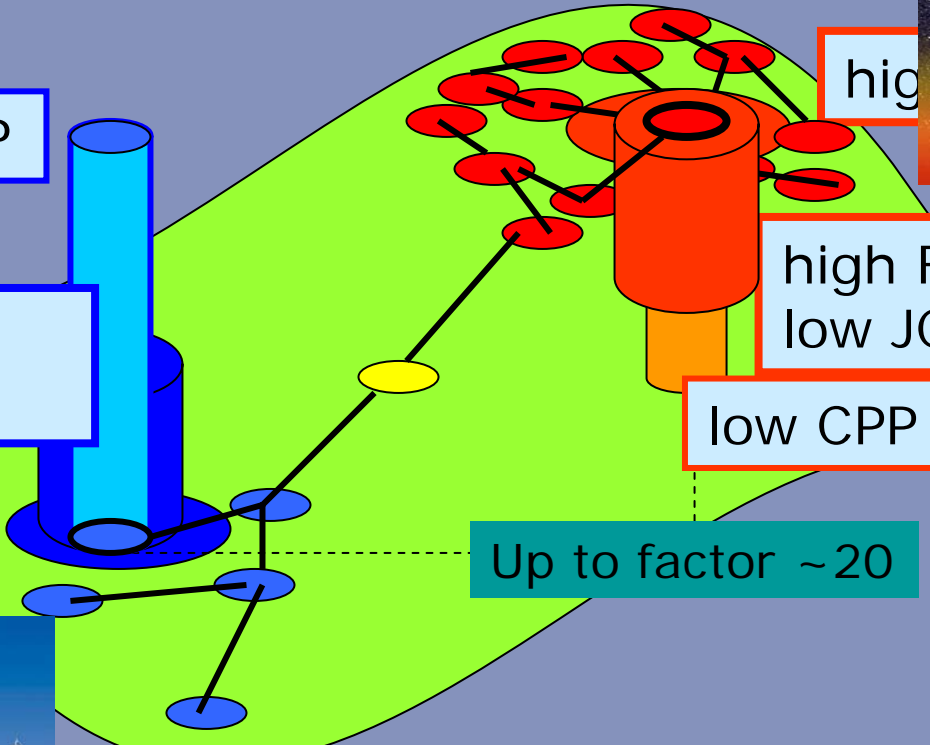
Basic res



High CPP

low FCSm, but high JCSm

low FCSm



high

high FCSm, but low JCSm

low CPP

Up to factor ~20

earch,



Citing publications

Field-specific normalization

$C(A)/P(A)$

----- = $CPP/FCSm$

$C(f)/P(f)$

cf

+ *doc. type normalization*

+ *no self-citations, also not in $C(f)$!*

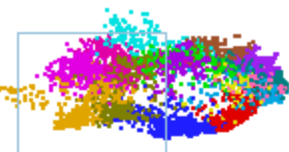
Cited publications

CWTS applies three types of field definitions: sets of journals, classification codes, word-correlation maps

Field = set of journals
'established fields'
*scientific **medium-grained** structure*

+ reference-based re-definition
(expansion) of fields

Label View Density View Cluster Density View Scatter View



Find VOS Options

Find items

Find

Show item

measurement

meat sci

meccanica

mech age d

mech devel

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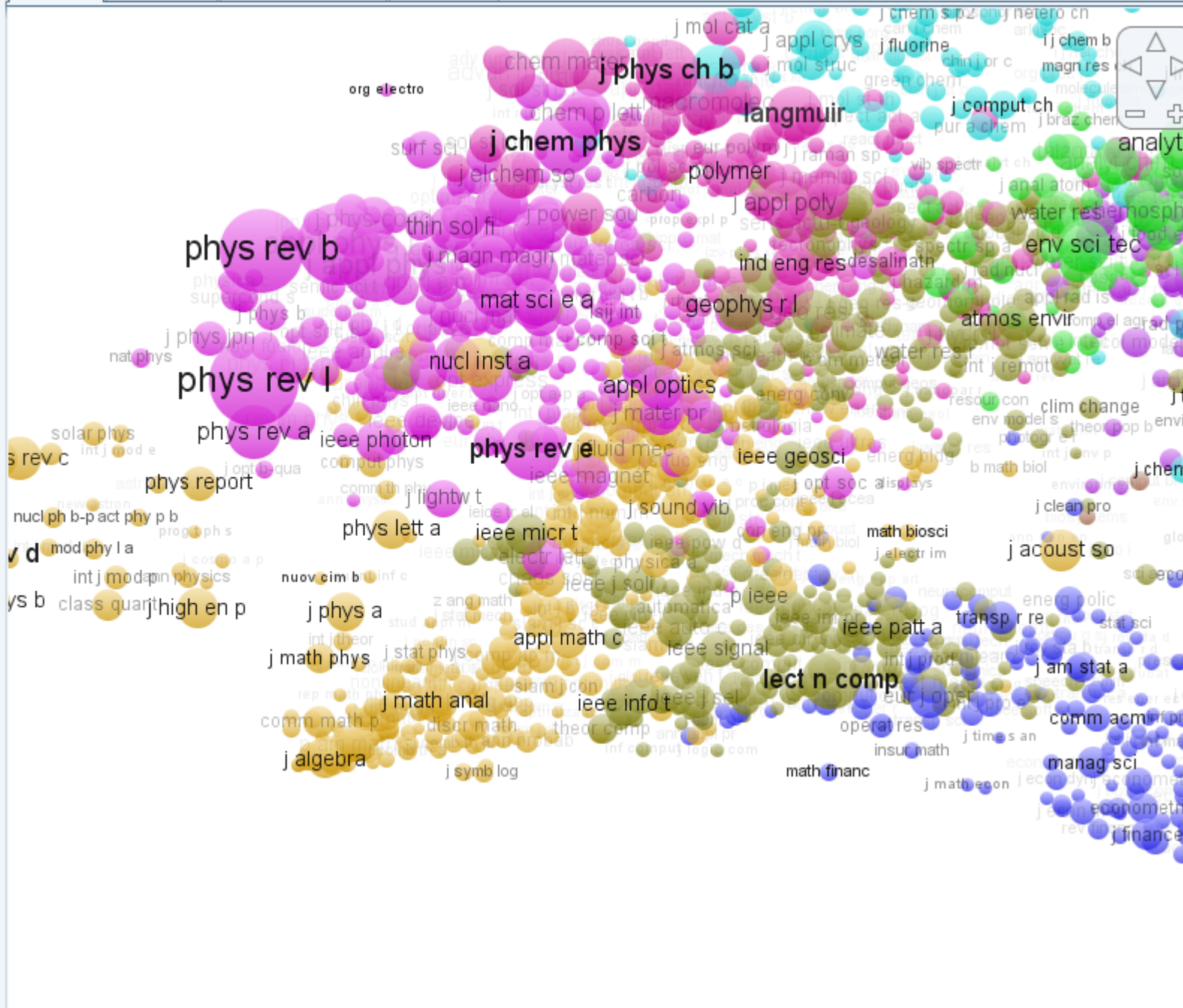
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Show





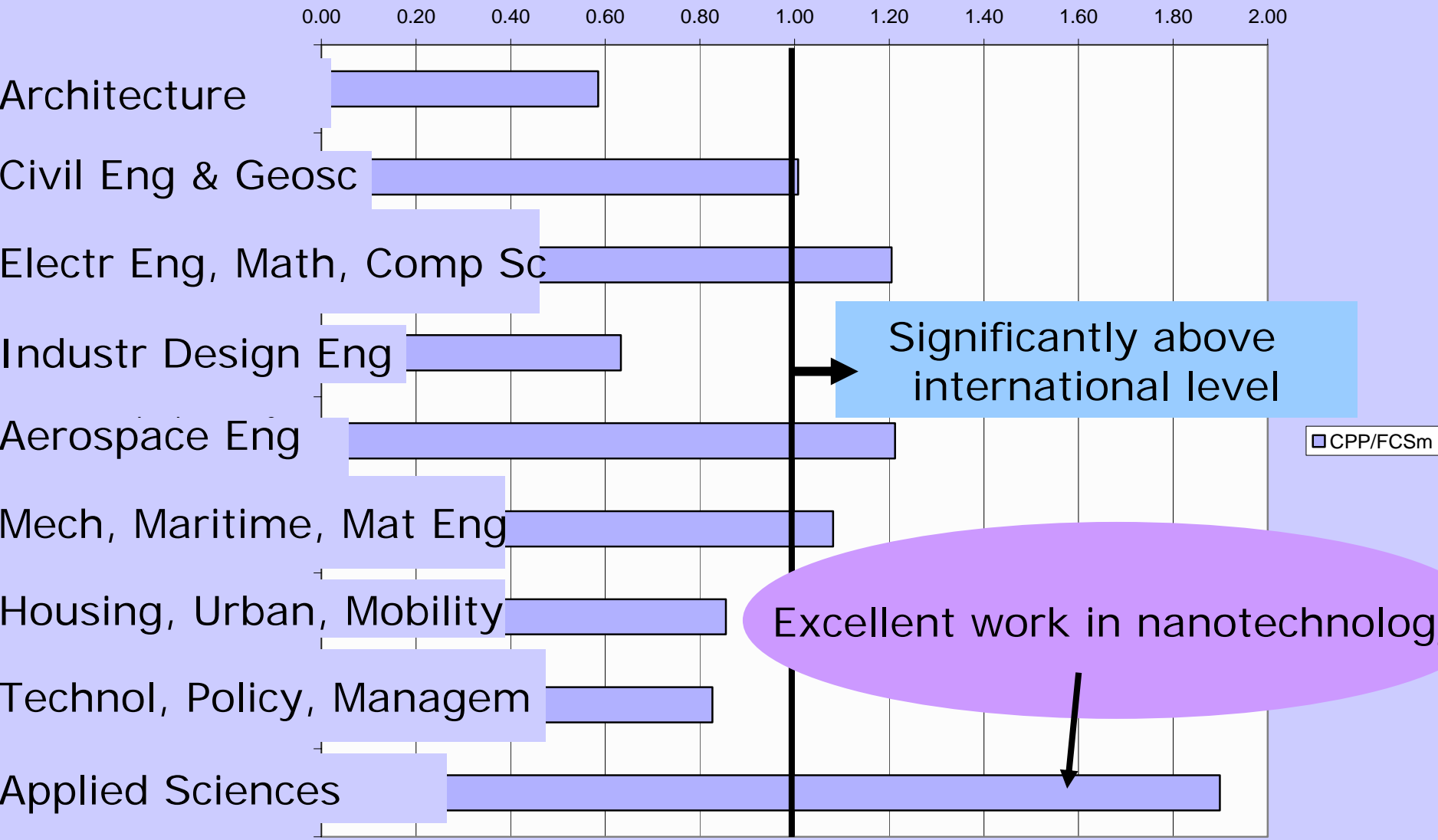
EPF Lausanne

Period	P	C+sc	CPP +sc	CPP	Pnc	CPP/ JCSm	CPP/ FCSm	JCSm/ FCSm	Scit
1994 - 2003	8,657	78,439	9.06	6.71	35%	1.30	1.61	1.22	26%
1994 - 1997	2,820	9,084	3.22	2.06	59%	1.26	1.53	1.19	36%
1995 - 1998	3,067	9,429	3.07	1.92	59%	1.21	1.40	1.15	38%
1996 - 1999	3,349	10,526	3.14	1.93	56%	1.14	1.39	1.19	38%
1997 - 2000	3,494	11,951	3.42	2.20	55%	1.21	1.53	1.23	36%
1998 - 2001	3,618	12,992	3.59	2.32	54%	1.20	1.54	1.25	36%
1999 - 2002	3,731	13,210	3.54	2.30	54%	1.19	1.51	1.24	35%
2000 - 2003	4,027	14,353	3.56	2.36	54%	1.21	1.52	1.24	34%

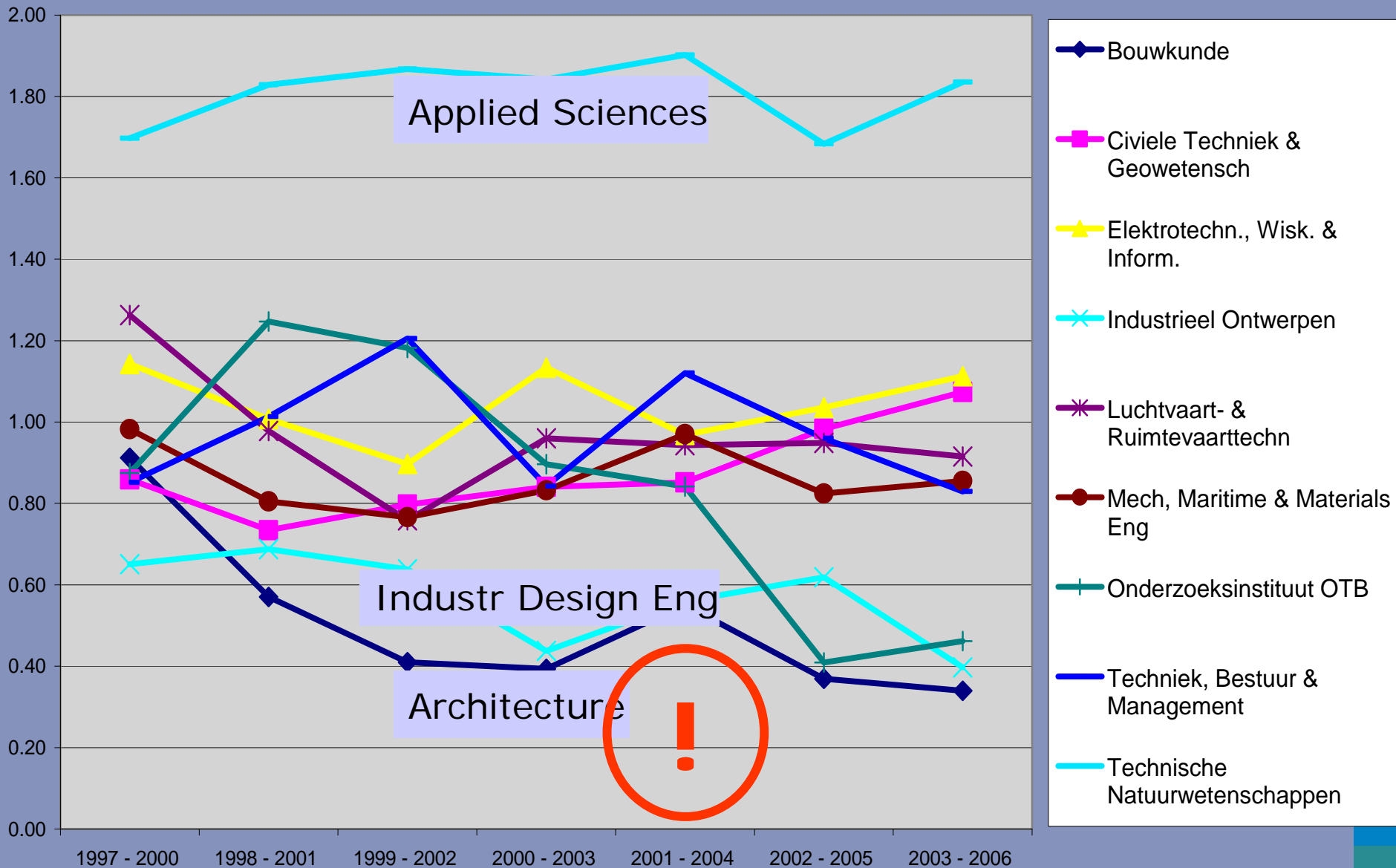
EPF Lausanne

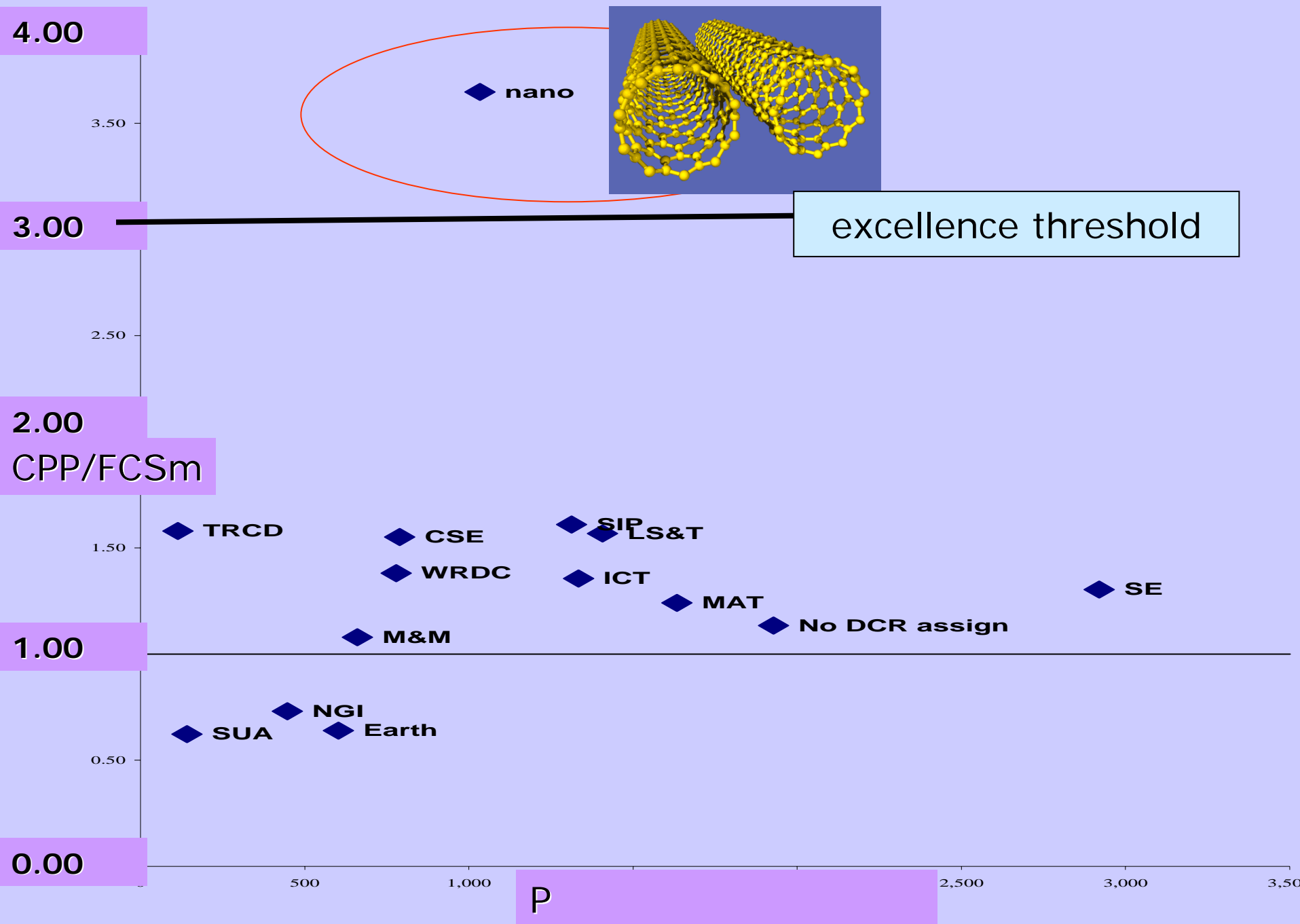
	P	C+sc	CPP +sc	CPP	Pnc	CPP/ JCSm	CPP/ FCSm	JCSm/ FCSm	Scit
EPFL group	3,164	27,237	8.61	6.55	35%	1.34	1.57	1.18	24%
NATIONAL	1,313	11,049	8.42	6.17	33%	1.21	1.42	1.17	27%
INTERNAT	4,173	40,093	9.61	7.01	36%	1.29	1.69	1.31	27%

Impact of TUD Schools, *CPP/FCSm* recent years

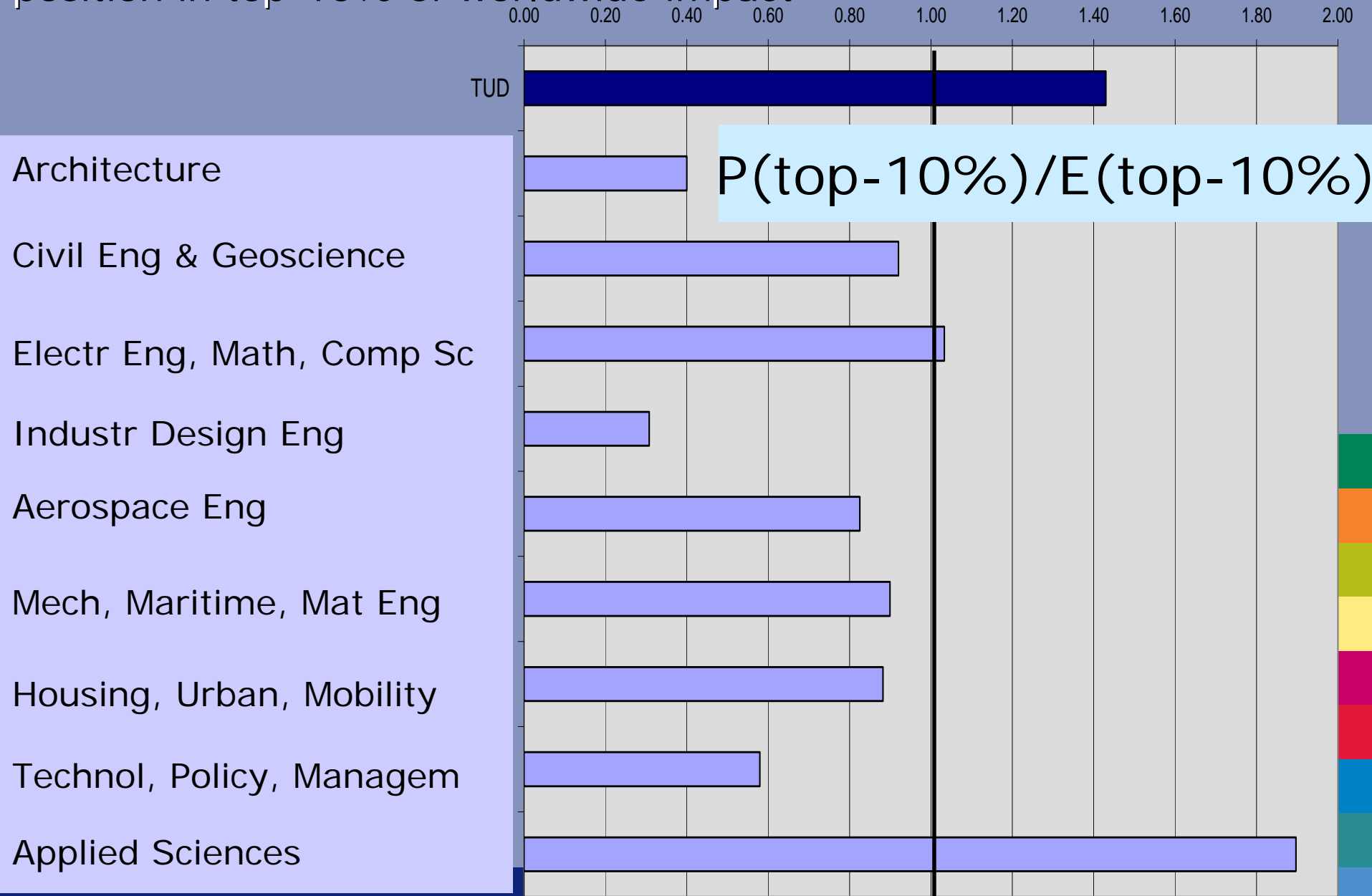


Impact of TUD Schools, *CPP/FCSm* trend





Impact of TUD Schools, position in top-10% of worldwide impact

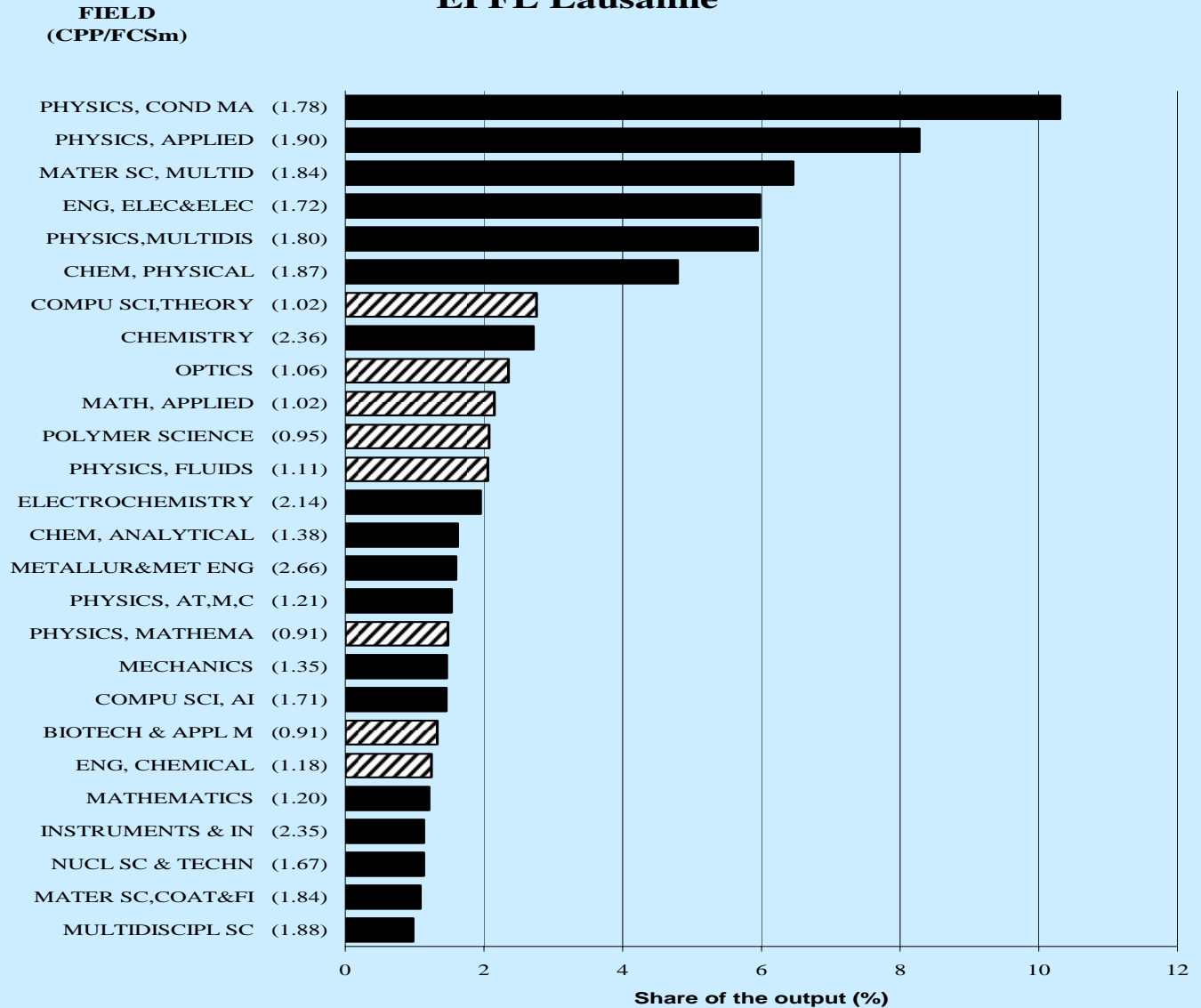


Research profile

Output and impact per field

1994 - 2003

EPFL Lausanne



IMPACT:

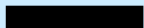
LOW



AVERAGE

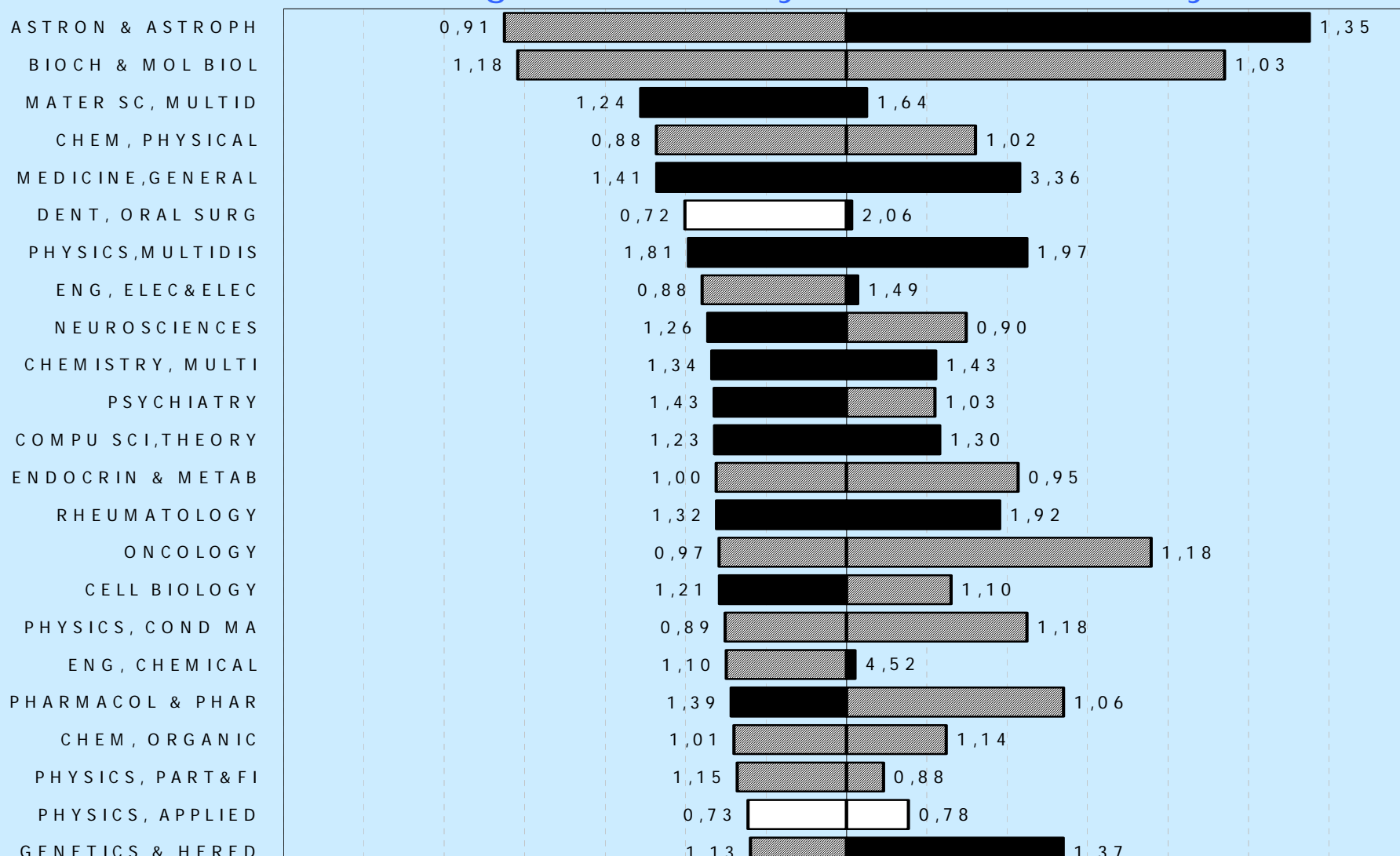


HIGH



RESEARCH AND IMPACT PROFILE COMPARISON 2000 - 2005

Large UK University vs. Leiden University



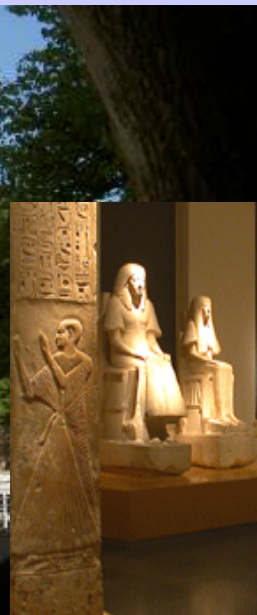
Conclusion

Advanced bibliometric analysis is a powerful tool to make research assessment more **objective**, **transparent** and **effective**, and to reveal **important aspects** of research performance, particularly in the natural science and medical fields, but **also in the engineering** and social science fields

- more and more scientific results are published in journals
- more and more journals are covered in the WoS
- but still: take coverage into account
- never use bibliometric analysis as a stand-alone tool!**



Thank you for your attention



Appendix

Application of Thomson-ISI Impact Factors for research performance evaluation is **irresponsible**

- * Much too short 'Citation window'
- * No Field-specific Normalization
- * No distinction between document types
- * Calculation errors/inconsistencies
nominator/denominator
- * Underlying citation distribution is very skew:
IF-value heavily determined by a few very highly cited papers

Example: *The Lancet*

	Publs	Cits
	2000+01	2002
Art	784	7134
Not	144	593
Rev	29	232
<i>Subtot</i>	<i>957(a)</i>	<i>7959(b)</i>
Let	4181	4264
Edi	1313	905
Other	1421	909
<i>Total</i>	<i>7872</i>	<i>14037 (c)</i>

ISI IF

Citations in 2002
Citeable documents in 2000 and 2001

$$\frac{14037 \text{ (c)}}{957 \text{ (a)}} \longrightarrow \text{IF} = 14.7$$

CWTS IF

Citations to Art/Not/Rev in 2002
Art/Not/Rev in 2000 and 2001

$$\frac{7959 \text{ (b)}}{957 \text{ (a)}} \longrightarrow \text{IF} = 8.3$$

Citations to Art/Let/Not/Rev in 2002
Art/Let/Not/Rev in 2000 and 2001

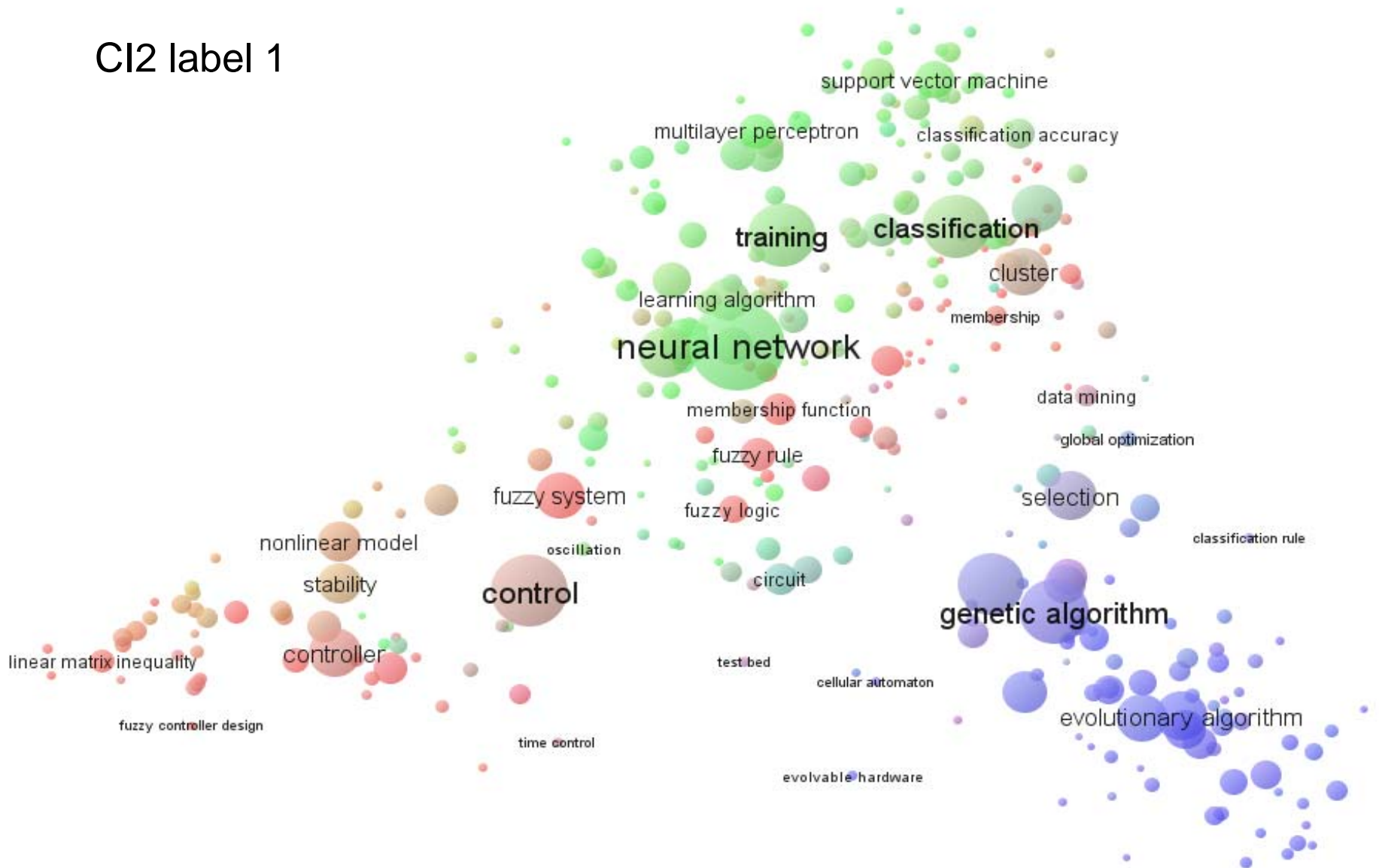
$$\frac{7959+4264}{957+4181} \longrightarrow \text{IF} = 2.4$$

..and on the basis of the 30,000,000 grammatically parsed publication abstracts (1980-2008):

2. Field = clusters of concept-related publications

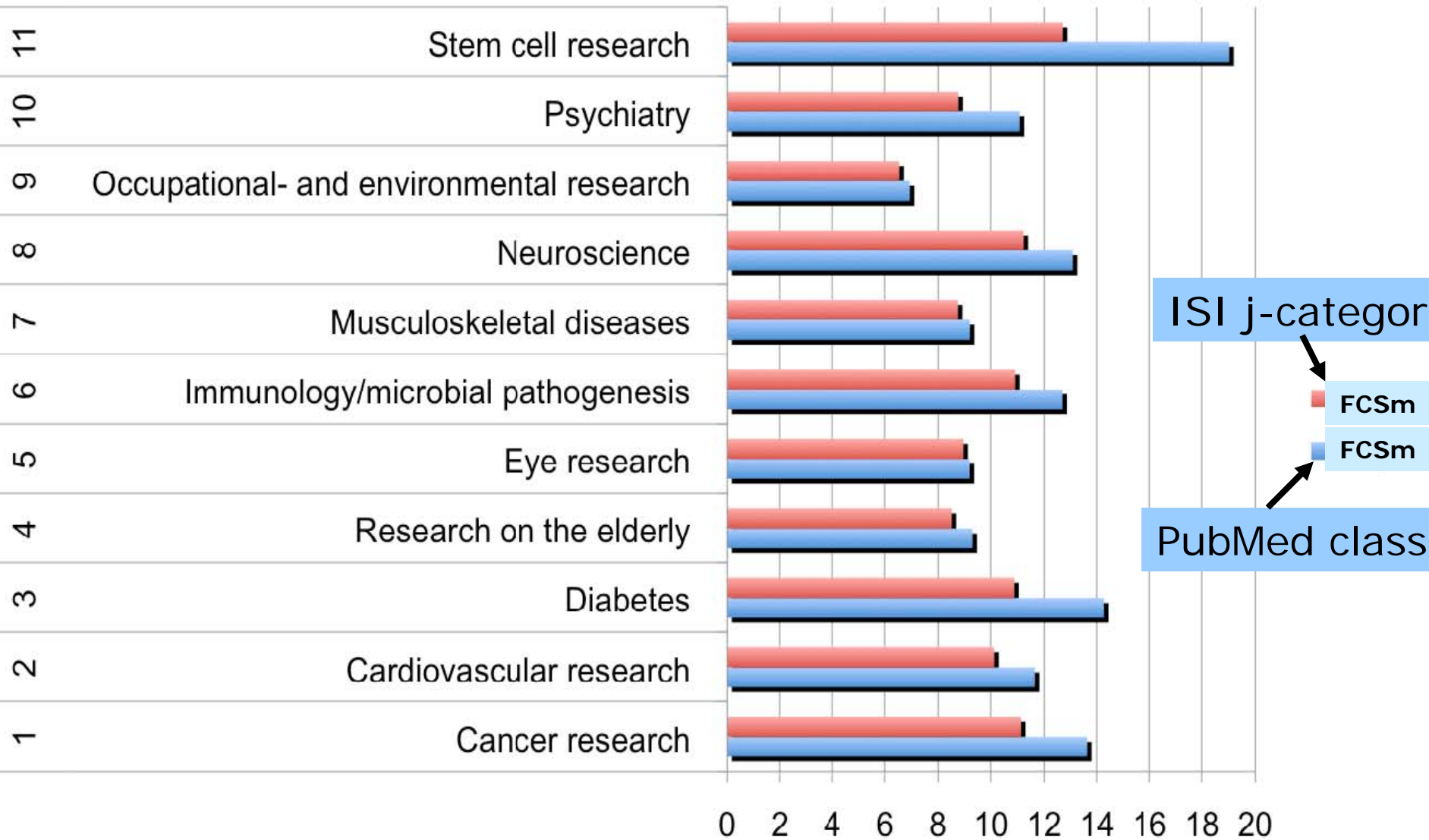
new, emerging often interdisc. Fields
scientific fine-grained structure

CI2 label 1



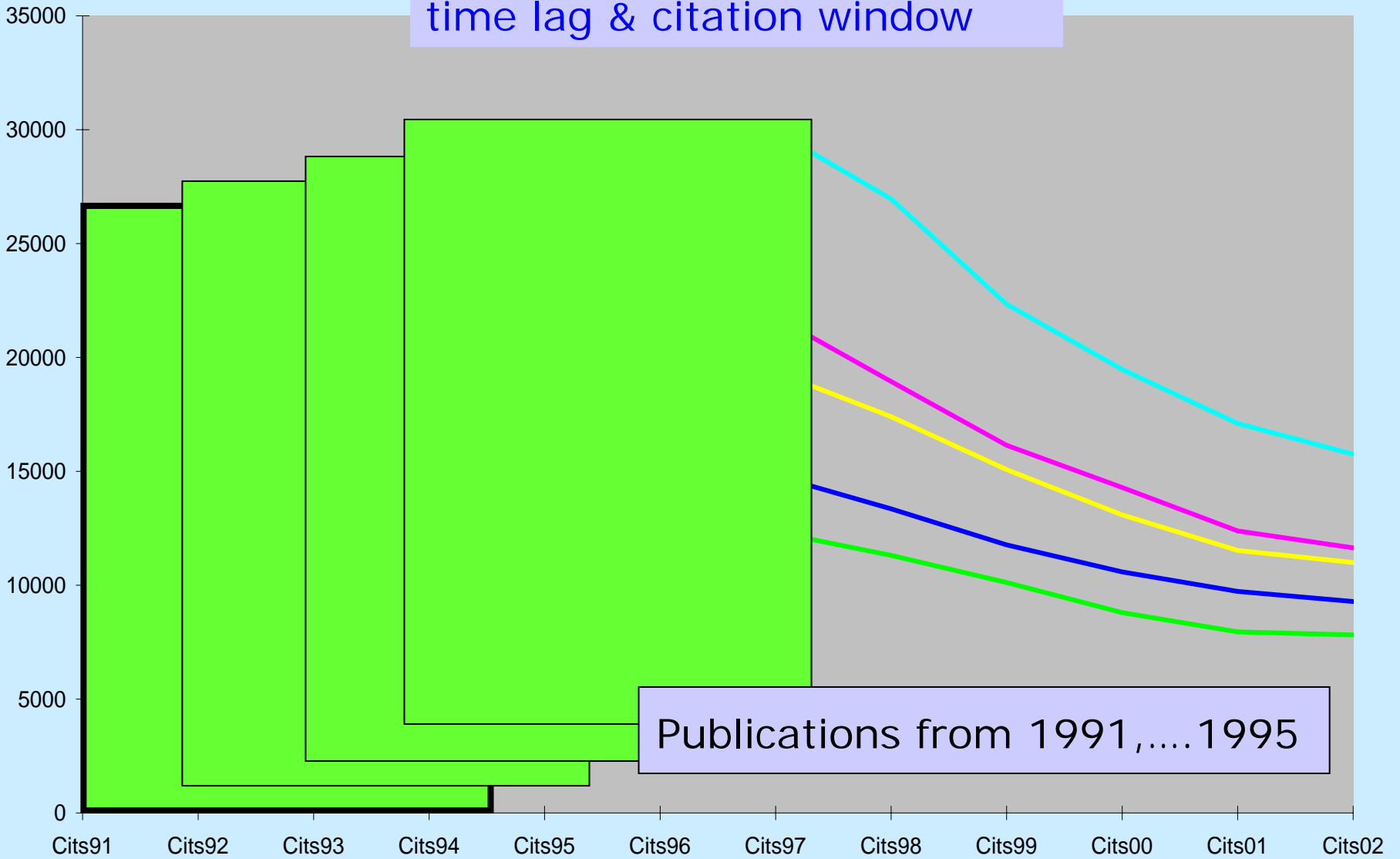
3. Field = set of publications with thematic/field-specific classification codes
e.g., from INSPEC
again for new, emerging often interdisc. fields
scientific fine-grained structure

Problem of the 'right' FCSm.....



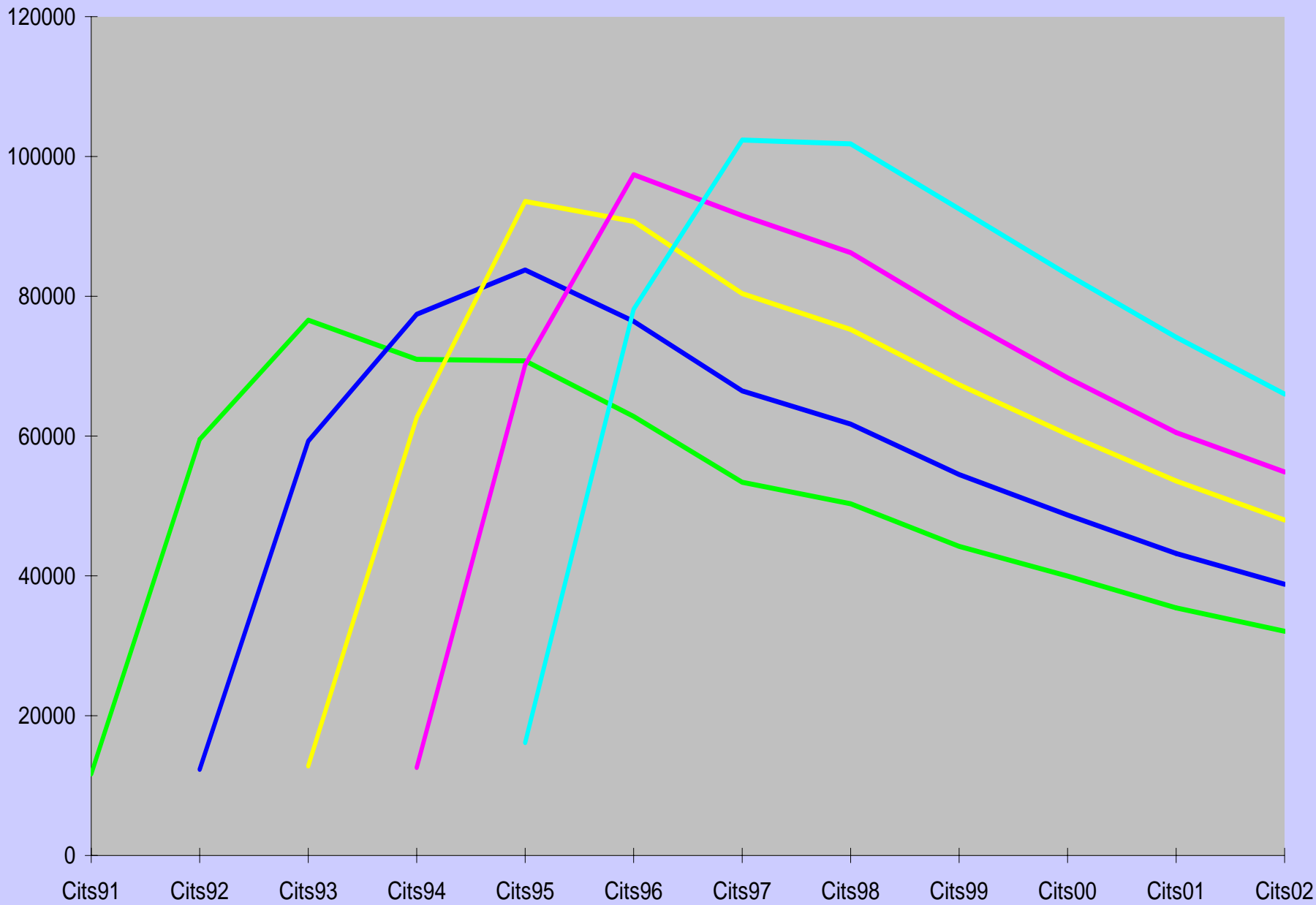
PHYSICS

time lag & citation window

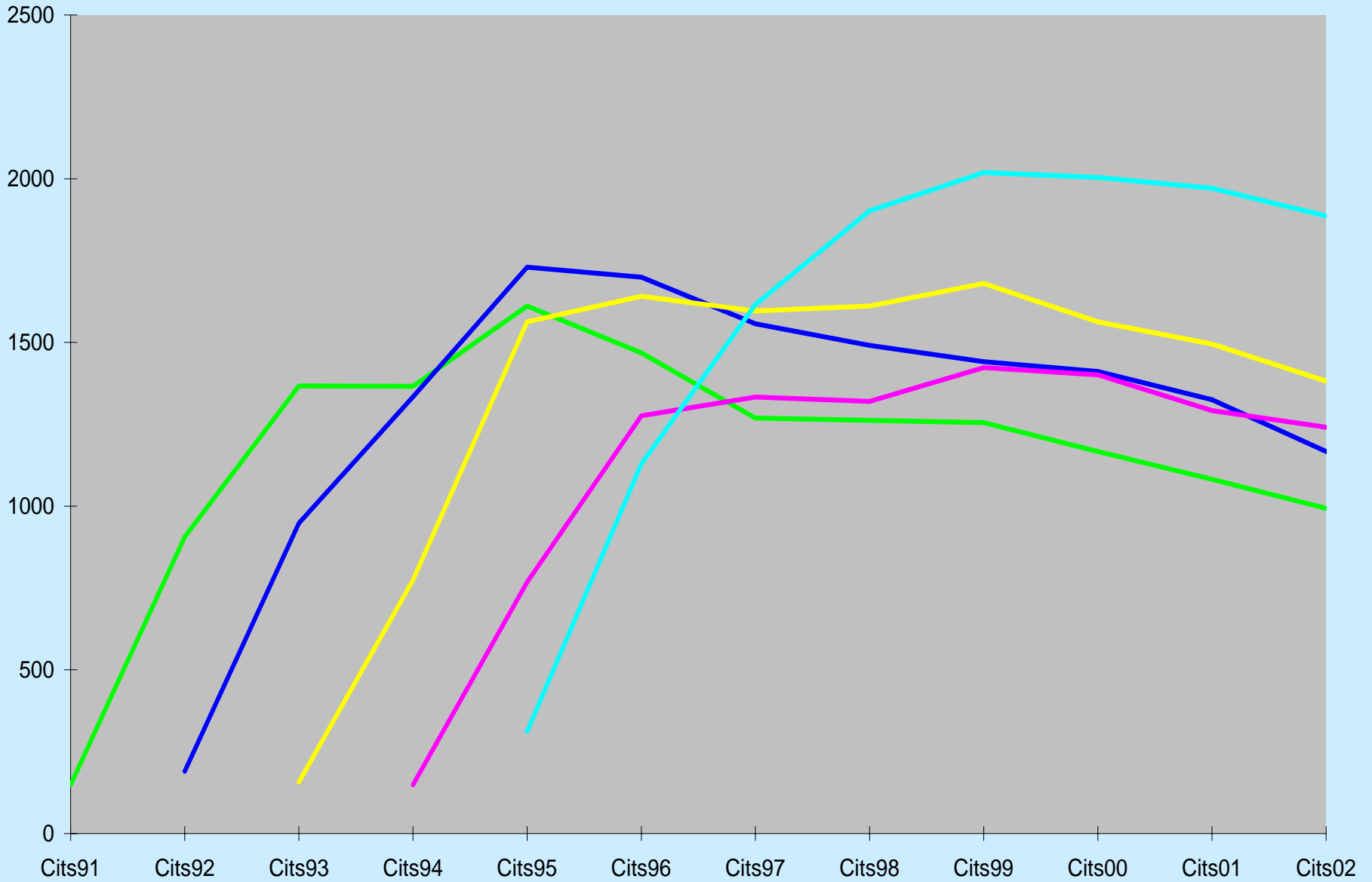


Publications from 1991,.....1995

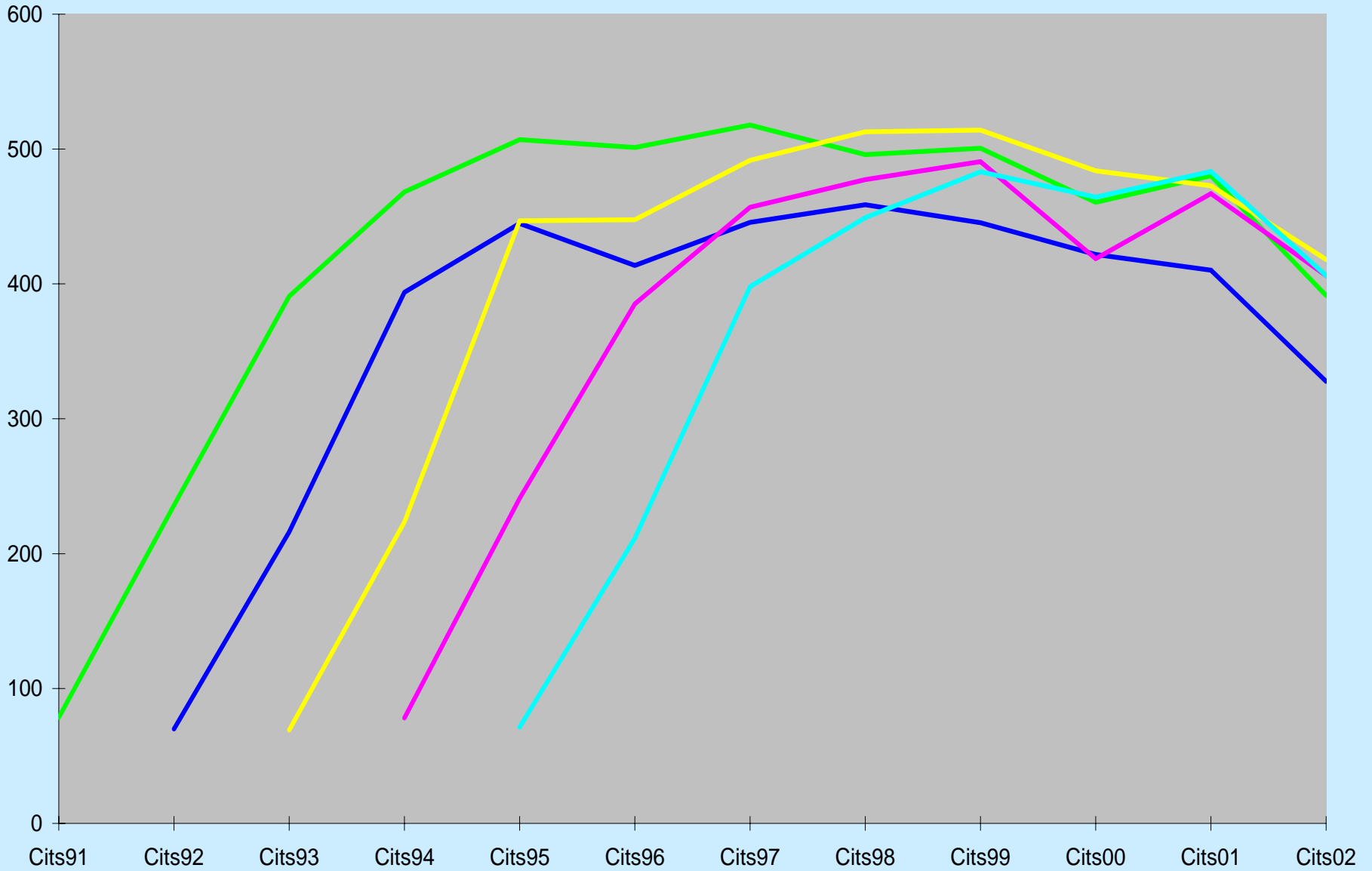
BIOCH & MOL BIOL



*** SOCIOLOGY**



*** LANGUAGE&LING**



Departments

'bottom-up' analysis: input data (assignment of researchers to departments) necessary;
> *Detailed research performance analysis of a university by department*

University

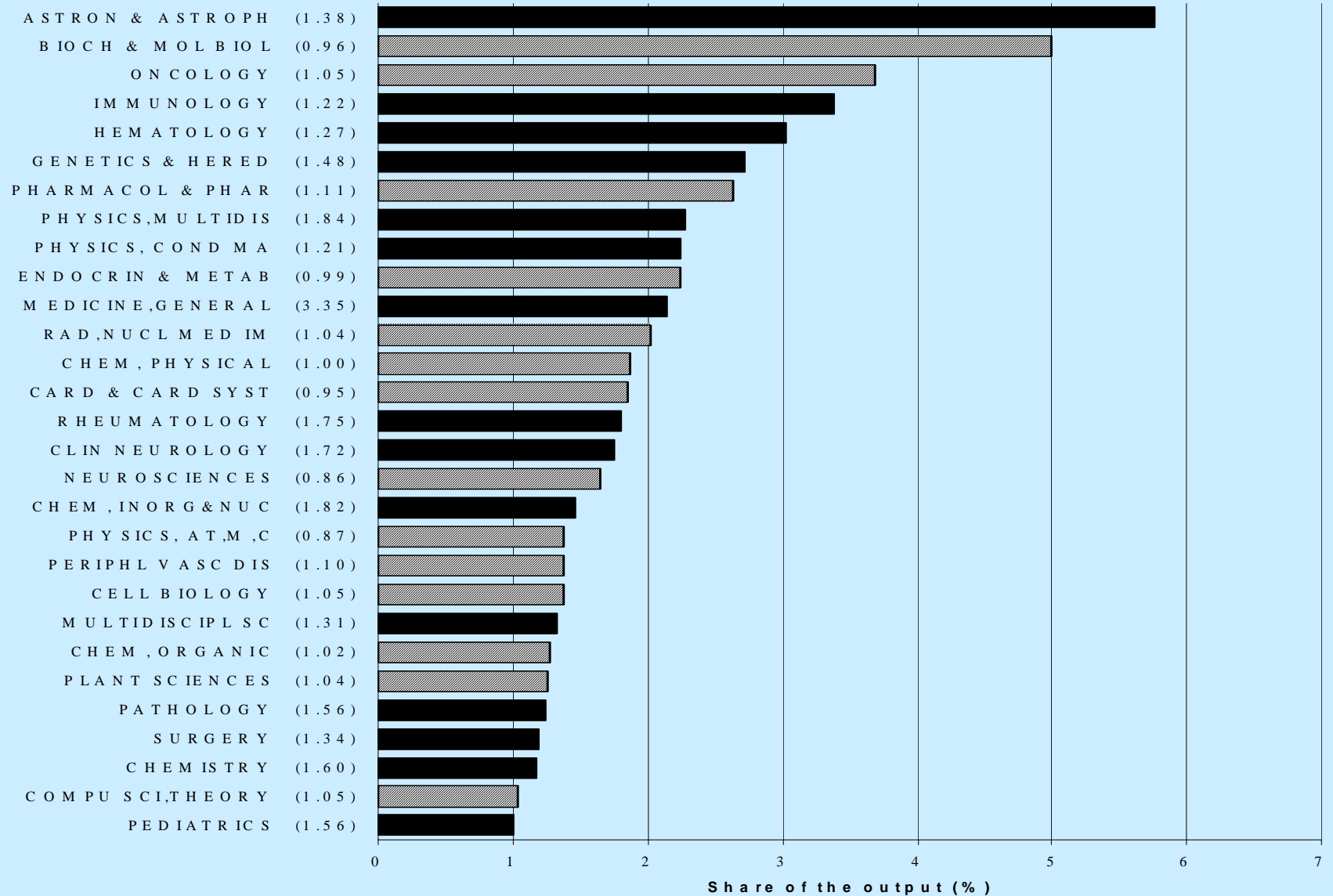
Fields

'top-down' analysis: field-structure is imposed to university;
> *Broad overview analysis of a university by field*

Output and impact per field 2000 - 2003

Leiden University

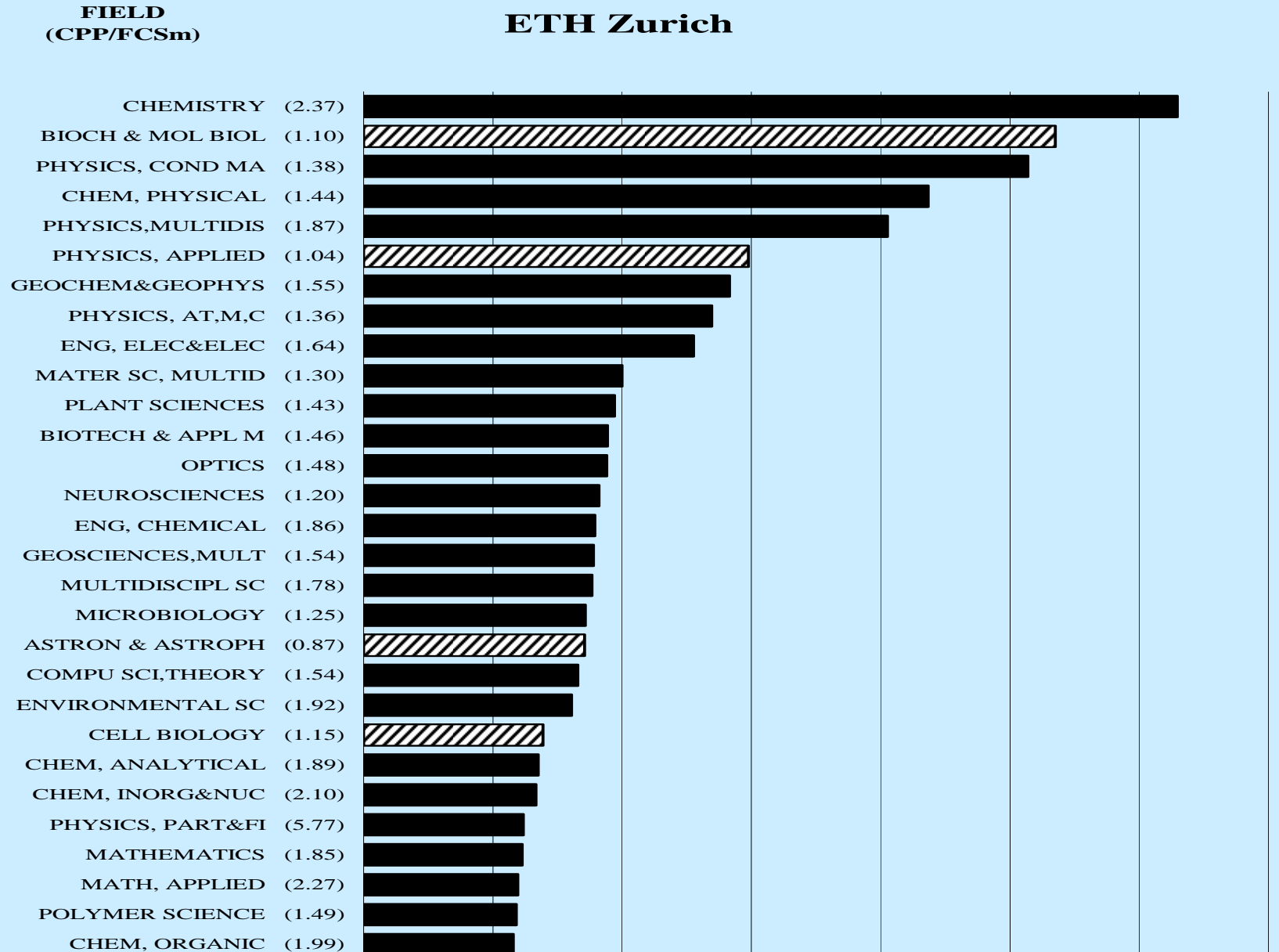
FIELD
(CPP/FCSm)

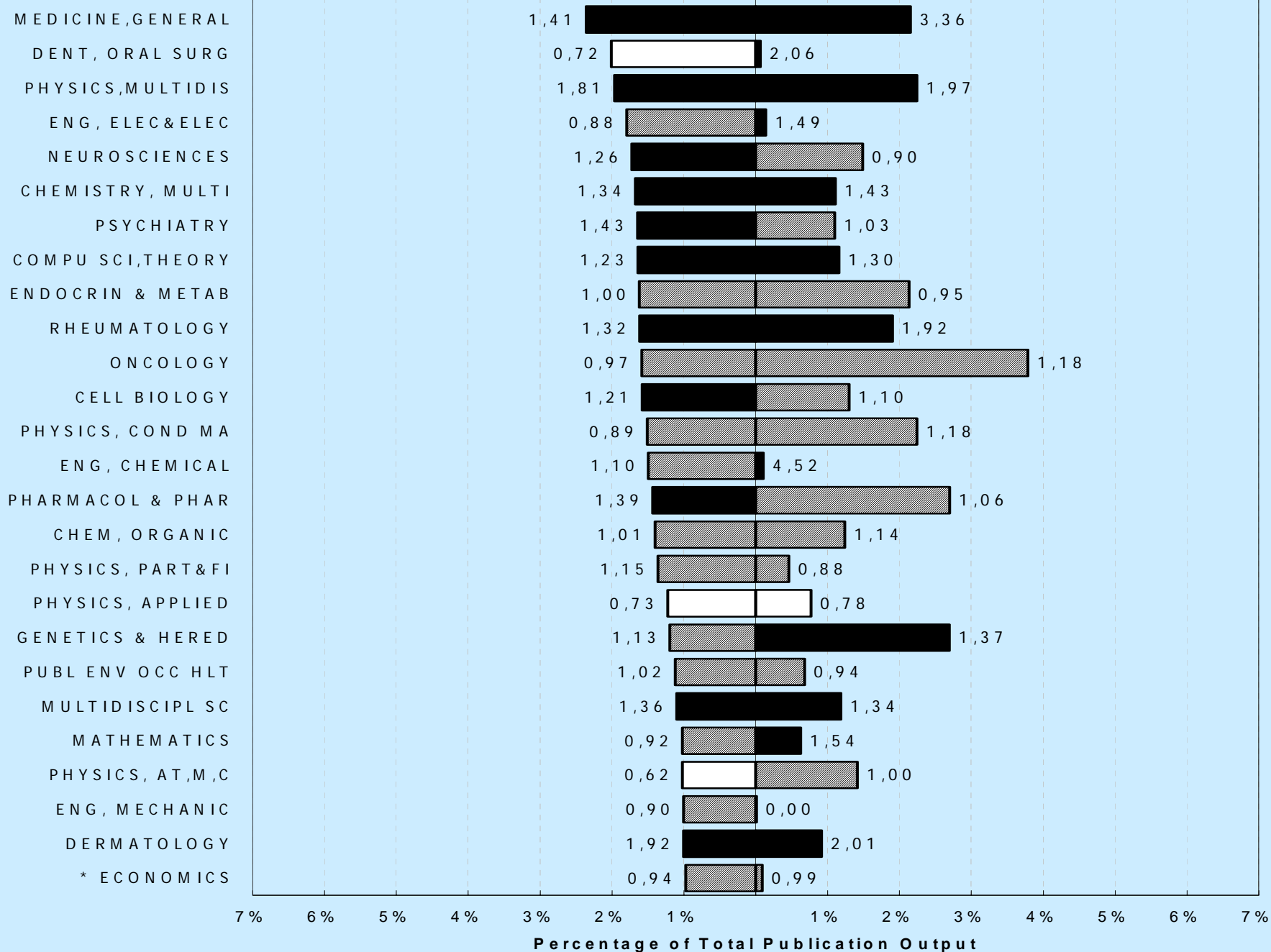


RESEARCH PROFILE

Output and impact per field

1994 - 2003





IMPACT:

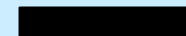
LOW



AVERAGE



HIGH



RESEARCH PROFILE: OUTPUT AND IMPACT PER FIELD 2000 - 2005

AMOLF

FIELD
(CPP/FCSm)

FIGURE 2b:

RESEARCH PROFILE:
OUTPUT AND IMPACT PER FIELD
2000 - 2005

AMOLF-NOEM

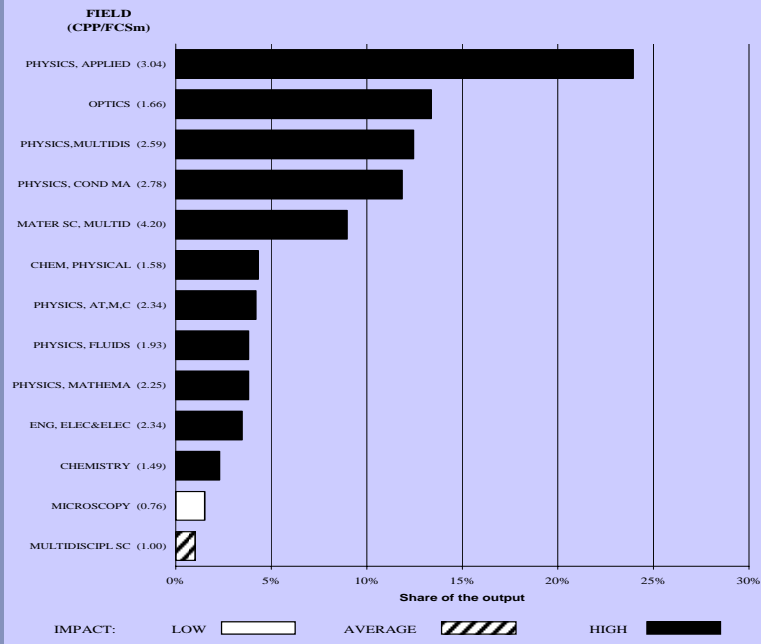
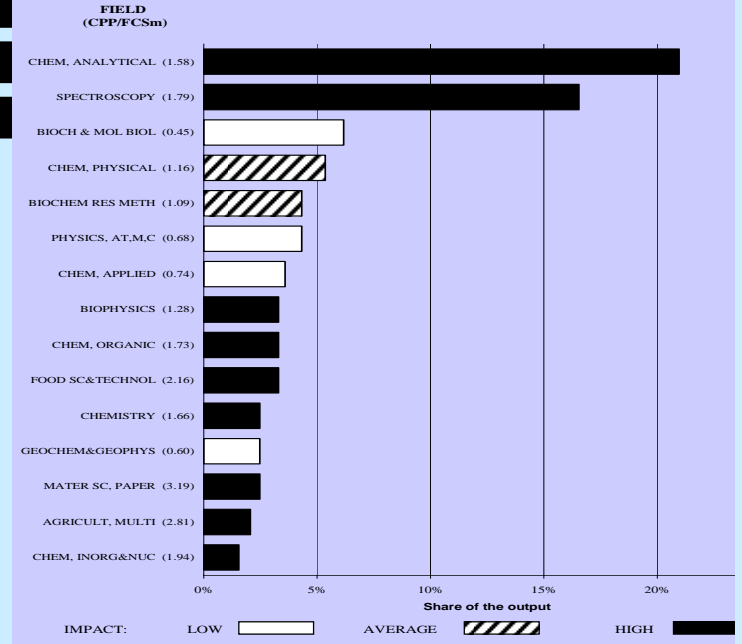


FIGURE 2a:

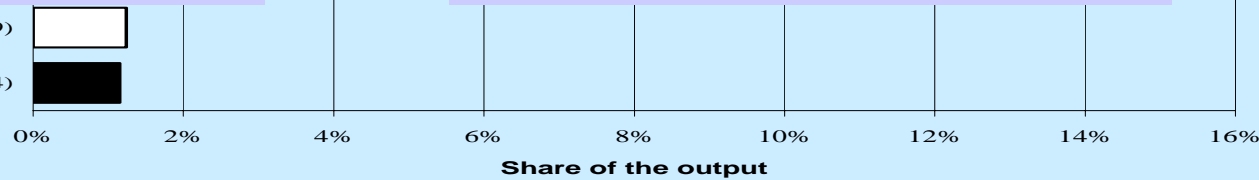
RESEARCH PROFILE:
OUTPUT AND IMPACT PER FIELD
2000 - 2005

AMOLF-MSMS



BIOCH & MOL BIOL (0.49)

ENG, ELEC&ELEC (2.34)



IMPACT:

LOW



AVERAGE



HIGH

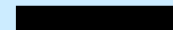
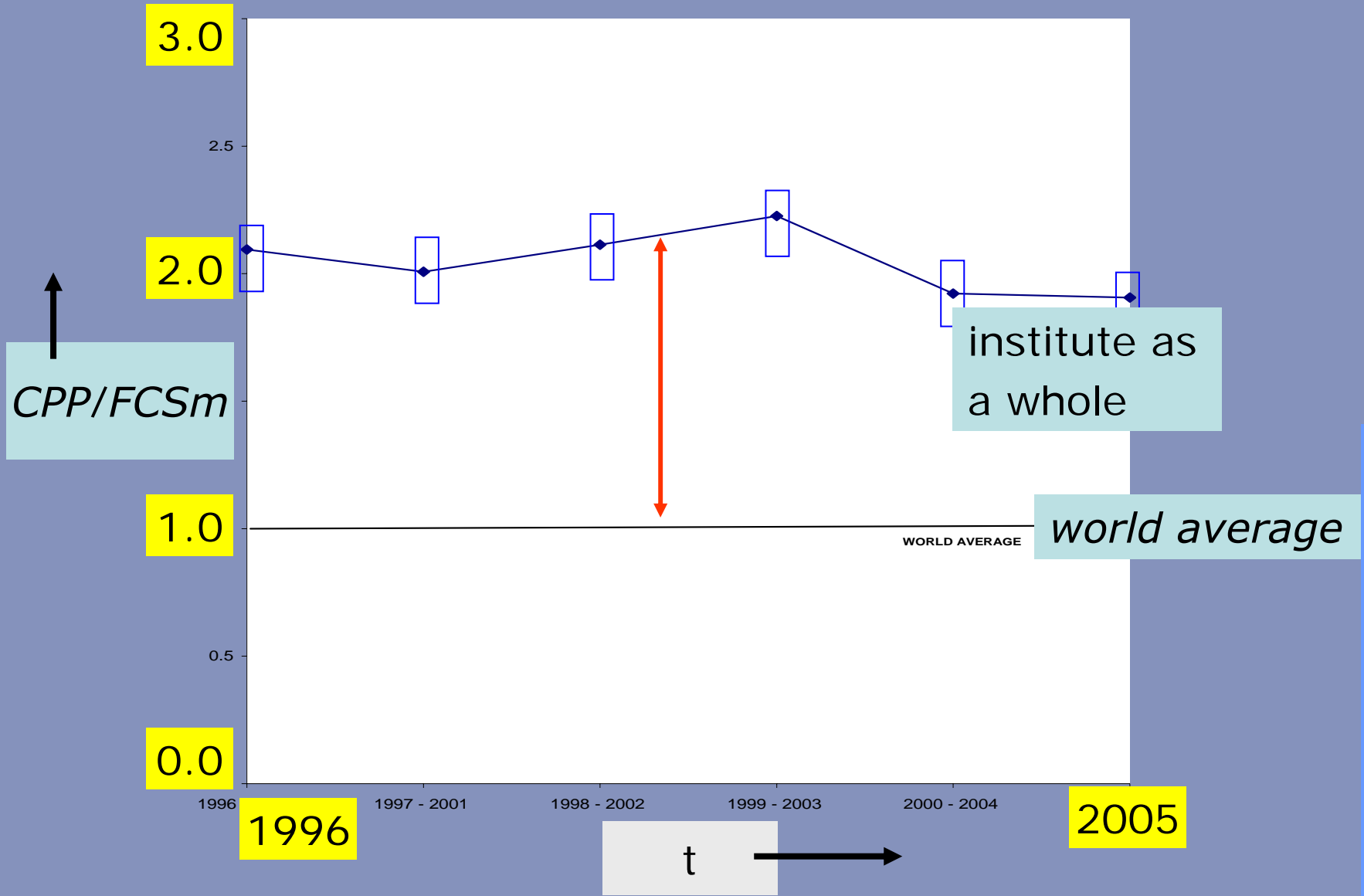
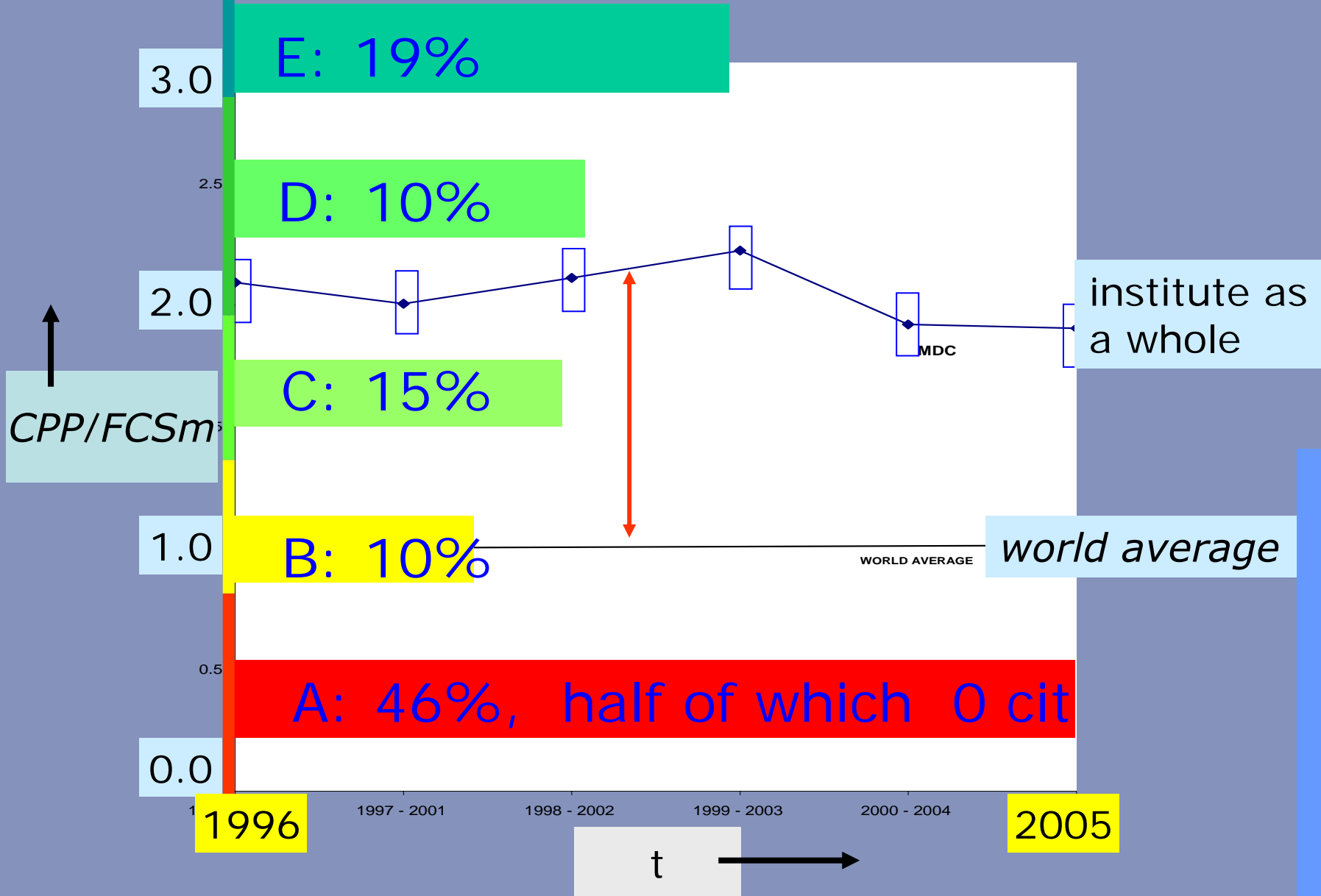


FIGURE 1 :
TREND IN IMPACT PER PUBLICATION
COMPARED TO WORLD SUBFIELD AVERAGE



**FIGURE 1 :
TREND IN IMPACT PER PUBLICATION
COMPARED TO WORLD SUBFIELD AVERAGE**





Gerard 'tHooft

Martinus Veltman

shold

Nobel Prize in Physics 1999

CPP/FCSm in 1980-1998:

3.94

$P \longrightarrow$

4.01

250

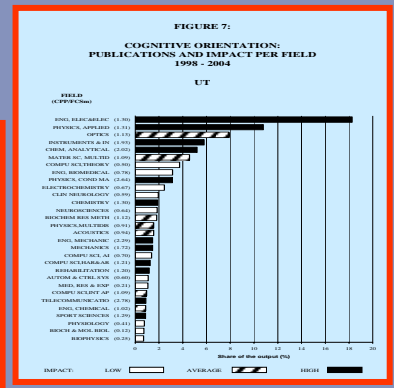
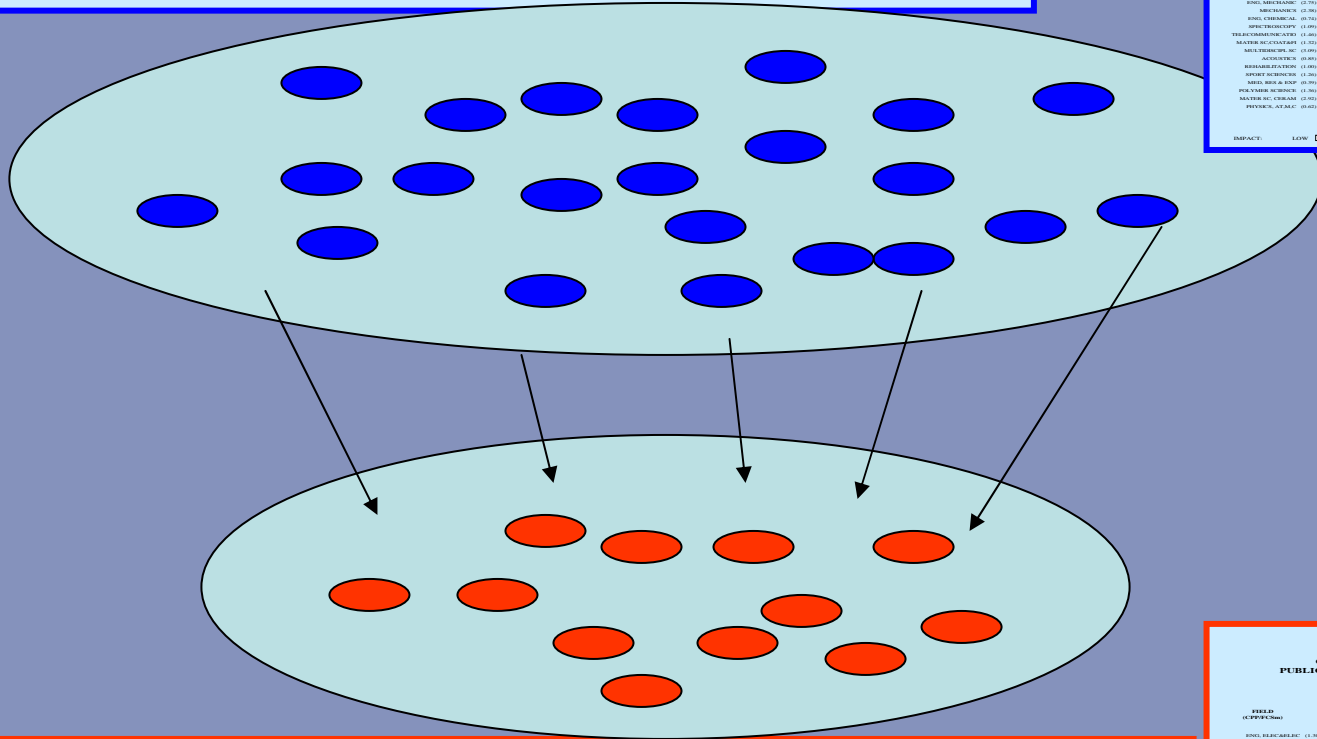
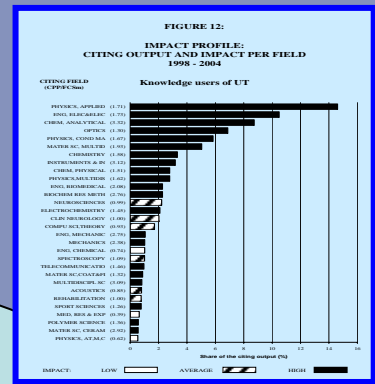
375

25

750

NL-PHYS

Citing Publications: Knowledge users with field-specific profile

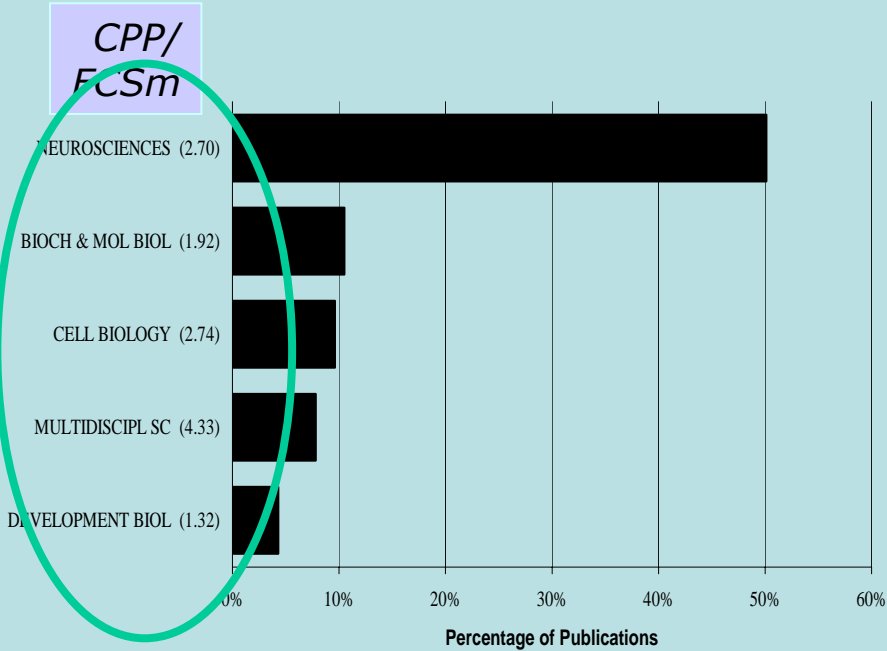


Cited Publications: Knowledge producers with field-specific profile

Diseases of the Neurosystem

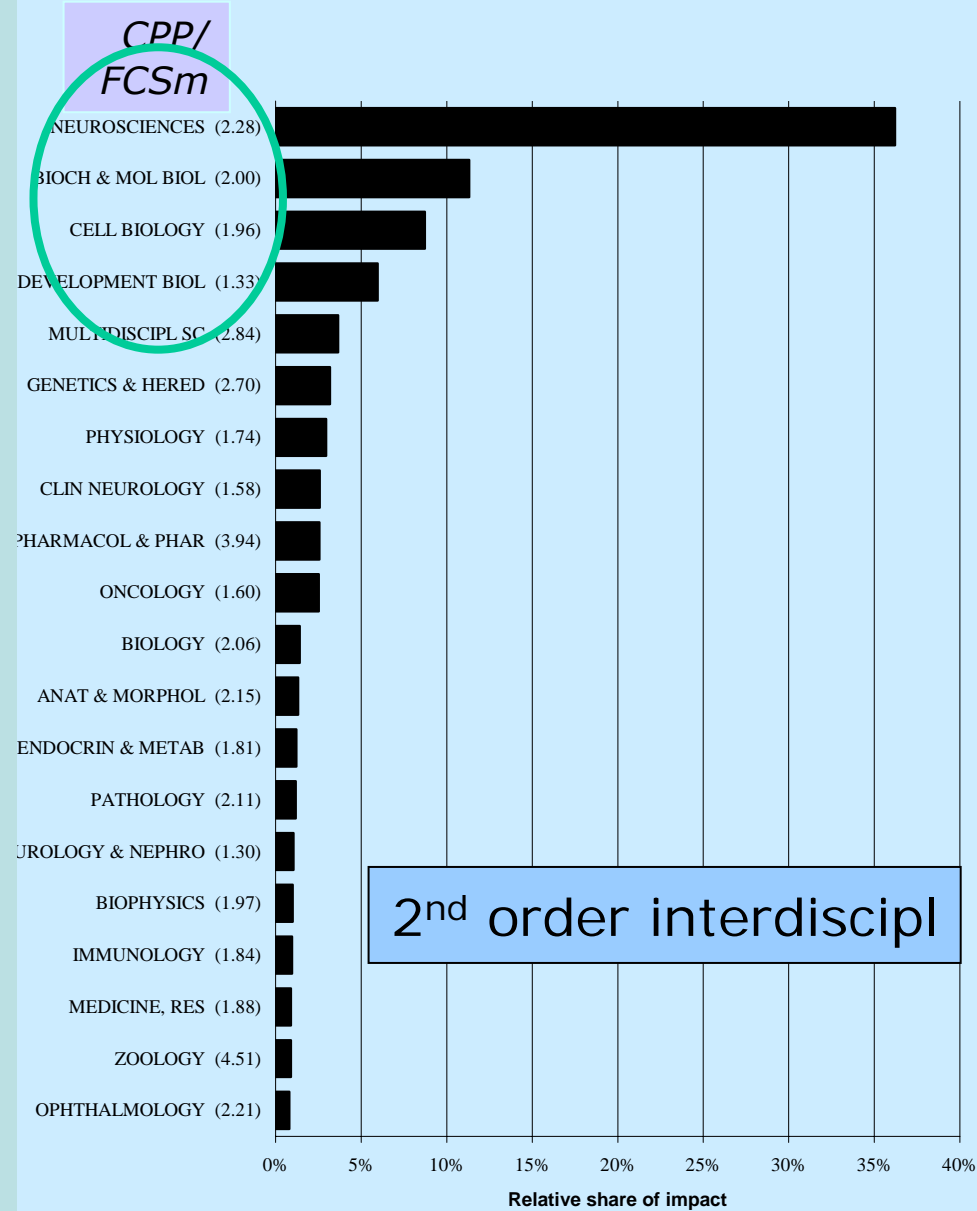
Dept Output In Fields

Dept Impact From Fields



1st order interdiscipl

IMPACT: LOW AVERAGE HIGH



2nd order interdiscipl

IMPACT: LOW AVERAGE HIGH

CWTS has a unique bibliometric data-system:

(1) 1000 universities worldwide are defined and 'unified' as accurate as possible;

(2) For these universities all bibliometric indicators are calculated and updated, in particular:

P , C , $CPP/FCSm$, $P*CPP/FCSm$, $Pt/\Pi t$ (Top5%)

*for the universities as a whole (average over all fields) and for each of the 16 main fields: **Ranking***

(3) Compares any of these universities with any selection:
Benchmarking

There are in the world ~500 largest
universities with $P > 700/y$

University		P	C	CPP	Pnc	CPP/ FCSm
UK	UNIV CAMBRIDGE	37,972	438,892	11.56	27%	1.67
UK	UNIV COLL LONDON	36,889	414,034	11.22	25%	1.46
UK	UNIV OXFORD	35,979	429,642	11.94	27%	1.69
UK	IMPERIAL COLL LONDON	29,829	300,030	10.06	27%	1.48
FR	UNIV PARIS VI P&M CURIE	26,301	192,269	7.31	31%	1.16
BE	KATHOLIEKE UNIV LEUVEN	25,892	203,657	7.87	31%	1.28
DK	KOBENHAVNS UNIV	25,519	216,152	8.47	26%	1.24
UK	UNIV MANCHESTER	25,358	180,184	7.11	32%	1.20
NL	UNIV UTRECHT	25,299	232,033	9.17	26%	1.35
SE	KAROLINSKA STOCKHOLM	24,902	280,108	11.25	21%	1.28
DE	LMU					21
IT	UNIV					13
IT	UNIV					94
RU	MOS					40
SE	LUNDS UNIV	23,386	201,225	8.60	25%	1.23
FI	UNIV HELSINKI	22,976	225,207	9.80	26%	1.41
NL	UNIV AMSTERDAM	21,471	198,018	9.22	27%	1.36
DE	UNIV HEIDELBERG	20,923	187,256	8.95	27%	1.23
CH	ETH ZURICH	20,798	184,434	8.87	28%	1.54
SE	UPPSALA UNIV	19,833	168,047	8.47	27%	1.21
AT	UNIV WIEN	19,732	170,604	8.65	25%	1.07
FR	UNIV PARIS XI SUD	19,667	142,715	7.26	31%	1.17
DE	HUMBOLDT UNIV BERLIN	19,552	164,729	8.43	29%	1.15
UK	KINGS COLL UNIV LONDON	19,551	185,532	9.49	27%	1.31
CH	UNIV ZURICH	19,056	193,299	10.14	27%	1.37
ES	UNIV BARCELONA	18,773	136,105	7.25	29%	1.10
IT	UNIV BOLOGNA	18,761	114,400	6.10	34%	1.03
UK	UNIV EDINBURGH	18,734	190,753	10.18	28%	1.47
BE	UNIV GENT	18,308	117,016	6.39	35%	1.20
NL	LEIDEN UNIV	17,838	169,445	9.50	25%	1.28

Leiden Ranking 2003-2007, EU Top-100
rank by P, yellow list, first 30

University		P	C	CPP	Pnc	CPP/ FCSm
CH	UNIV LAUSANNE	10,676	132,163	12.38	25%	1.50
UK	UNIV OXFORD	35,979	429,642	11.94	27%	1.69
UK	UNIV CAMBRIDGE	37,972	438,892	11.56	27%	1.67
SE	KAROLINSKA STOCKHOLM	24,902	280,108	11.25	21%	1.28
UK	UNIV COLL LONDON	36,889	414,034	11.22	25%	1.46
CH	UNIV GENEVE	13,534	146,726	10.84	26%	1.40
CH	UNIV BASEL	11,733	127,186	10.84	25%	1.41
NL	ERASMUS UNIV ROTTERDAM	16,090	173,905	10.81	25%	1.47
UK	UNIV EDINBURGH	18,734	190,753	10.18	28%	1.47
CH	UNIV BASEL STADT	11,733	127,186	10.18	25%	1.37
UK	IMPERIAL COLLEGE LONDON	17,838	169,445	9.53	25%	1.48
DE	JGU ERLANGEN NUREMBERG	16,090	173,905	9.53	25%	1.20
FI	UNIV HELSINKI	18,734	190,753	9.53	28%	1.41
DE	H HEINE UNIV DUSSELDORF	10,007	95,318	9.53	25%	1.18
NL	LEIDEN UNIV	17,838	169,445	9.50	25%	1.28
FR	UNIV PARIS V RENE DESCARTES	11,368	107,981	9.50	28%	1.18
UK	KINGS COLL UNIV LONDON	19,551	185,532	9.49	27%	1.31
NL	VRIJE UNIV AMSTERDAM	16,591	153,807	9.27	26%	1.38
NL	UNIV AMSTERDAM	21,471	198,018	9.22	27%	1.36
NL	UNIV UTRECHT	25,299	232,033	9.17	26%	1.35
UK	UNIV GLASGOW	15,918	143,741	9.03	28%	1.33
DE	UNIV HEIDELBERG	20,923	187,256	8.95	27%	1.23
SE	GOTEBORG UNIV	15,565	138,594	8.90	24%	1.21
DE	LMU UNIV MUNCHEN	24,809	220,115	8.87	29%	1.21
CH	ETH ZURICH	20,798	184,434	8.87	28%	1.54
DE	UNIV FREIBURG	13,992	123,993	8.86	27%	1.21
DE	J W GOETHE UNIV FRANKFORT	12,586	110,999	8.82	30%	1.26
DE	BJM UNIV WURZBURG	12,632	109,771	8.69	26%	1.13
AT	UNIV WIEN	19,732	170,604	8.65	25%	1.07
SE	LUNDS UNIV	23,386	201,225	8.60	25%	1.23

Leiden Ranking 2003-2007, EU Top-100
rank by CPP, blue list, first 30

University		P	C	CPP	Pnc	CPP/ FCSm	brute force
UK	UNIV OXFORD	35,979	429,642	11.94	27%	1.69	60783
UK	UNIV CAMBRIDGE	37,972	438,892	11.56	27%	1.67	63345
CH	E P F LAUSANNE	10,650	67,908	6.38	34%	1.59	16938
CH	ETH ZURICH	20,798	184,434	8.87	28%	1.54	31987
DK	TECH UNIV DENMARK	10,474	78,996	7.54	29%	1.52	15952
CH	UNIV LAUSANNE	10,676	132,163	12.38	25%	1.50	16020
UK	IMPERIAL COLL LONDON	29,829	300,030	10.06	27%	1.48	44164
NL	ERASMUS UNIV ROTTERDAM	16,090	173,905	10.81	25%	1.47	23704
UK	UNIV EDINBURGH	18,734	190,753	10.18	28%	1.47	27520
UK	UNIV COLL LONDON	36,889	414,034	11.22	25%	1.46	53845
NL	DELFT UNIV TECHNOL	10,411	50,415	5.71	27%	1.41	14598
FI	UNIV HELSINKI	10,294	102,940	10.00	27%	1.39	294
CH	UNIV BASEL	10,188	101,880	10.00	27%	1.38	188
CH	UNIV GENEVE	10,719	107,190	10.00	27%	1.37	719
NL	VRIJE UNIV AMSTERDAM	16,591	153,807	9.27	26%	1.38	22920
CH	UNIV ZURICH	19,056	193,299	10.14	27%	1.37	26149
DE	TECH UNIV MUNCHEN	17,015	144,167	8.47	30%	1.36	23082
NL	UNIV AMSTERDAM	21,471	198,018	9.22	27%	1.36	29127
NL	UNIV UTRECHT	25,299	232,033	9.17	26%	1.35	34267
UK	UNIV BRISTOL	17,692	149,926	8.47	27%	1.34	23644
UK	UNIV GLASGOW	15,918	143,741	9.03	28%	1.33	21247
UK	UNIV SHEFFIELD	15,844	122,338	7.72	32%	1.31	20830
UK	KINGS COLL UNIV LONDON	19,551	185,532	9.49	27%	1.31	25563
BE	UNIV CATHOLIQUE LOUVAIN	10,001	79,027	7.90	32%	1.30	12975
UK	UNIV SOUTHAMPTON	15,482	112,850	7.29	32%	1.28	19889
BE	KATHOLIEKE UNIV LEUVEN	25,892	203,657	7.87	31%	1.28	33220
NL	LEIDEN UNIV	17,838	169,445	9.50	25%	1.28	22765
SE	KAROLINSKA STOCKHOLM	24,902	280,108	11.25	21%	1.28	31776
NL	WAGENINGEN UNIV	12,497	94,652	7.57	25%	1.27	15842
NL	UNIV GRONINGEN	16,366	138,286	8.45	27%	1.27	20731

Leiden Ranking 2003-2007, EU Top-100
rank by CPP/FCSm, green list, first 30

University		P	C	CPP	Pnc	CPP/ FCSm	brute force
UK	UNIV CAMBRIDGE	37,972	438,892	11.56	27%	1.67	63345
UK	UNIV OXFORD	35,979	429,642	11.94	27%	1.69	60783
UK	UNIV COLL LONDON	36,889	414,034	11.22	25%	1.46	53845
UK	IMPERIAL COLL LONDON	29,829	300,030	10.06	27%	1.48	44164
NL	UNIV UTRECHT	25,299	232,033	9.17	26%	1.35	34267
BE	KATHOLIEKE UNIV LEUVEN	25,892	203,657	7.87	31%	1.28	33220
FI	UNIV HELSINKI	22,976	225,207	9.80	26%	1.41	32294
CH	ETH ZURICH	20,798	184,434	8.87	28%	1.54	31987
SE	KAROLINSKA STOCKHOLM	24,902	280,108	11.25	21%	1.28	31776
DK	KOBENHAVNS UNIV	25,510	214,152	8.47	26%	1.24	31615
FR	UNIV						36
UK	UNIV						03
DE	LMU						62
Leiden Ranking 2003-2007, EU Top-100 rank by $P * \{CPP/FCSm\}$, orange list, first 30							
NL	UNIV AMSTERDAM	21,471	176,016	8.22	27%	1.30	29127
SE	LUNDS UNIV	23,386	201,225	8.60	25%	1.23	28786
IT	UNIV MILANO	24,801	200,184	8.07	29%	1.13	27959
UK	UNIV EDINBURGH	18,734	190,753	10.18	28%	1.47	27520
CH	UNIV ZURICH	19,056	193,299	10.14	27%	1.37	26149
DE	UNIV HEIDELBERG	20,923	187,256	8.95	27%	1.23	25638
UK	KINGS COLL UNIV LONDON	19,551	185,532	9.49	27%	1.31	25563
SE	UPPSALA UNIV	19,833	168,047	8.47	27%	1.21	23963
NL	ERASMUS UNIV ROTTERDAM	16,090	173,905	10.81	25%	1.47	23704
UK	UNIV BRISTOL	17,692	149,926	8.47	27%	1.34	23644
DE	TECH UNIV MUNCHEN	17,015	144,167	8.47	30%	1.36	23082
FR	UNIV PARIS XI SUD	19,667	142,715	7.26	31%	1.17	22953
NL	VRIJE UNIV AMSTERDAM	16,591	153,807	9.27	26%	1.38	22920
NL	LEIDEN UNIV	17,838	169,445	9.50	25%	1.28	22765
IT	UNIV ROMA SAPIENZA	24,159	145,430	6.02	34%	0.94	22749
DE	HUMBOLDT UNIV BERLIN	19,552	164,729	8.43	29%	1.15	22534
BE	UNIV GENT	18,308	117,016	6.39	35%	1.20	21908

250 European Universities with $P(y) > 350$

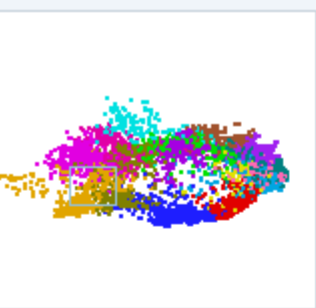
Top-20 in 'size', Physics, ranked by crown indicator'

DE	UNIV KARLSRUHE (TH)	2174,8	2,06
UK	UNIV CAMBRIDGE	7438,6	1,91

Ranking by field >>>

Field-specific benchmarking universities by field

FR	UNIV PARIS XI SUD	5580,3	1,36
IT	UNIV ROMA SAPIENZA	3637,4	1,29
NL	UNIV AMSTERDAM	2442,3	1,25
DK	KOBENHAVNS UNIV	2320,8	1,22
DE	UNIV BONN	2124,1	1,22
IT	UNIV PADOVA	2724,6	1,21
UK	UNIV COLL LONDON	2512,8	1,19
FR	UNIV GRENOBLE I	2129,3	1,17
FR	UNIV PARIS VI	3823,1	1,15



Label View Density View Cluster Density View Scatter View

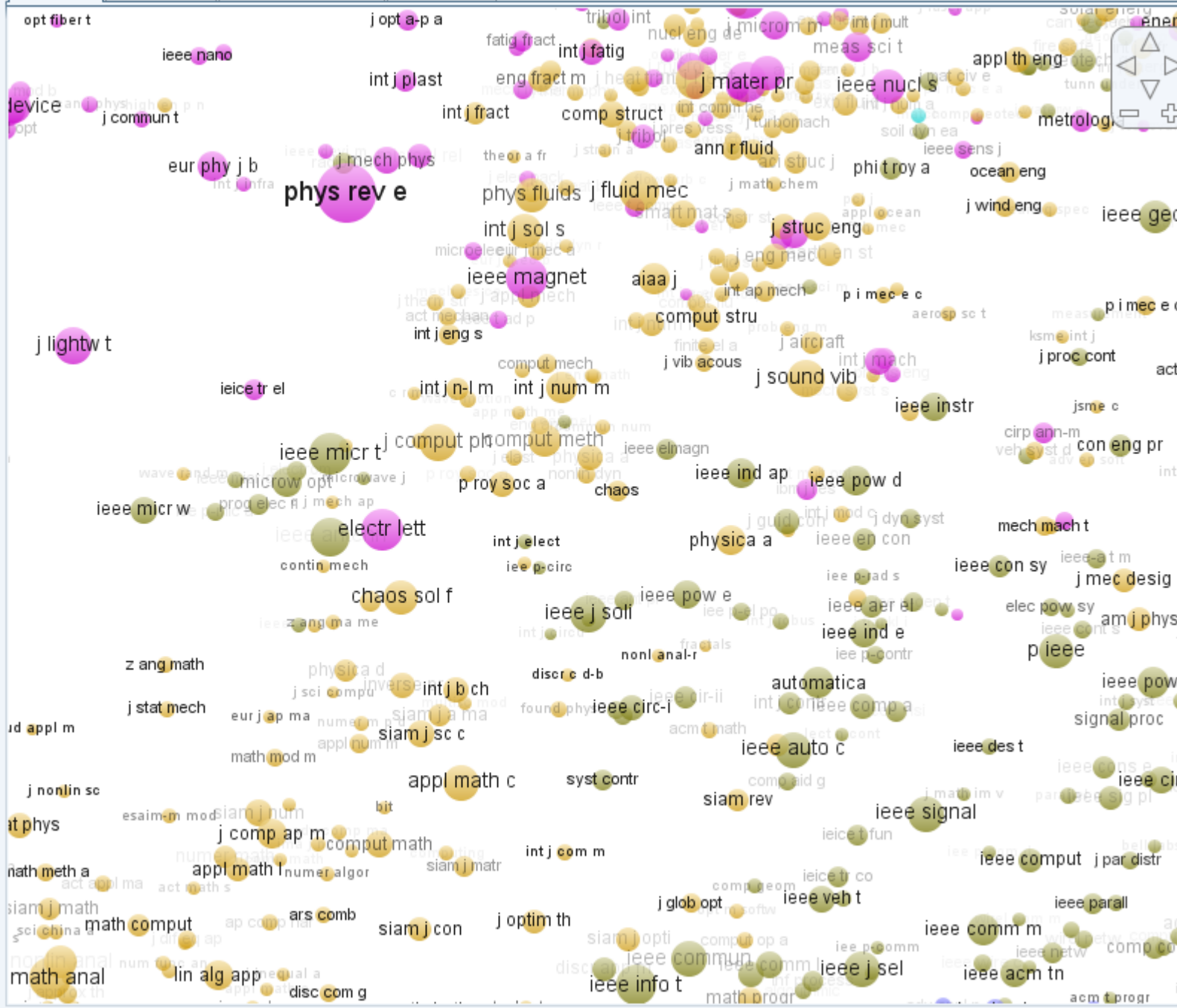
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- mechatronic
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- med c res r
- med care
- med clin
- med clin na
- med decis m
- med educ
- med eng phy
- med hypoth
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Manipulability of citation indicators proposed in this study

To which extent are our citation-based indicators sensitive to manipulation?

Can one increase actual citation impact by:

(1) Increasing author self citation?

In the methodology proposed in this study author self-citations are *not* included in the citation counts.

As a result, increasing author self-citation has *no effect* upon the value of citation impact.

(2) Publishing in high impact journals?

A case study of 2,000 senior authors from the UK publishing at least 10 articles/year revealed that journal impact explains ~20 per cent of the variance in the citation impact rates.

Journal impact is therefore not a dominant determinant of actual citation impact at the level of individual senior authors.

(3) Collaborate more intensively?

Some studies report positive correlation between a paper's number of authors and its citation impact, but they ignore differences in authoring and citation practices among research fields. One should also keep in mind that author self-citations are not included in this study. It all depends upon who collaborates with whom. There is also the issue of causality: 'good' research may attract high-impact collaborators.

(4) Publishing with US authors because they overcite their own papers?

Studies found no conclusive evidence that US scientists in science fields excessively cite papers originating from their own country.

(5) Publishing less, only the very best papers?

One would indeed expect a higher citation impact per paper. But the longer term effects of such a publication strategy are uncertain. PhD students need papers in their CV's. It may become difficult for a group to attract good PhD students if its policy is to let them publish only a few papers. Another factor is that publications also enhance the visibility of a group's research activities. If a group starts publishing substantially less papers, this may lead to a lower visibility and hence to a lower citation impact, even per paper.

(6) Making citation arrangements?

A high impact group receives its citations from dozens if not hundreds of different institutions. The distribution of citations amongst citing institutions is very skewed. The contribution of the tail of the distribution to the citation impact is relatively large. Making arrangements with a few institutions will not lead to a substantial increase in citation impact.

According to an influential Swiss scientist:

Bibliometric investigations are clearly not very reliable.... In particular, the "frequency of citation" does not account for the quality of the researchers, because

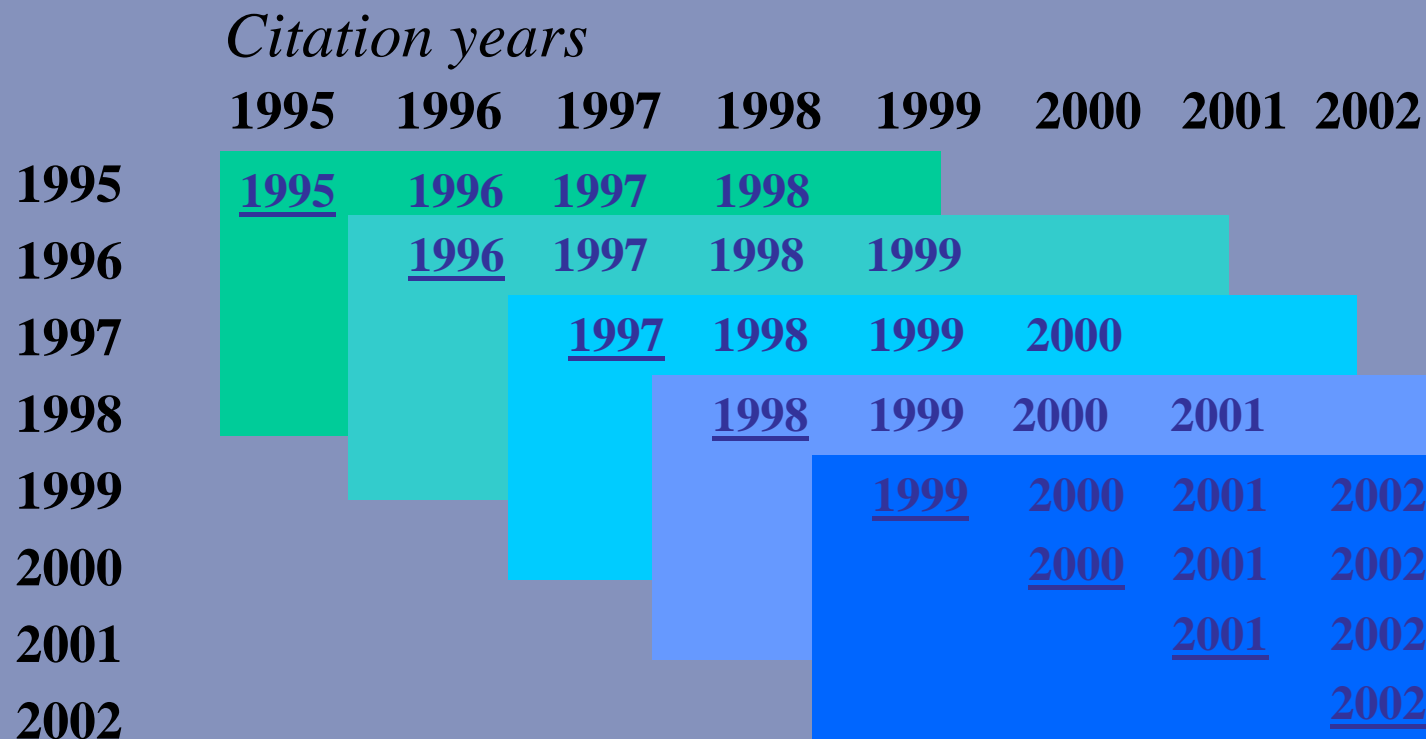
- (1) it depends more often on the **social recognition** of the researcher than **excellence** of his/her scientific work;
- (2) it favors researchers who work on **fashionable topics**;
- (3) it favors the fields of knowledge which traditionally publish **shorter articles** compared to those where publications are longer;
- (4) it cannot differentiate between the **fashion** and the substance of a paper;
- (5) it can favor the authors of "**surveys**", who are very frequently cited, compared to the authors of focused research papers;
- (6) a position article or even an **erroneous article** can be criticized and consequently well cited.

According to an influential Swiss scientist:

How to increase your 'bibliometric values'

- Write your name on papers by your PhD students
- Ignore your publisher's copyright: put your paper online
- Work in a popular area so that many others can cite you
- Write survey papers, not research papers
- Never change your established research area
- Avoid innovative and new (but risky) projects
- Chose catchy titles for your papers
- Emphasize quantity instead of quality
- Do not lose valuable time, avoid events like this one
- Concentrate on paper production, not good teaching
- Heavily cite you own (and your friend's) papers
- Never publish more than a single 'least publishable unit'
- Cannibalize your old papers: refurbish and republish them

Citation-counting scheme based on 'roof-tile' method:



A scientist has index h
if h of his/her N papers have at least h
citations each
and the other $(N-h)$ papers have no more
than h citations each

Search Results -- Summary

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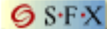
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- 1. MOED HF, BURGER WJM, FRANKFORT JG, et al.
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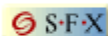


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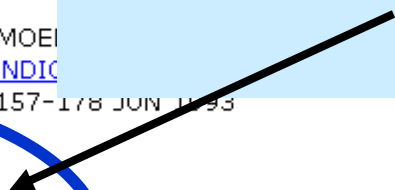
[A COMPARATIVE-STUDY OF BIBLIOMETRIC PAST PERFORMANCE ANALYSIS AND PEER JUDGMENT](#)

SCIENTOMETRICS 8 (3-4): 149-159 1985

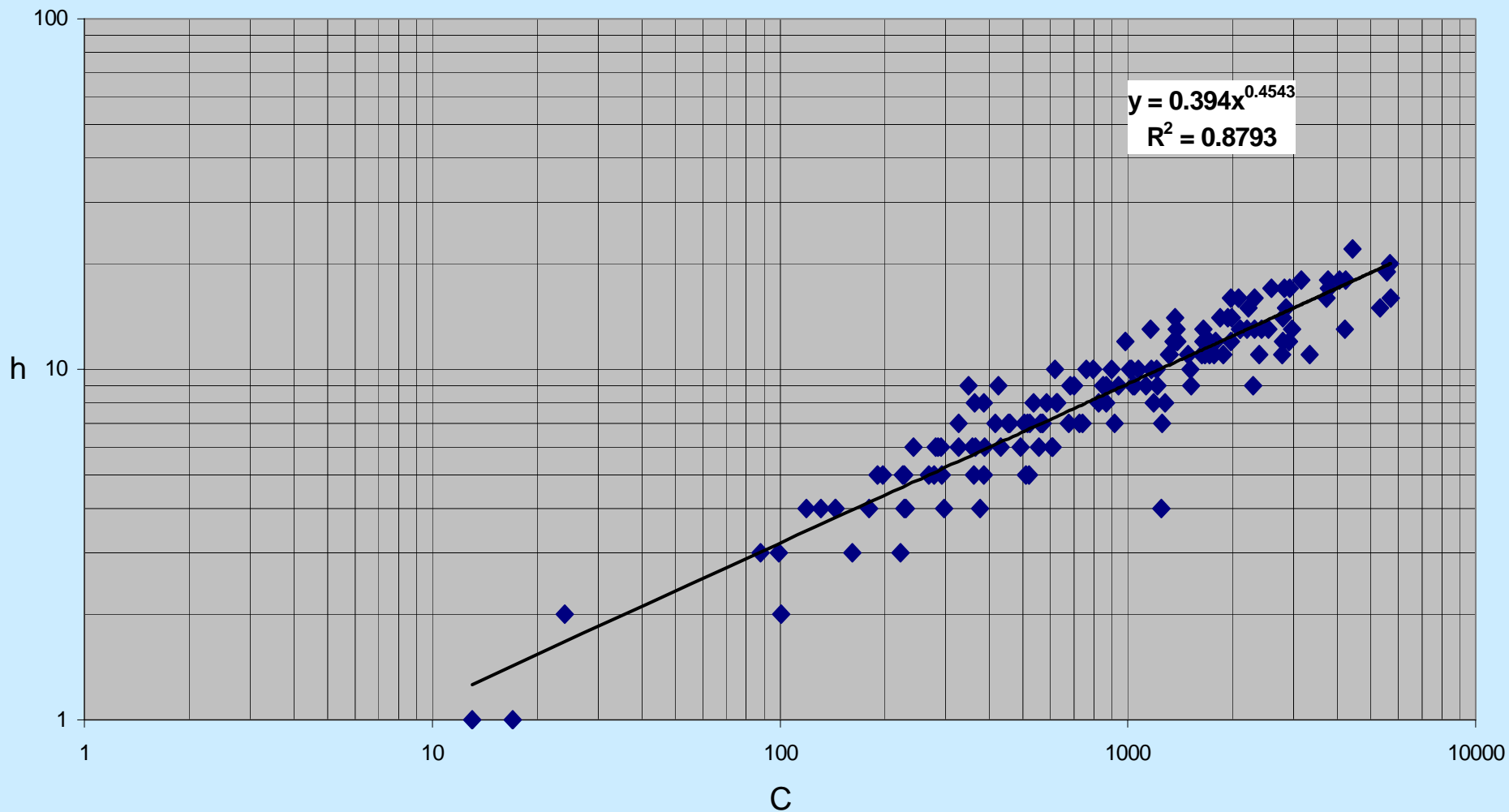
Times Cited: [17](#)

Hirsch (h-) index AFJ van Raan =

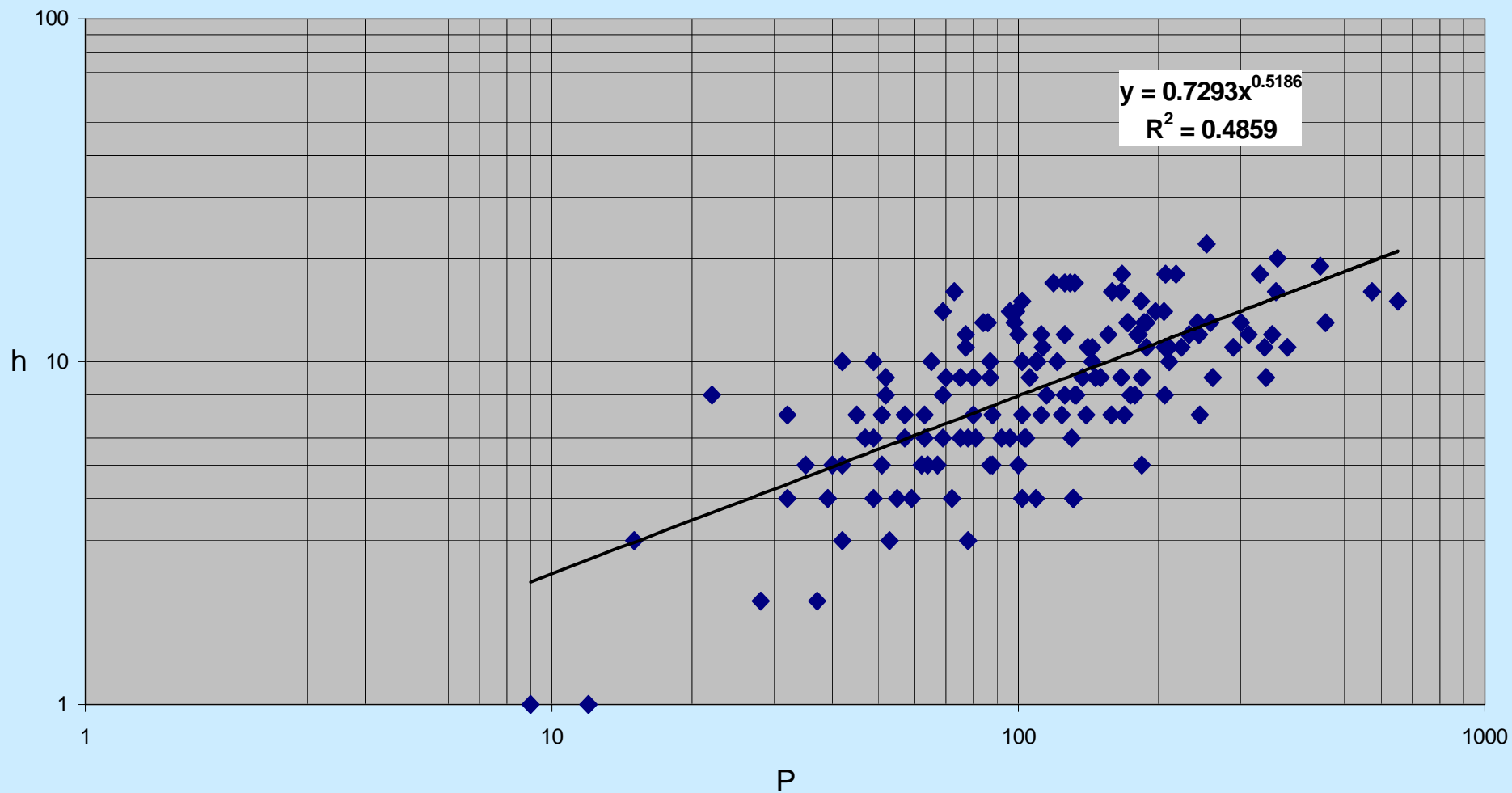
18



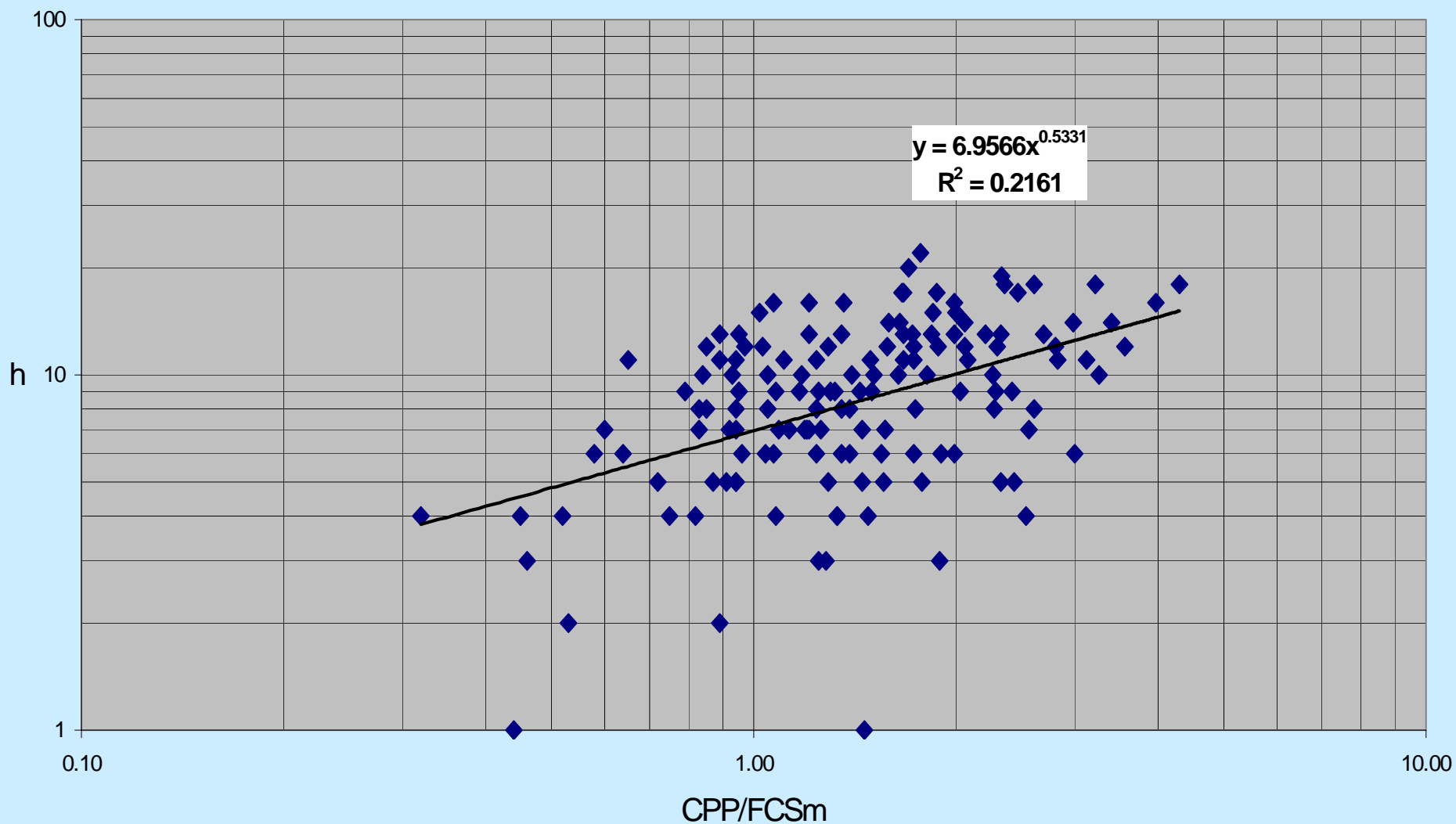
Correlation of h-index (h) with number of citations (C)
for all chemistry groups in the Netherlands



Correlation of h-index (h) with number of publications (P)
for all chemistry groups in the Netherlands



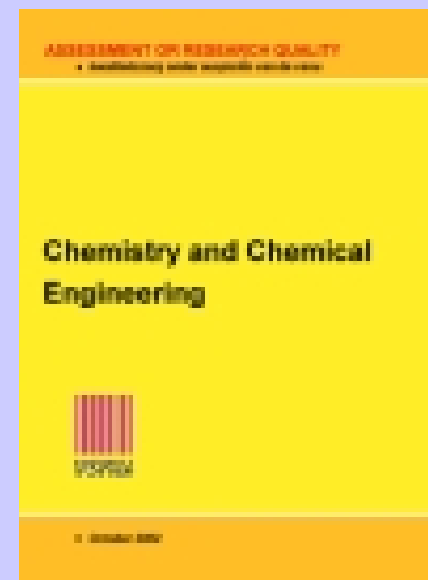
Correlation of h-index (h) with CPP/FCSm
for all chemistry groups in the Netherlands



Comparison of **bibliometric impact** values (*CPP/FCSm*) and **peer judgment** for 150 NL Chemistry groups 2002

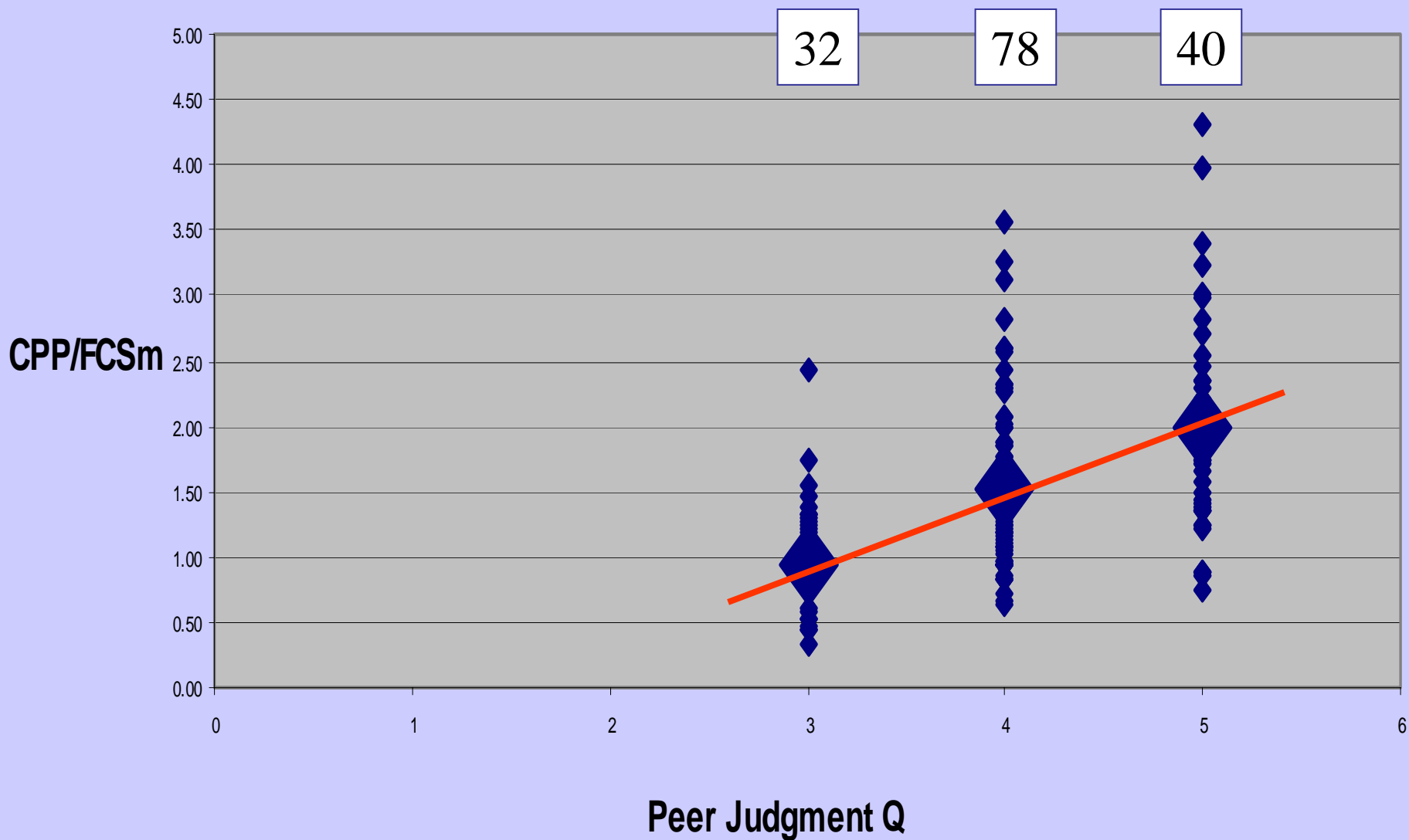
	P	C	CPP/FCSm	Qual
KUN // Buydens	92	554	1.39	5
KUN // Gal	69	536	2.61	4
KUN // Hilbers	129	3780	2.47	5
KUN // Kentgens	80	725	1.45	4
KUN // Nolte	188	1488	1.49	5
KUN // Rutjes	52	424	2.29	4
KUN // Scheeren	52	362	1.39	3
KUN // Vlieg	171	1646	2.21	5
KUN // Vriend	132	2581	1.67	4
KUN // de Jong	119	2815	1.66	4
KUN // van Venrooij	141	1630	0.94	4
KUN // van der Avoird	102	1025	1.40	5
LEI // Abrahams	77	1883	3.13	4
LEI // Bedeaux	115	623	0.83	4
LEI // Brouwer	84	1164	1.21	4
LEI // Canters	156	1785	1.03	4
LEI // Fraaije	67	268	0.72	4
LEI // Kleyn	184	1036	0.95	4
LEI // Lugtenburg	224	1312	0.89	5
LEI // Pleij	70	699	0.79	3
LEI // Reedijk	350	2785	1.73	5
LEI // de Groot	121	898	0.84	4
LEI // van Boom	357	3718	1.21	5
LEI // van Hemert	75	682	1.44	4

VSNU Evaluation
of NL Chemistry
2002 by an
international peer
committee,
150 groups, first 24
as an example



Bibliometric Impact Values and Peer Judgment

All Univ. Chemistry Research Groups, Netherlands (n=150)



Peer ratings versus crown indicator value for 306 departments in physics, chemistry, and biology

<i>rating</i>	<i>Q</i>	<i>CPP/FCSm</i>				Σ
		<i>very low</i>	<i>low</i>	<i>high</i>	<i>very high</i>	
		0.0- <0.5	0.5- <1.0	1.0- <1.7	>1.7	
unsatisfactory	2	3	7	0	0	10
satisfactory	3	6	51	31	3	91
good	4	1	27	80	29	137
excellent	5	0	6	26	36	68
		10	91	137	68	306

from: H.F. Moed 2005

Convergence between average *CPP/FCSm* values and the three judgments marks, but still considerable variance.

Important reasons may be:

*Just four *discrete* peer judgment grades vs. *continuous CPP/FCSm*

**Lack of consensus among the peers, 'distance' too large*

**Different time periods*

More concrete objections:

- * Field-definition and therefore the denominator *FCSm* may be inappropriate;
- * Time-lag ('older situation');
- * Main stream work will be cited better than 'risky', new work

Calculation of *JCSm* and *FCSm*

Step 1

	Art type	publ. year	journal	field	C up to 2007
I	<i>review</i>	2004	<i>CANCER RES</i>	Oncology	17
II	<i>note</i>	2005	<i>J CLIN END</i>	Endocrinology	4
III	<i>article</i>	2007	<i>J CLIN END</i>	Endocrinology	6
IV	<i>article</i>	2007	<i>J CLIN END</i>	Endocrinology	8

Calculation of *JCSm* and *FCSm*

step 2

	CPP	<i>JCS</i>	<i>FCS</i>
I	17	16.9	23.7
II	4	3.1	3.0
III	6	4.8	4.1
IV	8	4.8	4.1

Calculation of *JCSm* and *FCSm* Step 3

Determination of the average article citation rate:

$$CPP = \frac{17 + 4 + 6 + 8}{1 + 1 + 1 + 1} = 8.8$$

Determination of the average
journal-based citation rate:

$$JCSm = \frac{(1 \times 16.9) + (1 \times 3.1) + (2 \times 4.8)}{1 + 1 + 2} = 7.4$$

CPP / JCSm

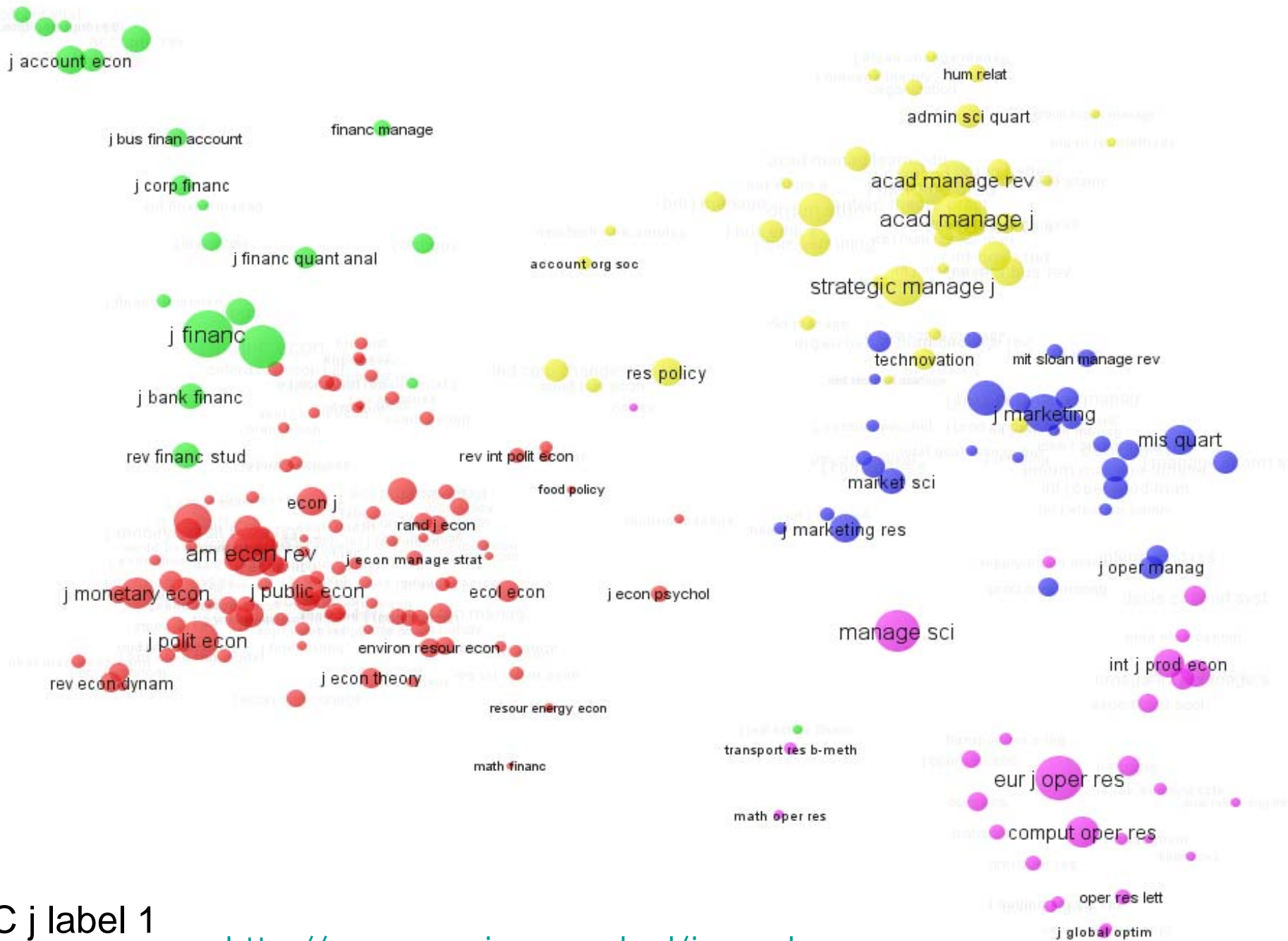
$$(8.8 / 7.4) = 1.19$$

Determination of the average
field-based citation rate:

$$FCSm = \frac{(1 \times 23.7) + (1 \times 3.0) + (2 \times 4.1)}{1 + 1 + 2} = 8.7$$

CPP / FCSm

$$(8.8 / 8.7) = 1.01$$



EC j label 1

<http://www.neesjanvaneck.nl/journalmap>

University	P		C		CPP/FCSm		P*	
	Rank		Rank		Rank		Rank	
DELFT UNIV TECHNOL	6,205	211	40,877	259	1.41	99	8,772	169
EINDHOVEN UNIV TECHNOL	4,221	321	27,887	312	1.48	77	6,230	249
UNIV TWENTE	3,159	-	21,009	-	1.42	-	4,497	-
3TU UNIVERSITIES	13,285	-	87,877	-	1.43	-	19,021	-
CALTECH	11,651	74	200,919	29	2.05	7	23,936	32
CARNEGIE MELLON UNIV	5,727	236	61,279	180	2.10	6	12,049	112
IMPERIAL COLL LONDON	18,359	22	216,764	25	1.46	85	26,737	25
INDIAN INST TECHNOL MUMBAI	1,923	-	6,392	-	0.66	-	1,274	-
MIT	16,861	27	299,718	17	2.42	1	40,835	7
NATL UNIV SINGAPORE	12,900	57	73,397	153	1.07	247	13,781	87
STANFORD UNIV	22,255	11	419,551	2	2.15	4	47,772	2
UNIV CALIF BERKELEY	19,132	20	300,134	16	2.04	9	38,978	9
UNIV CAMBRIDGE	23,194	9	311,467	12	1.67	33	38,651	11
UNIV TOKYO	33,802	2	312,658	11	1.20	161	40,726	8
AALBORG UNIV	1,681	-	8,534	-	0.94	-	1,587	-
ETH ZURICH	11,997	68	127,364	67	1.52	62	18,261	50
KATHOLIEKE UNIV LEUVEN	14,948	35	135,286	57	1.25	144	18,701	47
PARISTECH	7,457	170	48,933	226	1.22	152	9,133	159
TECH UNIV HAMBURG HARBURG	790	-	3,314	-	0.92	-	730	-
UNIV AACHEN (RWTH)	7,831	158	58,181	191	1.13	207	8,888	164
UNIV WARWICK	4,374	308	28,806	309	1.13	208	4,959	289
CHALMERS UNIV TECHNOL	4,717	286	27,210	313	1.16	189	5,481	267
EPFL LAUSANNE	5,657	239	42,313	253	1.54	59	8,690	172
GEORGIA INST TECHNOL	7,057	181	56,487	198	1.74	21	12,312	108
TECH UNIV DENMARK	4,166	327	37,393	274	1.57	48	6,556	234
TECH UNIV MUNCHEN	10,219	98	100,739	97	1.36	112	13,854	86
TSING HUA UNIV	10,904	84	32,684	289	0.62	345	6,732	232
UNIV GRONINGEN	9,374	111	95,253	106	1.26	136	11,827	118
UNIV MELBOURNE	11,765	71	104,805	87	1.19	175	13,953	85
UNIV TORONTO	26,541	3	322,587	9	1.46	84	38,781	10
UNIV UTRECHT	14,853	37	161,433	43	1.35	116	20,096	41
BENCHMARK UNIVERSITIES	308,057	-	3,309,724	-	1.48	-	456,872	-
NETHERLANDS UNIVERSITIES	87,217	-	869,900	-	1.31	-	113,934	-
NETHERLANDS	106,009	-	1,039,562	-	1.31	-	139,213	-
EUROPE	1,720,384	-	12,378,276	-	1.02	-	1,761,643	-

TABLE 2: BIBLIOMETRIC INDICATORS FOR ALL DISCIPLINES