Evaluating individuals, institutions and nations using advanced bibliometrics

THOMSON REUTERS ROADSHOW
AUSTRALIA
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BERENIKA M. WEBSTER

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Agenda

- Domains of research performance evaluation - what or who and why
- Advanced bibliometrics – data in context
- Tools to support publication and citation-based research evaluation on individual, institutional and national levels – some examples

Domains of research performance evaluation

What or who?	
Organisational:	Individuals
	Groups and teams
	Departments
	Institutions
	Regions
	Countries
Cognitive:	Networks
	Disciplines

Why?

Funding allocations

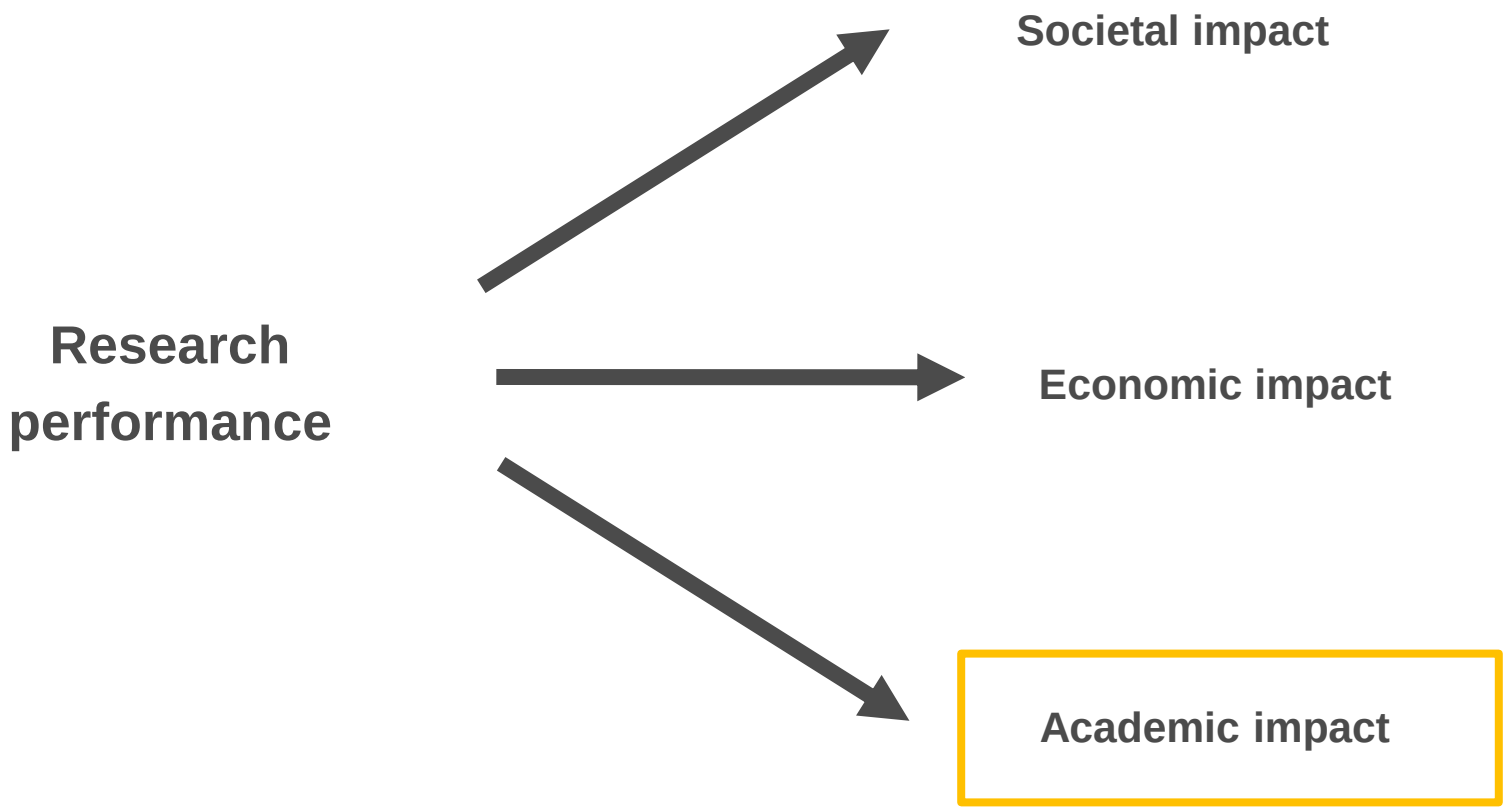
Grants and prizes

Staff hiring

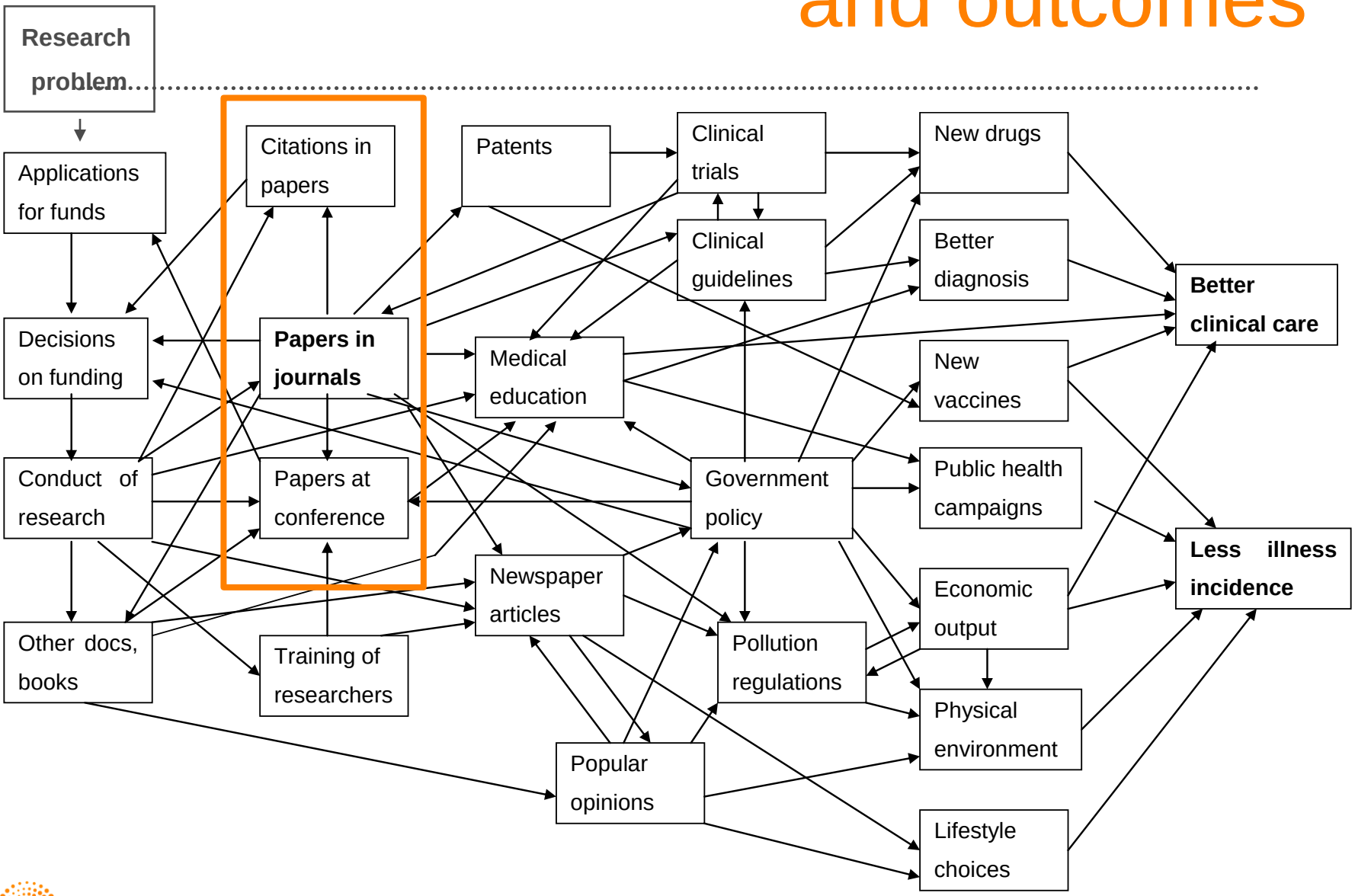
Promotions and tenure

Science policy

What do we want to evaluate?



Research process: outputs, impacts and outcomes



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After G. Lewison, 1999

What can be turned into indicators?

INPUTS

Funding and income

Workforce

Infrastructure and facilities

OUTPUTS

Publications

Patents, spin-offs, commercialisation income

Honours, keynotes, memberships, policy impact

What questions can be answered using publication metrics?

Which programs are producing world class research?

Which researchers are standing out from the rest?

How does our research compare with our peer institutions?

Did our investments in new faculty or research facilities pay off?

How can we get more research funding?

Typology of indicators: from data to information

What	Measures:	Indicator
Output statistics	Productivity	# of Papers
	Recognition/Impact	# of Citations
	Efficiency	Citations per paper H-index and its variants
Relative position	Direct comparison	Ranking
	Benchmark	Baselines
Trend	Growth rate	Time Series
Specialty	Concentration Disciplinarity	Research Fronts Disciplinarity Index

Research Analytics: source and foundation data

Web of Knowledge

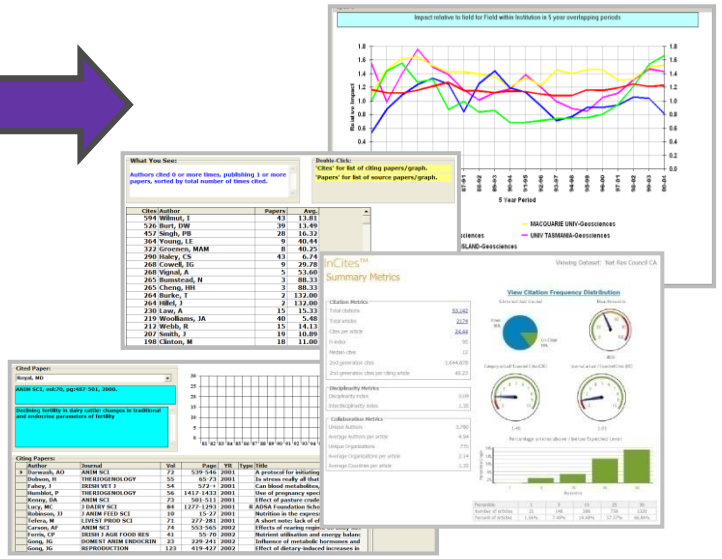
Thomson Reuters Expertise and Processing

Address Unification

Data Cleansing & Standardisation

Normalisation and Baselines

Research Analytics Resources



Article Match Retrieve

Web Services

Researcher ID

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Basic vs advanced bibliometrics

- Raw numbers – what do they mean?
  - Numbers of papers
  - Numbers of citations
  - h-index
- Normalised data:
  - Document type
  - Subject category
  - Journal
  - Academic age
  - Publication year

Citations	Citations	Citations
15	150	15
10	100	10
10	50	10
5	25	5
5	5	5
1	1	0
1	0	0
1	0	0
1	0	0
1	0	0

3 authors with 10 publications each and h-index = 5

No normalisation for:

- citation characteristics of publication outlets
- citation characteristics of fields of science
- age of publications
- type of publications
- co-authorship

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After Robert Tijssen, 2009

Alternatives

Contemporary H-index

- (Sidiropoulos et al., 2006) aiming to improve on the h-index by giving more weight to recent articles

Individual H-index

- (Batista et al., 2006), divides the standard h-index by the average number of authors in the articles that contribute to the h-index, in order to reduce the effects of co-authorship

G-index

- (Egghe, 2006*),* aims to improve on the h-index by giving more weight to highly-cited articles

Age-weighted citation rate (AWCR)

- The AWCR measures the average number of citations to an entire body of work, adjusted for the age of each individual paper

Distribution of CPP per document type

Document type	Papers	Cites	Avg. Cites/Paper
Review	11,051	165,621	14.99
Article	171,859	1,125,682	6.55
Editorial	8,777	20,887	2.38
News Item	150	229	1.53
Letter	7,779	9,044	1.16
Correction	611	254	0.42
Item About An Individual	338	51	0.15
Meeting Abstract	22,983	2,727	0.12
Book Review	8,509	113	0.01

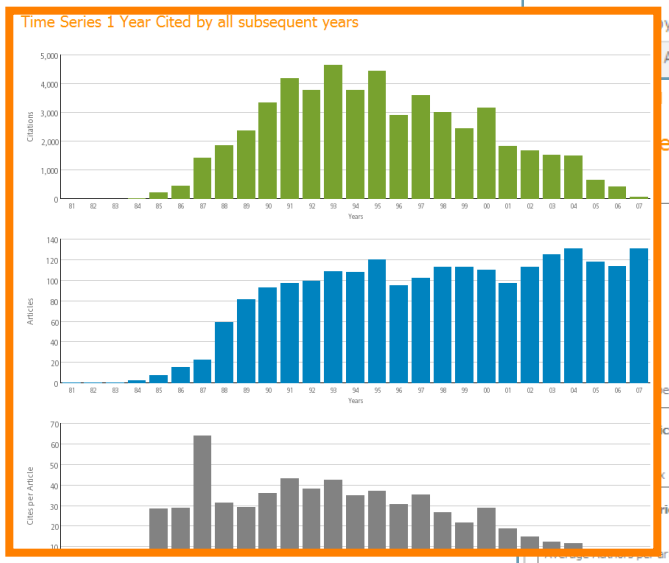
National Citation Reports, Australia 2001-2007

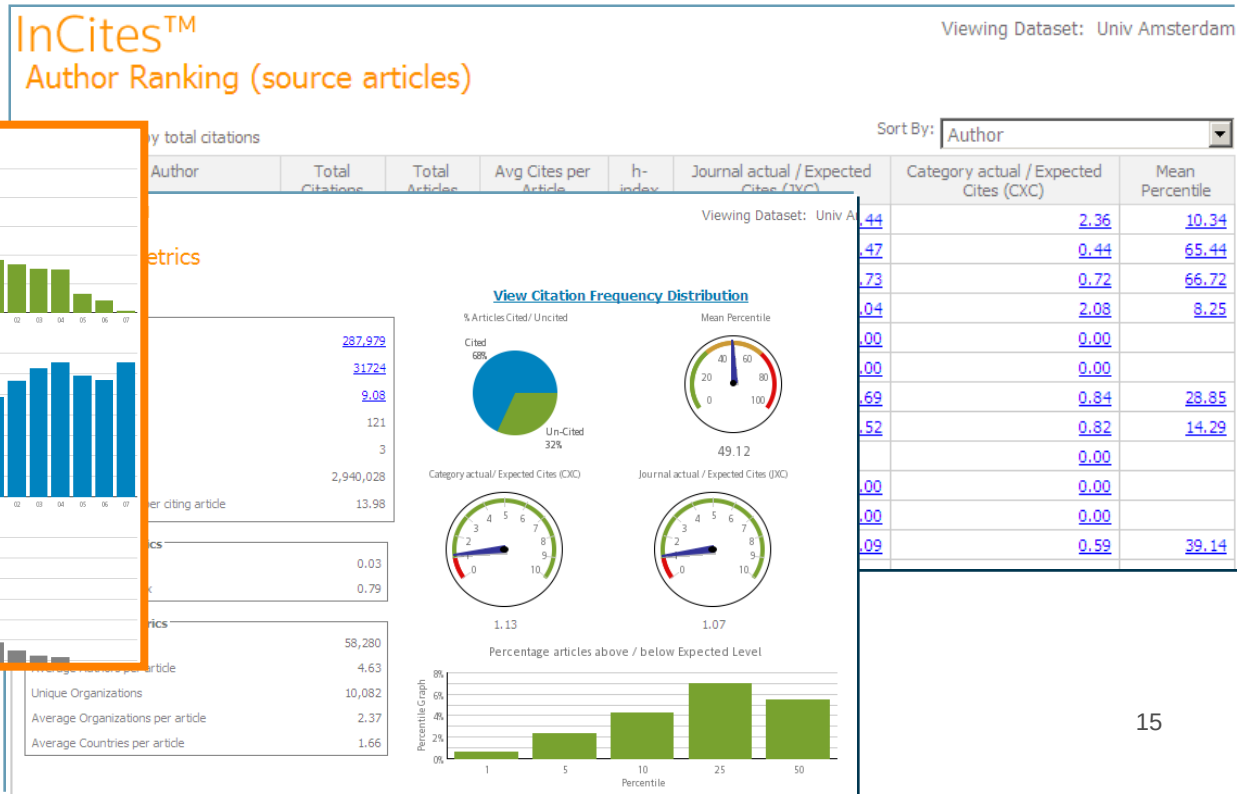
Impact of publication year

Agricultural Sciences	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0.01 %	464	531	295	398	286	308	211	76	42	25	84
0.10 %	211	207	178	138	146	99	72	41	23	11	3
1.00 %	90	85	73	63	58	45	32	21	12	5	2
10.00 %	28	28	26	23	20	17	13	9	5	2	1
20.00 %	18	18	16	15	13	11	9	6	3	1	0
50.00 %	6	6	6	6	5	4	3	3	1	0	0
Biology & Biochemistry	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
0.01 %	1557	1512	1167	1275	800	589	427	325	223	89	9
0.10 %	633	538	500	468	364	260	204	137	77	25	5
1.00 %	222	197	176	157	139	111	81	52	30	10	2
10.00 %	64	62	56	49	42	35	27	18	10	3	1
20.00 %	39	39	35	31	27	23	17	12	7	2	0
50.00 %	15	15	14	12	11	10	7	5	3	1	0
Chemistry	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
0.01 %	1195	1221	1151	1152	714	458	432	222	156	57	8
0.10 %	408	416	382	351	264	223	169	107	61	21	4
1.00 %	130	128	113	112	92	81	62	42	25	9	2
10.00 %	37	37	33	32	28	25	20	14	8	3	1
20.00 %	23	23	20	20	18	15	13	9	5	2	0
50.00 %	8	8	7	7	6	6	5	3	2	1	0

Research Performance Profile data

- Detail-level data used to analyse local performance
- Rank and analyse your staff's performance
- Investigate metrics per paper
- Analyse collaboration





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All metrics and analyses can be performed on any subset of the data

- Your entire institution
- One researcher
- Group of researchers (e.g. a department)
- Field of research within your institution
- Topic of research within your institution
- A collaboration partnership within your institution and externally
- Cited and citing journals – aiding collection development

How do I evaluate a researcher?

Example: Dr. Smith

	Total Papers	Total Cites	Avg. Cites per Paper	H Index	Jnl Index	Category Index	Avg. Percentile
Dr. Smith (biochem/mol bio)	**140**	**5,047**	**36.05**	**40**	**1.29**	**1.05**	**27.02**
Dr. Jones (psychiatry)	**17**	**481**	**28.29**	**8**	**1.81**	**1.55**	**21.22**
Biochem/Mol Bio at ABC University	**3,505**	**52,351**	**14.94**	**87**	**1.04**	**0.98**	**44.35**
ABC University	**29,226**	**237,610**	**8.13**	**133**	**1.09**	**0.88**	**50.03**

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InCites, 2008

Category-normalised citation impact indicator

CPP/Cat avg **≤ 0.80**
significantly below world average (mediocre research?)

0.80 < ***CPP/Cat avg*** **≤ 1.20**
around world average (good ?)

1.20 < ***CPP/Cat avg*** **≤ 2.00**
significantly above average (very good?)

2.00 < ***CPP/Cat avg*** **≤ 3.00**
very high (national excellence?)

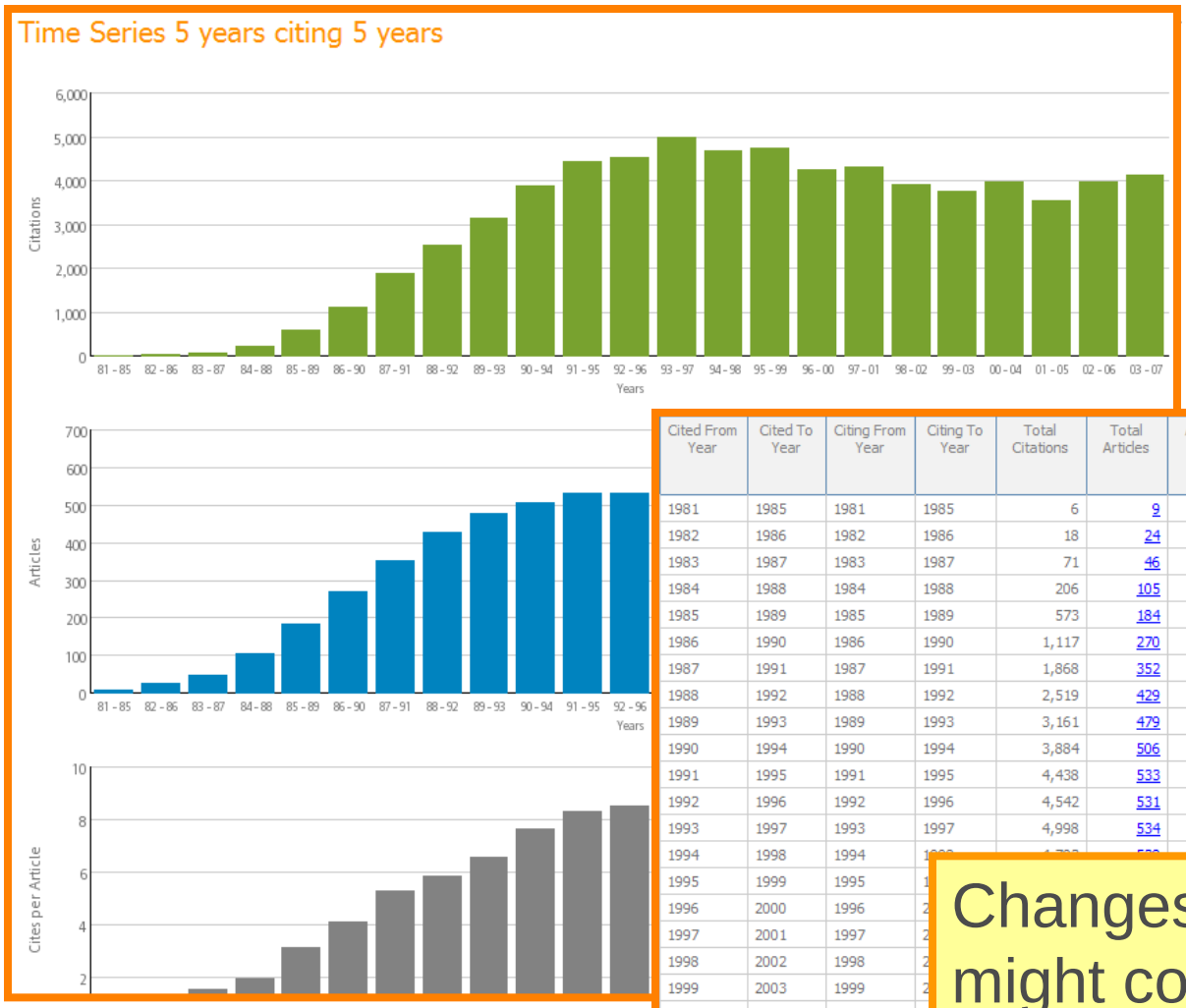
CPP/Cat avg **> 3.00**
extremely high (international excellence?)

Obtain multiple measures: comparing fields across organisations

Field	No org ranked	Paps	Cits	CPP
Agricultural Sciences	7	1	3	7
Biology & Biochemistry	8	1	2	4
Chemistry	8	5	6	6
Clinical Medicine	8	3	4	7
Computer Science	8	4	2	3
Engineering	8	5	4	7
Environment/Ecology	8	1	2	3
Geosciences	8	7	6	6
Immunology	7	4	7	6
Materials Science	7	4	3	3
Microbiology	6	1	1	5
Molecular Biology & Genetics	7	2	1	1
Neuroscience & Behaviour	7	3	3	3
Physics	7	5	5	1
Plant & Animal Science	8	1	2	8
Psychiatry/Psychology	8	2	3	5
Social Sciences, General	8	2	4	6

Source: TR Indicators Reports 08

Trend analysis: do your institution's policy changes correlate with a measureable result?



Cited From Year	Cited To Year	Citing From Year	Citing To Year	Total Citations	Total Articles	Average Cites per article	h-index Graph	Journal actual / Expected Cites (JXC) Graph	Category actual/ Expected Cites (CXC) Graph	Mean Percentile Graph
1981	1985	1981	1985	6	9	0.67	2	11.96	11.87	50.28
1982	1986	1982	1986	18	24	0.75	1	23.98	14.08	30.83
1983	1987	1983	1987	71	46	1.54	5	19.40	11.39	26.55
1984	1988	1984	1988	206	105	1.96	7	18.14	9.88	30.92
1985	1989	1985	1989	573	184	3.11	13	14.02	8.21	35.14
1986	1990	1986	1990	1,117	270	4.14	17	12.81	7.65	32.71
1987	1991	1987	1991	1,868	352	5.31	19	11.28	7.31	33.65
1988	1992	1988	1992	2,519	429	5.87	20	10.91	7.47	34.63
1989	1993	1989	1993	3,161	479	6.60	22	10.21	7.11	34.85
1990	1994	1990	1994	3,884	506	7.68	28	9.16	6.06	34.18
1991	1995	1991	1995	4,438	533	8.33	29	8.67	5.33	33.95
1992	1996	1992	1996	4,542	531	8.55	30	8.72	5.28	34.01
1993	1997	1993	1997	4,998	534	9.36	35	8.48	5.01	33.37
1994	1998	1994	1							
1995	1999	1995	1							
1996	2000	1996	2							
1997	2001	1997	2							
1998	2002	1998	2							
1999	2003	1999	2							
2000	2004	2000	2							
2001	2005	2001	2							
2002	2006	2002	2							
2003	2007	2003	2							

Changes in staffing/funding might correlate with changes in publication/citation counts

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Managing research collaborations

Cites	Organization	Papers	Avg.
11,597	Univ Calif Los Angeles	390	29.74
11,490	Princeton Univ	349	32.92
10,368	Univ Chicago	153	67.76
10,302	Stanford Univ	459	22.44
9,285	Univ Calif Berkeley	399	23.27
9,095	NASA	38	239.34
9,031	Univ Calif San Diego	417	21.66
8,956	Brown Univ	49	182.78
8,128	MIT	350	23.22
7,854	Univ Penn	364	21.58
7,796	McGill Univ	750	10.39
7,541	Ist Nazl Fis Nucl	318	23.71
7,483	Univ Toronto	904	8.28

Collaborations that receive the most citations

Versus

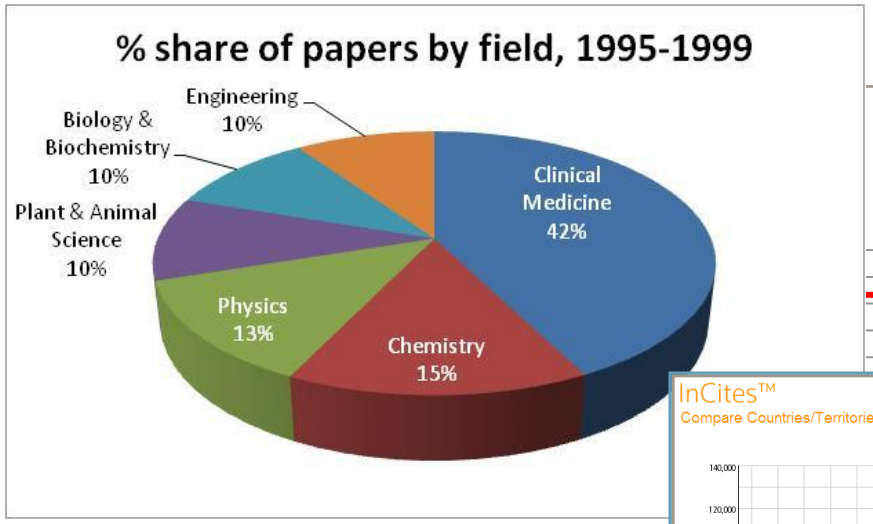
Cites	Organization	Papers	Avg.
7,483	Univ Toronto	904	8.28
7,796	McGill Univ	750	10.39
7,359	Univ Alberta	619	11.89
5,270	British Columbia Canc Agcy	583	9.04
6,068	Univ Victoria	567	10.70
4,416	Univ Montreal	563	7.84
6,497	Harvard Univ	551	11.79
4,339	St Pauls Hosp	527	8.23
2,716	Vancouver Gen Hosp	500	5.43
6,015	Univ Texas	479	12.56
2,429	Simon Fraser Univ	461	5.27

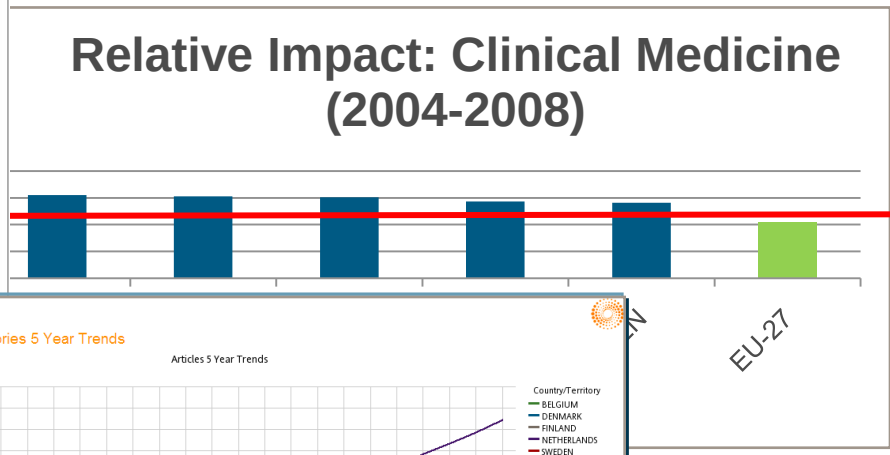
Most frequent collaborators

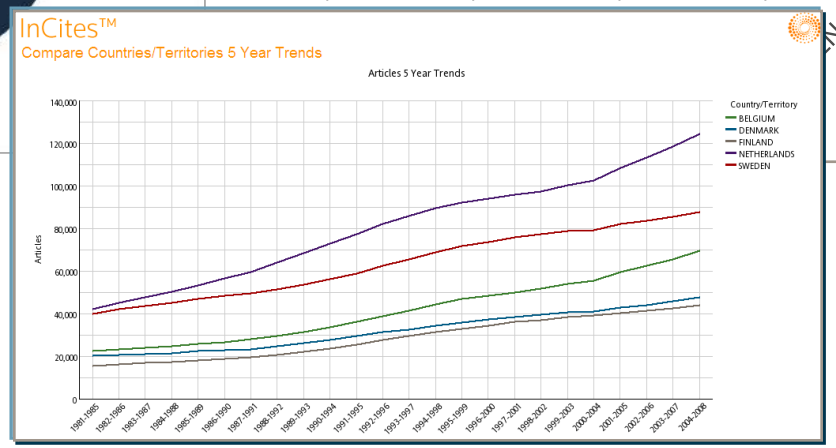
- **What is the ROI for these collaborations?**

Comparative data

- Rank and compare countries and institutions
- Drill down to a specific research discipline



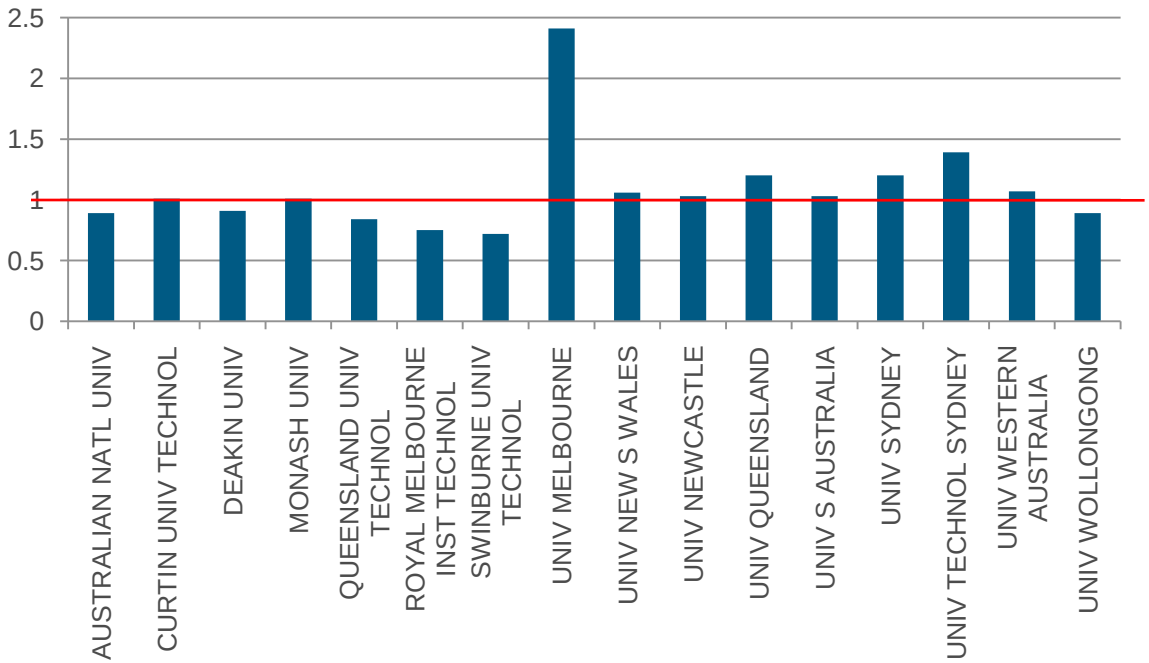




How does my organisation rank against peers?

Institution	Impact	Citations	Papers
AUSTRALIAN NATL UNIV	2.44	412	169
CURTIN UNIV TECHNOL	2.76	188	68
DEAKIN UNIV	2.5	443	177
MONASH UNIV	2.78	1362	490
QUEENSLAND UNIV TECHNOL	2.3	262	114
ROYAL MELBOURNE INST TECHNOL	2.05	272	133
SWINBURNE UNIV TECHNOL	1.97	114	58
UNIV MELBOURNE			
UNIV NEW S WALES			
UNIV NEWCASTLE			
UNIV QUEENSLAND			
UNIV S AUSTRALIA			
UNIV SYDNEY			
UNIV TECHNOL SYDNEY			
UNIV WESTERN AUSTRALIA			
UNIV WOLLONGONG			

Materials Science papers and citations in Australian institutions, 2003-2007



Relative Impact of Material Science papers

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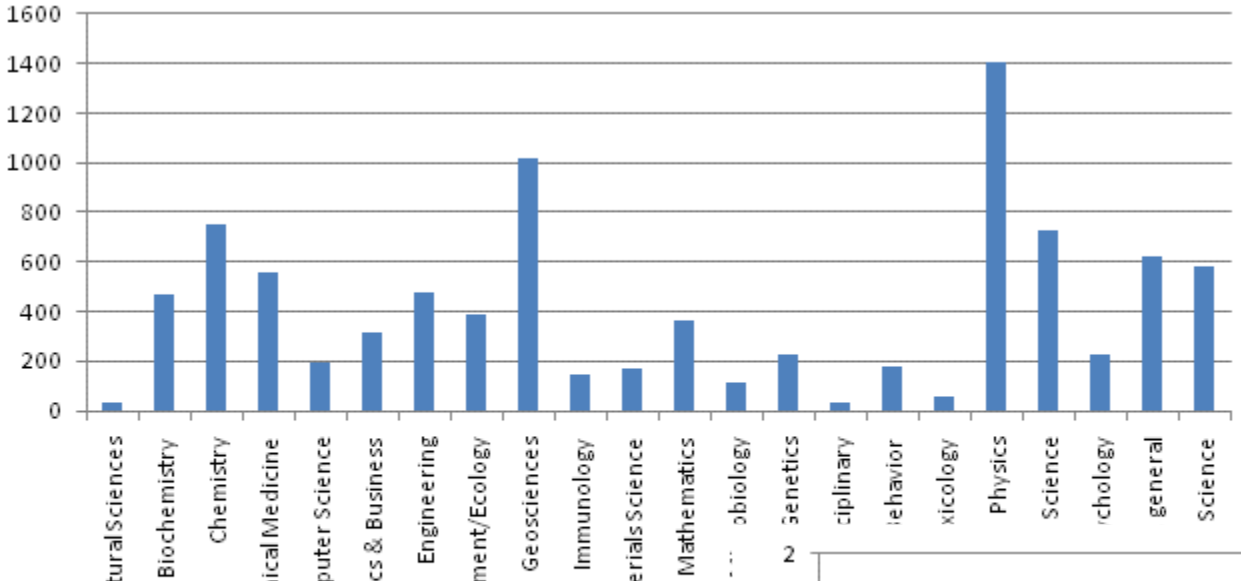
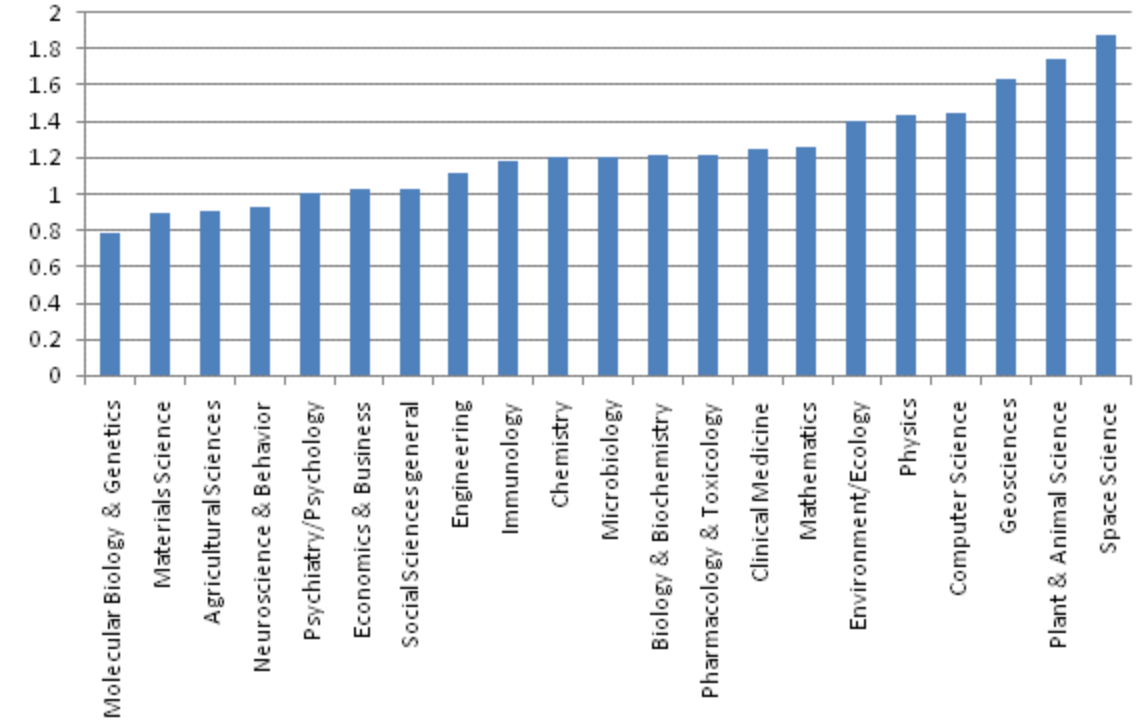
University Science Indicators, 2007



ANU publications, 2003-2007



ANU relative impact, 2003-2007 papers

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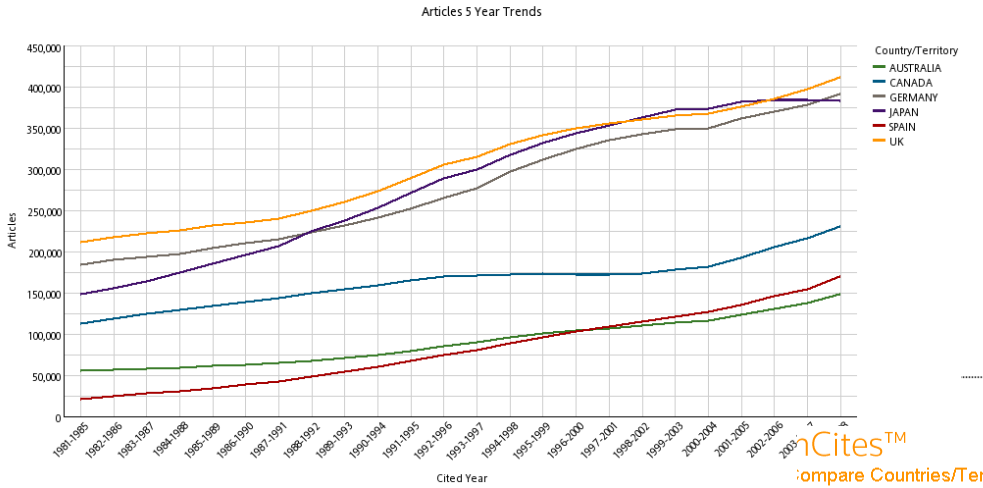
InCites – national comparisons

InCites™

Compare Countries/Territories 5 Year Trends



Your report will include the following:
Countries/Territories: AUSTRALIA, CANADA, GERMANY, JAPAN, SPAIN, UK,

Biology & Biochemistry
Chemistry
Clinical Medicine
Computer Science
Economics & Business
Engineering
Environment/Ecology
Geosciences
Immunology
Materials Science

Time Period:
- User Defined
- 5 Year Trends
- All Years

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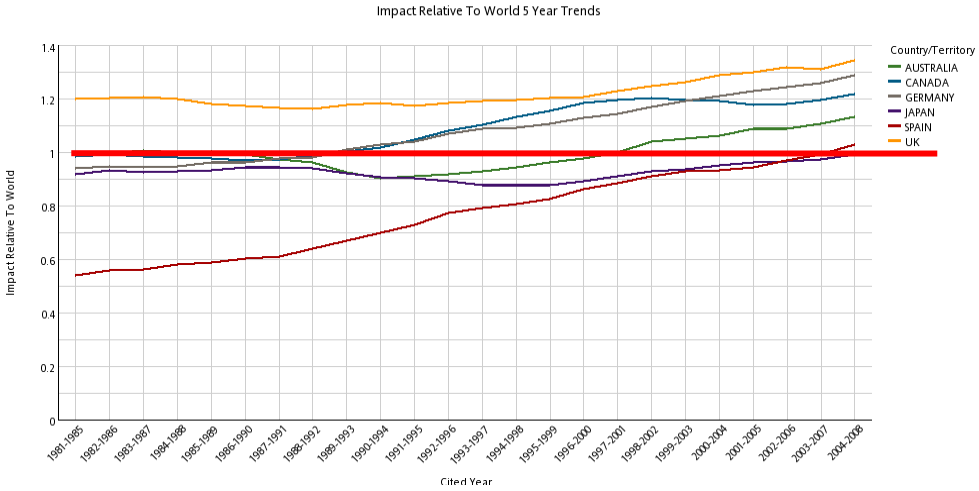
Compare Countries/Territories 5 Year Trends



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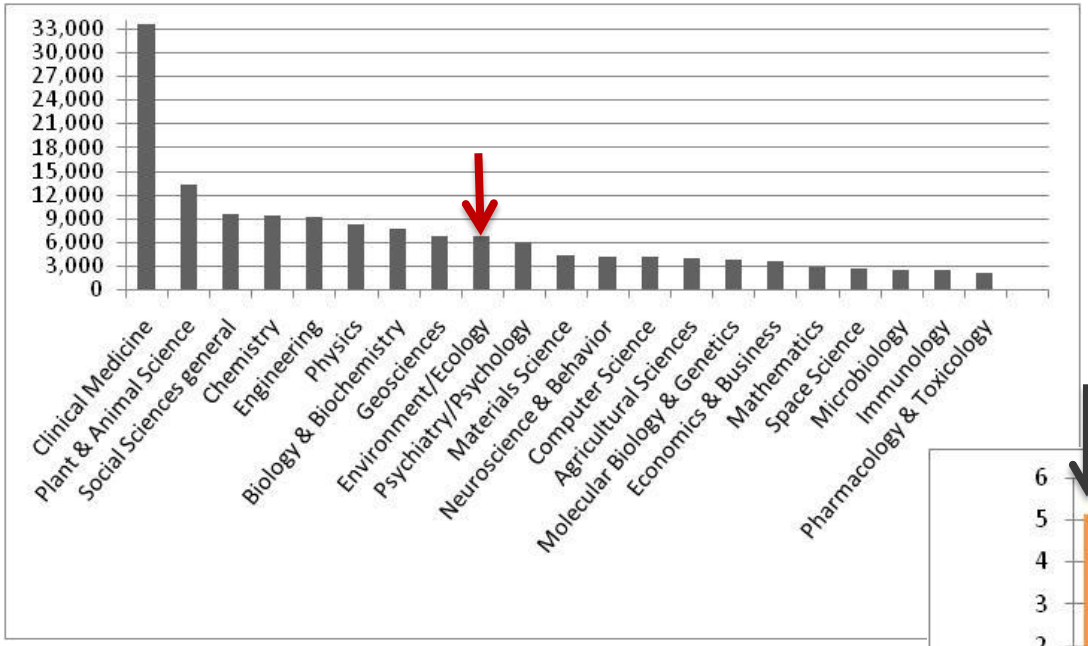
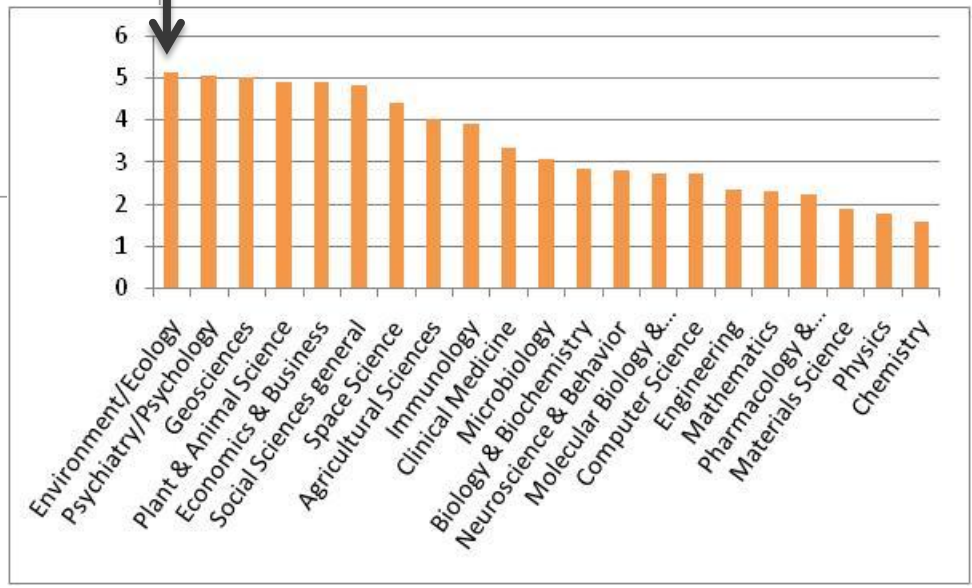
Australia in context – subject fields



Number of papers, 2004-2008



Percentage of world output, 2004-2008

InCites, 2008

PDF

InCites™

Summary Metrics

Viewing Dataset: Human Papilloma Virus

View Citation Frequency Distribution

Citation Metrics

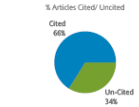
Total citations	1,020
Total articles	53
Cites per article	19.25
h-index	16
Median cites	3
2nd generation cites	13,033
2nd generation cites per citing article	13.98

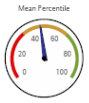
Disciplinarity Metrics

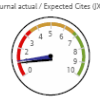
Disciplinarity index	0.06
Interdisciplinarity index	1.34

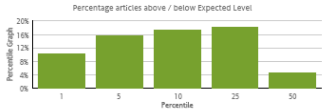
Collaboration Metrics

Unique Authors	193
Average Authors per article	4.94
Unique Organizations	77
Average Organizations per article	3.17
Average Countries per article	2.26









Percentile	1	5	10	25	50
Number of articles	5	9	12	19	24
Percent of articles	11.36%	20.45%	27.27%	43.18%	54.55%

Report Limited To
Institution HARVARD UNIV
Publication Years 1995 - 2008

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Please give us your on using InCites

3 Feb 2009

MS Excel

	A	B
1	nCites™	
2		Viewing Dataset: Human Papilloma Virus
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4		
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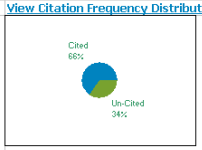
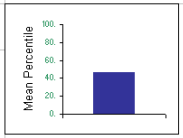
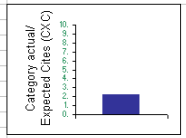
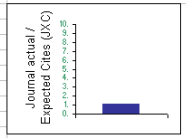
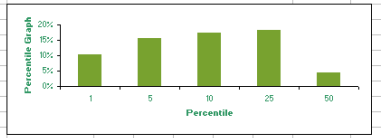
View Citation Frequency Distribution











Percentile	1	5	10	25	50
Number of articles	5	9	12	19	24
Percent of articles	11.36%	20.45%	27.27%	43.18%	54.55%

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Thank you

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