



Australian Government
Australian Research Council

ARC-supported research:
the impact of journal publication output
2001–2005



Supported research

RESEARCH in the national interest - enabling the future

Produced by the Australia Research Council

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The Australian National University

October 2009



Australia's university researchers are the bedrock of our innovation system. They do most of our basic research and make a vital contribution to applied research and experimental development. They also do the lion's share of our research in the humanities, arts and social sciences. If we want a world-class innovation system, we must have world-class university researchers.

This report on the impact of university research funded by the Australian Government through the Australian Research Council from 2001 to 2005 shows that our researchers are setting very high standards indeed. It follows an earlier study covering 1996–2000.

The report analyses the number of publications attributable to ARC-funded research and how often they are cited in the international research literature – a standard indicator of research impact. It measures these results against Australian and world benchmarks.

The number of publications attributable to ARC-funded research increased by 41 per cent between 1996–2000 and 2001–2005 – more than double the international growth rate. Publications linked to ARC funding now account for a third or more of all Australian publications in the physical, chemical and mathematical sciences. The impact of Australian research publications overall is above the world average, and the impact of publications attributable to ARC-funded research is higher still.

The report also shows that Australian researchers are increasingly likely to collaborate, especially with their counterparts overseas – 40 per cent of Australian research publications now have an international co-author. It is also pleasing to see the strong growth in research publications linked to the ARC's Linkage Projects Scheme, which supports collaboration between university researchers, industry, community organisations and government agencies.

ARC-Supported Research: The Impact of Journal Publication Output, 2001–2005 provides a valuable insight into the state of Australian university research and the contribution it is making to the national innovation agenda. It reminds us just how good our researchers can be.

Senator Kim Carr

Minister for Innovation, Industry, Science and Research

Contents

Contents

Foreword	iii
Acknowledgments	xi
Abbreviations	xi
Executive summary	xii
Introduction	1
1. METHODOLOGY	2
1.1 Coverage of WoS database	2
1.2 Definition of schemes/sectors	2
1.3 Methodology overview	4
1.4 Performance measures	5
1.4.1 Relative Citation and Journal Impact Rates	5
1.4.2 Centile Distribution	5
1.4.3 Level of collaboration	5
1.5 Underlying data	5
1.6 Comparison to methodologies in previous REPP studies	6
2. SCHEME/SECTOR CHARACTERISTICS AND PERFORMANCE	7
2.1 Scheme/sector research profiles	7
2.2 Collaboration	9
2.3 Location of Australian research	11
2.4 Citation performance	14
3. RFCD FIELDS AND SUBFIELDS OF RESEARCH	19
3.1 Field: Mathematical Sciences	20
3.2 Subfield: Mathematics	22
3.3 Subfield: Statistics	24
3.4 Field: Physical Sciences	26
3.5 Subfield: Astronomical Sciences	28
3.6 Subfield: Condensed Matter Physics	30
3.7 Subfield: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics	32
3.8 Subfield: Optical Physics	34
3.9 Subfield: Other Physical Sciences	36
3.10 Subfield: General Physical Sciences	38
3.11 Field: Chemical Sciences	40
3.12 Subfield: Physical Chemistry	42
3.13 Subfield: Inorganic Chemistry	44
3.14 Subfield: Organic Chemistry	46
3.15 Subfield: Analytical Chemistry	48
3.16 Subfield: Macromolecular Chemistry	50
3.17 Subfield: General Chemical Sciences	52
3.18 Field: Earth Sciences	54
3.19 Subfield: Geology	56
3.20 Subfield: Geosciences	58
3.21 Subfield: Oceanography	60
3.22 Subfield: Atmospheric Sciences	62
3.23 Subfield: Other Earth Sciences	64
3.24 Subfield: General Earth Science	66

3.25	Field: Biological Sciences	68
3.26	Subfield: Biochemistry and Cell Biology	70
3.27	Subfield: Genetics	72
3.28	Subfield: Microbiology	74
3.29	Subfield: Botany	76
3.30	Subfield: Zoology	78
3.31	Subfield: Ecology and Evolution	80
3.32	Subfield: Biotechnology	82
3.33	Subfield: General Biological Sciences	84
3.34	Field: Information, Computing & Communication Sciences	86
3.35	Field: Engineering and Technology	88
3.36	Subfield: Manufacturing Engineering	90
3.37	Subfield: Mechanical and Industrial Engineering	92
3.38	Subfield: Chemical Engineering	94
3.39	Subfield: Resources Engineering	96
3.40	Subfield: Civil Engineering	98
3.41	Subfield: Electrical and Electronic Engineering	100
3.42	Subfield: Metallurgy	102
3.43	Subfield: Materials Engineering	104
3.44	Subfield: Communications Technologies	106
3.45	Subfield: Interdisciplinary Engineering	108
3.46	Subfield: Nanoscience and Technology	110
3.47	Subfield: General Engineering	112
3.48	Field: Agricultural, Veterinary and Environmental Sciences	114
3.49	Subfield: Veterinary Sciences	116
3.50	Subfield: Fisheries	118
3.51	Subfield: Environmental Sciences	120
3.52	Field: Medical and Health Sciences	122
3.53	Subfield: Immunology	124
3.54	Subfield: Pharmacology and Pharmaceutical Science	126
3.55	Subfield: Medical Physiology	128
3.56	Subfield: Neurosciences	130
3.57	Subfield: Clinical Sciences	132
3.58	Subfield: Public Health and Health Services	134
3.59	Subfield: Interdisciplinary Life Sciences	136
3.60	Subfield: Multidisciplinary Sciences	138
3.61	Field: Economics	140
3.62	Field: Commerce, Management, Tourism and Services	142
3.63	Field: Studies in Human Society	144
3.64	Field: Behavioural and Cognitive Sciences	146
3.65	Field: History and Archaeology	148
	References	150
	TECHNICAL ANNEX: METHODOLOGY	151
T1	The Research Evaluation and Policy Project database	151
T2	Assignment of multi-institutional addresses	151
T3	Field of research classification	152
T4	Small numbers	152
T5	WoS coverage	152
T6	Identification of publications from ARC schemes	153
	T6.1 Discovery and Linkage Projects	153
	T6.2 Special Research Centres; Key Centres for Teaching and Research	155
	T6.3 Fellowships awards	155

T7	Delineation of comparator sectors	155
	T7.1 Cooperative Research Centres	155
	T7.2 Other Government publications	155
	T7.3 Other Hospital publications	155
	T7.4 Other University publications	155
	T7.5 Research Institutes	156
T8	Overlap between ARC schemes	156

APPENDIX: DETAILED STATISTICAL TABLES 158

LIST OF TABLES AND FIGURES

Table 1	Changes in ARC output and impact between the current study and the 2004 study, by fields and subfields	xv
Table 2	Changes in output and impact between the current study and the 2004 study by scheme	xvi
Table 3	Distribution of scheme/sector publications over time period	6
Table 4	Distribution of publications in schemes/sectors by RFCD (%)	7
Table 5	International collaboration by scheme/sector and country (percentage distribution)	10
Table 6	Distribution of publications in sectors by RFCD (percent).....	12
Table 7	Number of publications and relative impact: all publications, 2001–2005.....	14
Table 8	Centile distribution of publications: all publications	15
Table 9	Relative Citation and Journal Impact Rates, 2001–2005: Mathematical Sciences	20
Table 10	Centile Distribution of Publications, 2001–2005: Mathematical Sciences	20
Table 11	Relative Citation and Journal Impact Rates, 2001–2005: Mathematics	22
Table 12	Centile Distribution of Publications, 2001–2005: Mathematics	22
Table 13	Relative Citation and Journal Impact Rates, 2001–2005: Statistics	24
Table 14	Centile Distribution of Publications, 2001–2005: Statistics	24
Table 15	Relative Citation and Journal Impact Rates, 2001–2005: Physical Sciences	26
Table 16	Centile Distribution of Publications, 2001–2005: Physical Sciences	26
Table 17	Relative Citation and Journal Impact Rates, 2001–2005: Astronomical Sciences.....	28
Table 18	Centile Distribution of Publications, 2001–2005: Astronomical Sciences	28
Table 19	Relative Citation and Journal Impact Rates, 2001–2005: Condensed Matter Physics	30
Table 20	Centile Distribution of Publications, 2001–2005: Condensed Matter Physics	30
Table 21	Relative Citation and Journal Impact Rates, 2001–2005: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics	32
Table 22	Centile Distribution of Publications, 2001–2005: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics	32
Table 23	Relative Citation and Journal Impact Rates, 2001–2005: Optical Physics	34
Table 24	Centile Distribution of Publications, 2001–2005: Optical Physics	34
Table 25	Relative Citation and Journal Impact Rates, 2001–2005: Other Physical Sciences	36
Table 26	Centile Distribution of Publications, 2001–2005: Other Physical Sciences	36
Table 27	Relative Citation and Journal Impact Rates, 2001–2005: General Physical Sciences	38
Table 28	Centile Distribution of Publications, 2001–2005: General Physical Sciences	38
Table 29	Relative Citation and Journal Impact Rates, 2001–2005: Chemical Sciences	40
Table 30	Centile Distribution of Publications, 2001–2005: Chemical Sciences	40
Table 31	Relative Citation and Journal Impact Rates, 2001–2005: Physical Chemistry.....	42
Table 32	Centile Distribution of Publications, 2001–2005: Physical Chemistry	42
Table 33	Relative Citation and Journal Impact Rates, 2001–2005: Inorganic Chemistry	44
Table 34	Centile Distribution of Publications, 2001–2005: Inorganic Chemistry	44
Table 35	Relative Citation and Journal Impact Rates, 2001–2005: Organic Chemistry	46
Table 36	Centile Distribution of Publications, 2001–2005: Organic Chemistry	46
Table 37	Relative Citation and Journal Impact Rates, 2001–2005: Analytical Chemistry	48
Table 38	Centile Distribution of Publications, 2001–2005: Analytical Chemistry	48
Table 39	Relative Citation and Journal Impact Rates, 2001–2005: Macromolecular Chemistry	50
Table 40	Centile Distribution of Publications, 2001–2005: Macromolecular Chemistry	50
Table 41	Relative Citation and Journal Impact Rates, 2001–2005: General Chemical Sciences.....	52

Table 42	Centile Distribution of Publications, 2001–2005: General Chemical Sciences	52
Table 43	Relative Citation and Journal Impact Rates, 2001–2005: Earth Sciences	54
Table 44	Centile Distribution of Publications, 2001–2005: Earth Sciences	54
Table 45	Relative Citation and Journal Impact Rates, 2001–2005: Geology	56
Table 46	Centile Distribution of Publications, 2001–2005: Geology	56
Table 47	Relative Citation and Journal Impact Rates, 2001–2005: Geosciences	58
Table 48	Centile Distribution of Publications, 2001–2005: Geosciences	58
Table 49	Relative Citation and Journal Impact Rates, 2001–2005: Oceanography	60
Table 50	Centile Distribution of Publications, 2001–2005: Oceanography	60
Table 51	Relative Citation and Journal Impact Rates, 2001–2005: Atmospheric Sciences	62
Table 52	Centile Distribution of Publications, 2001–2005: Atmospheric Sciences	62
Table 53	Relative Citation and Journal Impact Rates, 2001–2005: Other Earth Sciences	64
Table 54	Centile Distribution of Publications, 2001–2005: Other Earth Sciences	64
Table 55	Relative Citation and Journal Impact Rates, 2001–2005: General Earth Sciences	66
Table 56	Centile Distribution of Publications, 2001–2005: General Earth Sciences	66
Table 57	Relative Citation and Journal Impact Rates, 2001–2005: Biological Sciences	68
Table 58	Centile Distribution of Publications, 2001–2005: Biological Sciences	68
Table 59	Relative Citation and Journal Impact Rates, 2001–2005: Biochemistry and Cell Biology	70
Table 60	Centile Distribution of Publications, 2001–2005: Biochemistry and Cell Biology	70
Table 61	Relative Citation and Journal Impact Rates, 2001–2005: Genetics	72
Table 62	Centile Distribution of Publications, 2001–2005: Genetics	72
Table 63	Relative Citation and Journal Impact Rates, 2001–2005: Microbiology	74
Table 64	Centile Distribution of Publications, 2001–2005: Microbiology	74
Table 65	Relative Citation and Journal Impact Rates, 2001–2005: Botany	76
Table 66	Centile Distribution of Publications, 2001–2005: Botany	76
Table 67	Relative Citation and Journal Impact Rates, 2001–2005: Zoology	78
Table 68	Centile Distribution of Publications, 2001–2005: Zoology	78
Table 69	Relative Citation and Journal Impact Rates, 2001–2005: Ecology and Evolution	80
Table 70	Centile Distribution of Publications, 2001–2005: Ecology and Evolution	80
Table 71	Relative Citation and Journal Impact Rates, 2001–2005: Biotechnology	82
Table 72	Centile Distribution of Publications, 2001–2005: Biotechnology	82
Table 73	Relative Citation and Journal Impact Rates, 2001–2005: General Biological Sciences	84
Table 74	Centile Distribution of Publications, 2001–2005: General Biological Sciences	84
Table 75	Relative Citation and Journal Impact Rates, 2001–2005: Information, Computing and Communication Sciences	86
Table 76	Centile Distribution of Publications, 2001–2005: Information, Computing and Communication Sciences	86
Table 77	Relative Citation and Journal Impact Rates, 2001–2005: Engineering and Technology Sciences	88
Table 78	Centile Distribution of Publications, 2001–2005 – Engineering and Technology Sciences	88
Table 79	Relative Citation and Journal Impact Rates, 2001–2005: Manufacturing Engineering	90
Table 80	Centile Distribution of Publications, 2001–2005: Manufacturing Engineering	90
Table 81	Relative Citation and Journal Impact Rates, 2001–2005: Mechanical and Industrial Engineering	92
Table 82	Centile Distribution of Publications, 2001–2005: Mechanical and Industrial Engineering	92
Table 83	Relative Citation and Journal Impact Rates, 2001–2005: Chemical Engineering	94
Table 84	Centile Distribution of Publications, 2001–2005: Chemical Engineering	94
Table 85	Relative Citation and Journal Impact Rates, 2001–2005: Resources Engineering	96
Table 86	Centile Distribution of Publications, 2001–2005: Resources Engineering	96
Table 87	Relative Citation and Journal Impact Rates, 2001–2005: Civil Engineering	98
Table 88	Centile Distribution of Publications, 2001–2005: Civil Engineering	98
Table 89	Relative Citation and Journal Impact Rates, 2001–2005: Electrical and Electronic Engineering	100
Table 90	Centile Distribution of Publications, 2001–2005: Electrical and Electronic Engineering	100
Table 91	Relative Citation and Journal Impact Rates, 2001–2005: Metallurgy	102
Table 92	Centile Distribution of Publications, 2001–2005: Metallurgy	102
Table 93	Relative Citation and Journal Impact Rates, 2001–2005: Materials Engineering	104
Table 94	Centile Distribution of Publications, 2001–2005: Materials Engineering	104
Table 95	Relative Citation and Journal Impact Rates, 2001–2005: Communications Technologies	106
Table 96	Centile Distribution of Publications, 2001–2005: Communications Technologies	106

Table 97	Relative Citation and Journal Impact Rates, 2001–2005: Interdisciplinary Engineering	108
Table 98	Centile Distribution of Publications, 2001–2005: Interdisciplinary Engineering	108
Table 99	Relative Citation and Journal Impact Rates, 2001–2005: Nanoscience and Technology	110
Table 100	Centile Distribution of Publications, 2001–2005: Nanoscience and Technology.....	110
Table 101	Relative Citation and Journal Impact Rates, 2001–2005: General Engineering	112
Table 102	Centile Distribution of Publications, 2001–2005: General Engineering	112
Table 103	Relative Citation and Journal Impact Rates, 2001–2005: Agricultural, Veterinary and Environmental Sciences	114
Table 104	Centile Distribution of Publications, 2001–2005: Agricultural, Veterinary and Environmental Sciences.....	114
Table 105	Relative Citation and Journal Impact Rates, 2001–2005: Veterinary Sciences	116
Table 106.	Centile Distribution of Publications, 2001–2005: Veterinary Sciences	116
Table 107	Relative Citation and Journal Impact Rates, 2001–2005: Fisheries Sciences	118
Table 108	Centile Distribution of Publications, 2001–2005: Fisheries Sciences	118
Table 109	Relative Citation and Journal Impact Rates, 2001–2005: Environmental Sciences	120
Table 110	Centile Distribution of Publications, 2001–2005: Environmental Sciences	120
Table 111	Relative Citation and Journal Impact Rates, 2001–2005: Medical and Health Sciences	122
Table 112	Centile Distribution of Publications, 2001–2005: Medical and Health Sciences	122
Table 113	Relative Citation and Journal Impact Rates, 2001–2005: Immunology	124
Table 114	Centile Distribution of Publications, 2001–2005: Immunology	124
Table 115	Relative Citation and Journal Impact Rates, 2001–2005: Pharmacology and Pharmaceutical Sciences	126
Table 116	Centile Distribution of Publications, 2001–2005: Pharmacology and Pharmaceutical Sciences	126
Table 117	Relative Citation and Journal Impact Rates, 2001–2005: Medical Physiology	128
Table 118	Centile Distribution of Publications, 2001–2005: Medical Physiology	128
Table 119	Relative Citation and Journal Impact Rates, 2001–2005: Neurosciences	130
Table 120	Centile Distribution of Publications, 2001–2005: Neurosciences	130
Table 121	Relative Citation and Journal Impact Rates, 2001–2005: Clinical Sciences	132
Table 122	Centile Distribution of Publications, 2001–2005: Clinical Sciences	132
Table 123	Relative Citation and Journal Impact Rates, 2001–2005: Public Health and Health Services	134
Table 124	Centile Distribution of Publications, 2001–2005: Public Health and Health Services	134
Table 125	Relative Citation and Journal Impact Rates, 2001–2005: Interdisciplinary Life Sciences	136
Table 126	Centile Distribution of Publications, 2001–2005: Interdisciplinary Life Sciences	136
Table 127	Relative Citation and Journal Impact Rates, 2001–2005: Multidisciplinary sciences	138
Table 128	Centile Distribution of Publications, 2001–2005: Multidisciplinary sciences.....	138
Table 129	Relative Citation and Journal Impact Rates, 2001–2005: Economics	140
Table 130	Centile Distribution of Publications, 2001–2005 – Economics.....	140
Table 131	Relative Citation and Journal Impact Rates, 2001–2005: Commerce, Management, Tourism and Services ...	142
Table 132	Centile Distribution of Publications, 2001–2005: Commerce, Management, Tourism and Services	142
Table 133	Relative Citation and Journal Impact Rates, 2001–2005: Studies in Human Society	144
Table 134	Centile Distribution of Publications, 2001–2005: Studies in Human Society	144
Table 135	Relative Citation and Journal Impact Rates, 2001–2005: Behavioural and Cognitive Sciences	146
Table 136	Centile Distribution of Publications, 2001–2005: Behavioural and Cognitive Sciences	146
Table 137	Relative Citation and Journal Impact Rates, 2001–2005: History and Archaeology	148
Table 138	Centile Distribution of Publications, 2001–2005: History and Archaeology	148
Table T1	Distribution of research by type of publication and field, 1999–2001.....	153
Table T2	Coverage of 1999–2003 Discovery and DIRD Projects Scheme	154
Table T3	Coverage of 1999–2003 Linkage Projects Scheme	154
Table T4	Duplication between ARC schemes (schemes 1–10)	157
Table A1	Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6)	159
Table A2	Collaboration patterns by sector (Figure 1)	164
Table A3	International collaboration by sector and country (Table 5).....	165
Table A4	Relative citation and journal impact: Selected Science Fields, Total ARC (Figure 2).....	166
Table A5	Relative citation and journal impact: Selected Social Science Fields, Total ARC (Figure 3)	166
Table A6	Relative citation and journal impact – Selected Science & Social Science Fields, ASC Discovery Projects (Figure 4)	166
Table A7	Relative citation and journal impact: Selected Science Fields, ARC Linkage Projects (Figure 5)	166

Figure 1	Collaboration patterns by scheme/sector	10
Figure 2	Relative citation and journal impact: Selected Science Fields, Total ARC	16
Figure 3	Relative citation and journal impact: Selected Social Sciences Fields, Total ARC.....	16
Figure 4	Relative citation and journal impact: Selected Science & Social Sciences Fields, ARC Discovery Projects	17
Figure 5	Relative citation and journal impact: Selected Sciences Fields, ARC Linkage Projects	17
Figure 6	Relative Citation and Journal Impact: Mathematical Sciences	21
Figure 7	Relative Citation and Journal Impact: Mathematics	23
Figure 8	Relative Citation and Journal Impact: Statistics	25
Figure 9	Relative Citation and Journal Impact: Physical Sciences	27
Figure 10	Relative Citation and Journal Impact: Astronomical Sciences.....	29
Figure 11	Relative Citation and Journal Impact: Condensed Matter Physics	31
Figure 12	Relative Citation and Journal Impact: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics	33
Figure 13	Relative Citation and Journal Impact: Optical Physics	35
Figure 14	Relative Citation and Journal Impact: Other Physical Sciences	37
Figure 15	Relative Citation and Journal Impact: General Physical Sciences.....	39
Figure 16	Relative Citation and Journal Impact: Chemical Sciences	41
Figure 17	Relative Citation and Journal Impact: Physical Chemistry	43
Figure 18	Relative Citation and Journal Impact: Inorganic Chemistry	45
Figure 19	Relative Citation and Journal Impact: Organic Chemistry	47
Figure 20	Relative Citation and Journal Impact: Analytical Chemistry	49
Figure 21	Relative Citation and Journal Impact: Macromolecular Chemistry.....	51
Figure 22	Relative Citation and Journal Impact: General Chemical Sciences.....	53
Figure 23	Relative Citation and Journal Impact: Earth Sciences	55
Figure 24	Relative Citation and Journal Impact: Geology	57
Figure 25	Relative Citation and Journal Impact: Geosciences	59
Figure 26	Relative Citation and Journal Impact: Oceanography	61
Figure 27	Relative Citation and Journal Impact: Atmospheric Sciences.....	63
Figure 28	Relative Citation and Journal Impact: Other Earth Sciences	65
Figure 29	Relative Citation and Journal Impact: General Earth Sciences.....	67
Figure 30	Relative Citation and Journal Impact: Biological Sciences	69
Figure 31	Relative Citation and Journal Impact: Biochemistry and Cell Biology	71
Figure 32	Relative Citation and Journal Impact: Genetics	73
Figure 33	Relative Citation and Journal Impact: Microbiology	75
Figure 34	Relative Citation and Journal Impact: Botany	77
Figure 35	Relative Citation and Journal Impact: Zoology	79
Figure 36	Relative Citation and Journal Impact: Ecology and Evolution.....	81
Figure 37	Relative Citation and Journal Impact: Biotechnology	83
Figure 38	Relative Citation and Journal Impact: General Biological Sciences	85
Figure 39	Relative Citation and Journal Impact: Information, Computing and Communication Sciences	87
Figure 40	Relative Citation and Journal Impact: Engineering and Technology Sciences	89
Figure 41	Relative Citation and Journal Impact: Manufacturing Engineering.....	91
Figure 42	Relative Citation and Journal Impact: Mechanical and Industrial Engineering	93
Figure 43	Relative Citation and Journal Impact: Chemical Engineering	95
Figure 44	Relative Citation and Journal Impact: Resources Engineering	97
Figure 45	Relative Citation and Journal Impact: Civil Engineering	99
Figure 46	Relative Citation and Journal Impact: Electrical and Electronic Engineering	101
Figure 47	Relative Citation and Journal Impact: Metallurgy	103
Figure 48	Relative Citation and Journal Impact: Materials Engineering.....	105
Figure 49	Relative Citation and Journal Impact: Communications Technologies	107
Figure 50	Relative Citation and Journal Impact: Interdisciplinary Engineering	109
Figure 51	Relative Citation and Journal Impact: Nanoscience and Technology	111
Figure 52	Relative Citation and Journal Impact: General Engineering.....	113
Figure 53	Relative Citation and Journal Impact: Agricultural, Veterinary and Environmental Sciences	115
Figure 54	Relative Citation and Journal Impact: Veterinary Sciences	117
Figure 55	Relative Citation and Journal Impact: Fisheries Sciences	119

Figure 56	Relative Citation and Journal Impact: Environmental Sciences	121
Figure 57	Relative Citation and Journal Impact: Medical and Health Sciences	123
Figure 58	Relative Citation and Journal Impact: Immunology	125
Figure 59	Relative Citation and Journal Impact: Pharmacology and Pharmaceutical Sciences	127
Figure 60	Relative Citation and Journal Impact: Medical Physiology	129
Figure 61	Relative Citation and Journal Impact: Neurosciences	131
Figure 62	Relative Citation and Journal Impact: Clinical Sciences	133
Figure 63	Relative Citation and Journal Impact: Public Health and Health Services	135
Figure 64	Relative Citation and Journal Impact: Interdisciplinary Life Sciences	137
Figure 65	Relative Citation and Journal Impact: Multidisciplinary Sciences	139
Figure 66	Relative Citation and Journal Impact: Economics	141
Figure 67	Relative Citation and Journal Impact: Commerce, Management, Tourism and Services	143
Figure 68	Relative Citation and Journal Impact: Studies in Human Society.....	145
Figure 69	Relative Citation and Journal Impact: Behavioural and Cognitive Sciences	147
Figure 70	Relative Citation and Journal Impact: History and Archaeology	149

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Abbreviations

Abbreviations

AAO	Anglo-Australian Observatory
AIMS	Australian Institute of Marine Science
ANSTO	Australian Nuclear Science and Technology Organisation
ANU	Australian National University
APD	Australian Postdoctoral Fellowships
APF	Australian Professorial Fellowships
ARC	Australian Research Council
ARF	Australian Research Fellowships
CE	Centres of Excellence
CRC	Cooperative Research Centre
Disc	Discovery Projects Scheme
FF	Federation Fellowships
KC	Key Centres for Teaching and Research
Link	Linkage Projects Scheme
QEII	Queen Elizabeth II Fellowships
REPP	Research Evaluation and Policy Project
SRC	Special Research Centres
SRF	Senior Research Fellowships

Executive summary

Background

The Research Evaluation and Policy Project (REPP) was commissioned by the Australian Research Council (ARC) to update its previous 2004 analysis of the impact of publications resulting from ARC-funded research¹. The ARC has many diverse schemes for funding research, which target different aggregations of effort – the research group, cross-institutional programs, and the individual researcher. This current analysis, like that in the previous study, creates a series of publication sets that enable each of the ARC's main research grant schemes to be evaluated on the basis of citation impact.

Database

The analysis is based primarily on the REPP database. It contains all Australian publications indexed in three main indices of the Thomson Reuters Web of Science (WoS): the Science Citation Index; the Social Sciences Citation Index; and the Arts and Humanities Citation Index.

Sectors analysed

The report identifies fifteen sectors. Ten equate to ARC research grant schemes: Discovery Projects; Linkage Projects; Special Research Centres; Centres of Excellence; Key Centres; and Research Fellowship Awards (Postdoctoral, QEII, Professorial, Research, and Federation). The remaining five represent other sites of activity in Australian research: research institutes; Cooperative Research Centres; universities; hospitals; and government departments and agencies. The methodology used created sectors with quite distinct characteristics, and minimised the overlap between ARC schemes and their comparators.

Field of research

Analyses were undertaken using journal sets to delineate fields. *Some journals are classified to more than one field/subfield and this leads to some double-counting across subfields*; however, this duplication is removed from aggregate field calculations. As a result, the sum of the subfields will be greater than the field total.

Journal sets based on the revised Australian Bureau of Statistics research classification scheme had not been finalised in time for this study. This report applies the same scheme used in the 2004 study.

Measures used

The analyses focus on publications that appeared between 2001 and 2005 and the citations they attracted in the same 5-year period. The two standard bibliometric measures used were:

- comparison of relative citation impact and relative journal impact
- centile distribution of publications.

Using bibliometrics

Bibliometric data alone cannot answer any single evaluative question. In the activity being analysed, bibliometric data must be considered alongside other measures: esteem, performance, visibility and the testimony of expert peers. The efficacy of bibliometric measures for the evaluation of various ARC schemes varies, not between schemes, but in relation to the different fields of research covered by each scheme.

¹ Butler, L., 2004. *ARC-Supported Research: The Impact of Journal Publication Output 1996–2000*, Australian Research Council, Canberra. Available online at: http://www.arc.gov.au/pdf/arc_supported_research.pdf

Main findings

ARC Output (see Tables 2 & 6)

- Publications linked to funding from the ARC grew by 41% between the 2004 study and this current analysis, well over twice the total Australian and world growth. The largest percentage increase in output was from the Linkage Projects scheme, though in raw numbers the output linked to Discovery Projects grew by some 2500. Much of the growth or decline in output from ARC schemes reflects changes to those schemes that occurred in the period between the two studies.
- In aggregate, 16.5% of Australian research publications are linked to ARC funding. In some fields, the importance of ARC funding is much greater, with nearly 40% of all publications in the Physical Sciences linked to the ARC. It is also high in Chemical Sciences (31.8%) and Mathematical Sciences (30.6%), but low in Agricultural, Veterinary and Environmental Sciences (7.6%) and Medical and Health Sciences (4.1%). This latter is hardly surprising, given the centrality of NHMRC funding for this field – which is linked to 26% of Australian output.
- The proportion of output linked to ARC funding in the Social Sciences and Humanities is quite low, with most research supported through alternative university funds.

Collaboration (See Figure 1 & Table 5)

- In aggregate terms, ARC research results in a smaller proportion of single-author publications than for Australia as a whole. Collaboration is stronger internationally than nationally, and multiple authorship from within the same institution (i.e. group authorship) predominates.
- Reflecting their missions, Linkage Projects and Key Centres have much higher levels of national collaboration than other ARC schemes (though not as high as a number of comparator sectors).
- The level of international collaboration has risen across all sectors since the previous study, reflecting world-wide trends, and now stands at 40% for all Australian output, and slightly above this for ARC in total. Close to half the publications from the Federation Fellowships sector involve international collaboration, the highest for any scheme/sector, and they also have the lowest levels of single authorship.
- The ARC as a whole has the highest number of international collaborations with USA (35%), followed by England, Germany and the Peoples Republic of China (15%, 11%, 10%, respectively). The main difference between the direction of ARC international collaborations and that for most comparator sectors is stronger links to Germany and China, and slightly weaker links to England and New Zealand. The Federation Fellowships and QEII schemes have particularly strong links to China. Key Centres have stronger than average links to Germany, Japan and France (see Table 5).

Citation performance (see Section 3)

- The relative impact of total ARC output remains unchanged between the two periods, and the differential between ARC-funded output and the Australian total is narrowing. The reasons for this are complex – some schemes have declined in impact (Research Fellowships and QEII Fellowships), while the influence of the Linkage Projects scheme (with a more applied focus and hence lower impact) has increased. The new flagship schemes – Federation Fellowships and Centres of Excellence – were still in their infancy during the period covered by the study.
- Research institutes have the highest relative citation impact of any sector, even after accounting for the high impact fields in which they are active. For the ARC schemes, Federation Fellowships and the Special Research Centres have the strongest performance. In this time-frame, the publications of Australian Postdoctoral Fellowships also perform very strongly and at a similar level to Australian Professorial Fellowships. This is a somewhat surprising result, given how early in their career the researchers are, and it warrants further investigation.
- ARC performance in all fields is above the world benchmark in all fields except Information, Computing and Communication Sciences. It is important to note that for this field, journal articles are less important than refereed conference proceedings as outlets for research.
- ARC performance is also above the Australian benchmark in all fields except Medical and Health Science. Medical research is primarily the remit of the National Health and Medical Research Council (NHMRC), whose funding is linked to 26% of Australian publications (compared to 4% for the ARC), so this result is not unexpected.
- In the sciences, the fields with the highest impact (relative to world benchmarks) are: Agricultural, Veterinary and Environmental Sciences (1.39); Earth Sciences (1.39); Physical Sciences (1.35); and Chemical Sciences (1.30).
- In the sciences, the fields with the highest impact compared to the Australian benchmark are: Agricultural, Veterinary and Environmental Sciences (1.39 compared to 1.05); Earth Sciences (1.39 compared to 1.09); Chemical Sciences (1.30 compared to 1.23); and Engineering (1.20 compared to 0.99).
- ARC publications in all disciplines in the social sciences and humanities that had sufficient numbers for analysis were well above world and Australian benchmarks. However, in some cases their presence in the most highly cited group of publications was more modest. It must be remembered that for all disciplines except Behavioural Sciences, journals represent only a small proportion of publication output, and extreme care must be used in the interpretation of this data.

- In all fields except Mathematical Sciences, the proportion of ARC publications appearing among the most highly cited for their discipline is higher than the norm of 1%. In Chemical Sciences, ARC publications are classified in this top band at double this rate, and in fact account for half of all Australian publications in this group. Other fields where ARC support is linked to a large proportion of the most highly cited Australian publications are Physical Sciences (39%) and Engineering (38%).

Comparison to previous study

A number of factors have made it difficult to make direct comparisons of results from this study to that published in 2004. However, productivity comparisons are possible, and impact comparisons at the broad-field level have been made, but the following issues need to be borne in mind when interpreting any changes:

Changes to ARC schemes and comparator sectors

A number of ARC grant schemes were superseded or substantially altered by new funding arrangements during the period covered by this analysis – for example, Federation Fellowships were introduced and the number of Australian Postdoctoral Fellowships were doubled. In addition, the composition of the comparator sectors was realigned, primarily due to the opening up of eligibility for ARC funding to researchers from the Institute of Advanced Studies (IAS) at the Australian National University.

Changes to methodology

It was necessary to adjust the methodology used in the 2004 bibliometric analysis. In contrast to the previous study, the output from ARC schemes was not distributed evenly across the 5-year window covered by the report. The major reasons were the introduction of new schemes during the period and the increase in the number of grants funded. This required our analysis to use yearly benchmarks, rather than employing a 5-year benchmark as used in the previous study. This issue is discussed in more detail in the text of the report.

Comparative data

Nevertheless, some comparisons between the current results and those from 2004 can be made. There are no issues in making direct comparisons on productivity, so that the data extracted in the previous study enables us to calculate our main citation measure – relative citation impact. *However, one difference between the studies remains, even for this measure: this current study is based on an aggregation of yearly relative citation impacts, while the previous study calculates relative citation impact on the basis of a 5-year window.* At the level of ARC in total by field, or for individual schemes in total, a comparison between the two is robust. But disaggregating schemes down into field of research could raise serious inequities in the comparisons, as at that level the different methodologies could have major impacts.

Table 1 presents a comparison of activity and impact between the last two studies for total ARC publications by field, while Table 2 compares the performance of individual schemes. Due to the changes to ARC funding schemes mentioned above, not all have a direct comparator in the previous study.

The interpretation of the results of this study would be enhanced by considering the policy changes that have occurred in the schemes administered by the ARC in the time-frame under consideration. For example, if there have been specific attempts to target funding to a discipline, then that is likely to result in increased publication output and/or an improved citation impact.

There has been an overall increase of 41% in the number of publications linked to ARC support in the 5 years since the previous study, well above the national increase of 15%; however, this has not been uniform across all disciplines. Optical Physics, Macromolecular Chemistry, Ecology and Evolution, Civil Engineering, Metallurgy, Materials Engineering, Environmental Sciences and Commerce all show a doubling of output or more; while output in Veterinary Sciences and Organic Chemistry journals decreased.

As noted under the heading of these tables, it is important to recognise that the two periods were calculated using a different methodology (the 2004 study used aggregate 5-year benchmarks, and this current study uses benchmarks for individual years), so some caution should be employed when interpreting the changes.

Table 1. Changes in ARC output and impact between the current study and the 2004 study, by fields and subfields

Note: The Relative Citation Impact data is not strictly comparable between the two studies due to the change in methodology – it is indicative only.

Field	NUMBER OF PUBLICATIONS			RELATIVE CITATION IMPACT		
	1996–2000	2001–2005	% change	1996–2000	2001–2005	% change
Mathematical Sciences	861	878	2	1.26	1.14	-10
Mathematics	494	725	47	1.12	1.15	3
Statistics	159	171	8	1.37	0.71	-48
Physical Sciences	3444	4584	33	1.14	1.35	18
Astronomical Sciences	456	668	46	0.94	1.33	41
Theoretical and Condensed Matter Physics	504	583	16	1.09	1.15	5
Atomic Molecul; Nucl Particle; Plasma Phys	740	1034	40	1.10	1.18	7
Optical Physics	369	756	105	1.06	1.59	50
Other Physical Sciences	348	509	46	1.18	1.25	6
General Physical Sciences	1550	2120	37	1.29	1.52	18
Chemical Sciences	2050	2732	33	1.44	1.30	-10
Physical Chemistry	749	981	31	1.33	1.29	-3
Inorganic Chemistry	518	524	1	1.79	1.62	-9
Organic Chemistry	342	314	-8	1.51	1.17	-23
Analytical Chemistry	269	358	33	1.13	1.26	11
Macromolecular Chemistry	159	349	119	1.93	1.85	-4
General Chemical Sciences	448	583	30	1.33	1.10	-17
Earth Sciences	1003	1596	59	1.15	1.39	21
Geology	287	438	53	1.30	1.49	14
Oceanography	115	207	80	0.67	1.04	55
Atmospheric Sciences	149	208	40	0.82	0.81	-2
Other Earth Sciences		120			1.41	
General Earth Sciences	372	633	70	0.93	1.28	37
Geosciences	318	512	61	1.00	1.36	36
Biological Sciences	2783	3663	32	1.08	1.04	-3
Biochemistry and Cell Biology	1087	1364	25	1.11	1.00	-10
Genetics	281	382	36	0.88	0.88	0
Microbiology	224	241	8	1.72	1.47	-14
Botany	498	557	12	1.49	1.50	0
Zoology	399	605	52	1.48	1.38	-6
Ecology and Evolution	455	930	104	1.37	1.32	-4
Biotechnology	269	379	41	1.19	1.05	-12
General Biological Sciences	242	354	46	1.32	1.57	19
Information, Computing and Communication Science	195	283	45	0.94	0.86	-8
Engineering and Technology	1639	3083	88	1.31	1.20	-9
Manufacturing Engineering	113	201	78	1.38	1.41	2
Mechanical and Industrial Engineering	115	198	72	1.34	1.24	-7
Chemical Engineering	229	425	86	1.75	1.36	-22
Resources Engineering	210	354	69	2.05	1.21	-41
Civil Engineering	139	297	114	0.97	1.27	31
Electrical and Electronic Engineering	327	621	90	1.28	1.24	-3
Metallurgy	131	279	113	1.41	1.45	3
Materials Engineering	494	1022	107	1.27	1.16	-9
Communications Technologies		106			1.62	
Interdisciplinary Engineering	249	340	37	1.47	1.20	-19
Nanoscience and Technology		132			0.75	

Table 1. Changes in ARC output and impact between the current study and the 2004 study, by fields and subfields (continued)

Field	NUMBER OF PUBLICATIONS			RELATIVE CITATION IMPACT		
	1996–2000	2001–2005	% change	1996–2000	2001–2005	% change
General Engineering and Technology		178			1.26	
Agricultural, Veterinary and Environmental Sciences	483	784	62	1.63	1.39	-15
Veterinary Sciences	171	114	-33	2.52	1.72	-32
Fisheries Sciences		138			1.44	
Environmental Sciences	162	373	130	1.12	1.21	8
Medical and Health Sciences	1105	1472	33	1.42	1.05	-26
Immunology	115	106	-8	2.53	1.17	-54
Pharmacology and Pharmaceutical Science	134	194	45	0.88	1.08	22
Medical Physiology	216	267	24	1.35	0.91	-33
Neurosciences	237	349	47	0.99	0.90	-9
Clinical Sciences	478	672	41	1.39	1.06	-24
Public Health and Health Services		150			0.87	
Economics	107	202	89	1.12	1.18	6
Commerce, Management, Tourism, Services	50	113	126		1.56	
Studies in Human Society	116	211	82	0.85	1.19	41
Behavioural and Cognitive Sciences	404	772	91	1.11	1.41	27
History and Archaeology	76	110	45		1.50	
Science – general	684	1029	50	1.03	1.16	12
Interdisciplinary Life Sciences	435	648	49	1.07	0.92	-14
Multidisciplinary Science	249	381	53	1.14	1.43	25

Table 2. Changes in output and impact between the current study and the 2004 study by scheme

NOTE: The Relative Citation Impact data is not strictly comparable between the two studies due to the change in methodology – it is indicative only.

ARC Scheme	NUMBER OF PUBLICATIONS			RELATIVE CITATION IMPACT		
	1996–2000	2001–2005	% change	1996–2000	2001–2005	% change
Australian Postdoctoral Fellowships	1105	1621	47	1.03	1.36	32
Australian Professorial Fellowships*	1129	2178	93	1.25	1.31	5
Australian Research Fellowships	941	1028	9	1.88	1.27	-32
Centres of Excellence**		574			1.35	
Discovery Projects	7977	10528	32	1.14	1.17	3
Federation Fellowships**		977			1.59	
Key Centres	426	402	-6	1.15	1.13	-2
Linkage Projects	364	1604	341	0.73	0.92	26
QEII Fellowships	885	1159	31	1.61	1.12	-30
Special Research Centres	1332	1863	40	1.69	1.53	-9
ARC Total	12212	17246	41	1.19	1.19	0
Australia	90501	104319	15	0.97	1.11	15
World	3348128	3782695	13	1.00	1.00	

* formerly Senior Research Fellowships

** not in existence in earlier study

Introduction

Introduction

The Australian Research Council (ARC) commissioned the Research Evaluation and Policy Project (REPP) to undertake an analysis of the impact of publications resulting from ARC-funded research. The ARC has many diverse schemes for funding research, which target different aggregations of effort: the institution, the unit, the research group, cross-institutional programs, and the individual researcher. This analysis creates a series of publication sets that enable each of the ARC's main research grant schemes to be evaluated on the basis of citation impact. It links publications from 2001 to 2005, indexed by Thomson Reuters in its Web of Science (WoS), to each of the ARC's schemes. This current study provides comparative data to an earlier study that was carried out by REPP which analysed ARC-supported research from 1996 to 2000. However, the fact that some schemes are being phased out and others introduced makes direct comparison difficult in some cases.

This report presents a bibliometric analysis comparing the impact of publications linked to each of the ARC schemes with other Australian research publications. The ARC funding mechanisms evaluated were: Australian Postdoctoral Fellowships (APD); Australian Professorial Fellowships (APF; this category also includes Senior Research Fellowships which were superseded by APFs); Australian Research Fellowships (ARF); Centres of Excellence (CE); Federation Fellowships (FF); Key Centres (KC); Linkage Projects; QEII Fellowships and Special Research Centres. The ARC publications were compared to those of Cooperative Research Centres (CRCs), other government departments and agencies, other hospital research, other university research, and research institutes (which included CSIRO).

Bibliometric data alone cannot answer any single evaluative question. This information must be seen alongside other measures of esteem, performance, visibility and the testimony of expert peers in relation to the activity that is being analysed. The efficacy of bibliometric measures for the evaluation of various ARC schemes varies, not between schemes, but in relation to the different fields of research covered by each scheme. (For a more detailed explanation of this point see section T5 in the Technical Annex.)

This report is presented in three sections, followed by a technical annex containing a detailed discussion of the methodology employed. The contents of each section of the report are as follows:

- **Section 1: Methodology** – a brief outline of the project methodology;
- **Section 2: Scheme/sector characteristics and performance** – compares and contrasts the research focus of each of the 15 schemes/sectors in the study, and analyses the citation performance of their total publication output; and
- **Section 3: RFCD fields and subfields of research** – analyses the citation performance of each of the 15 schemes/sectors in the study on the basis of journal sets using the Research Fields, Courses and Disciplines (RFCD) classification scheme.

1. Methodology



The publications that resulted from research supported by ARC funding were identified either directly from the REPP database using author and/or institutional address information, or from details obtained from the final reports of grants. Full details of the methodology used to identify the publications for each of the ARC funding schemes, and the comparator sectors against which their performance was judged, is given in the Technical Annex.

1.1 Coverage of WoS database

The use of bibliometric analysis as a tool for evaluating research performance cannot be universally applied across all fields of research (Bourke, Butler and Biglia 1996; NBEEET 1994). WoS does not comprehensively cover the output of Australian research in:

- most fields in the humanities and social sciences;
- engineering, information sciences, and other fields of research in the applied sciences; or
- the applied end of the research spectrum, even for those fields generally well covered by WoS indices.

The implication for this study is that the WoS database, while it provides a comprehensive coverage of the major journals in many subfields, is not universal. The Technical Annex examines in more detail WoS coverage of different disciplines, and this issue will also be addressed prior to the analysis undertaken for each field.

1.2 Definition of schemes/sectors

It is important to stress that the methodology used in this study was aimed at creating sectors with quite distinct characteristics and with as little overlap as possible. In order to achieve this, some of the sectors created do not bear a strong resemblance to their commonly perceived definition. In particular, the other university, other government, and other hospital sectors created as comparators are not comprehensive, covering only those publications not supported by ARC funding schemes or done in collaboration with other comparator sectors.

The specifications for the study identified 15 schemes/sectors for analysis:

ARC schemes:

1. Australian Postdoctoral Fellowship (APD) awards

APDs provide opportunities for researchers at the postdoctoral level to undertake research of national and international significance, and to broaden their research experience. Fellowships commence within 3 years of a PhD being awarded, and the standard tenure is 3 years. The scheme covers all 2001–2005 publications that could be attributed to these Fellowships.

2. Australian Professorial Fellowship (APF) awards (which replaced the Senior Research Fellowship (SRF) awards)

APFs support outstanding researchers with proven international reputations to conduct research of major importance in its field and which is of significant benefit to Australia. Applicants must have more than 8 years professional experience since the award of their PhD. The scheme covers all 2001–2005 publications that could be attributed to these Fellowships.

3. Australian Research Fellowship (ARF) awards

ARFs provide opportunities for established researchers to undertake research of national and international significance. At the time of their application, applicants must have more than 3 years (but not more than 8 years) professional experience since the award of their PhD. The standard tenure for an ARF is 5 years. The scheme covers all 2001–2005 publications that could be attributed to these Fellowships.

4. Centres of Excellence (CE)

ARC Centres of Excellence are established on the basis of excellence of the proposed research program and also the high quality of participating researchers. Funding is for highly innovative research in areas of national significance. The scheme aims to place Australia at the forefront of world research in the government's designated areas of research priority. Since the first round of these centres began only in 2003, the effects of ARC funding on their publications has only been evident in the later part of our study period.

5. Federation Fellowships (FF)

Federation Fellowships are open to outstanding researchers of international renown who will play a leadership role in building Australia's international competitive research capacity. Preference is given to early- to mid-career researchers and they receive a standard tenure of 5 years. The first recipients of the federal government's Federation Fellowships were announced in 2001, with subsequent rounds increasing the number of recipients. As with

Centres of Excellence, publications for this scheme are clustered in the later part of our study period.

6. Key Centres for Teaching and Research (Key Centres)

Key Centres for Teaching and Research have enabled education to respond to emerging national needs for the development of expertise in fields important to national development. Key Centres are funded for 6 years, subject to satisfactory performance. The scheme covers all 2001–2005 publications that could be attributed to these centres.

7. Queen Elizabeth II Fellowship (QEII) awards

QEII's encourage research in Australia by postdoctoral graduates of exceptional promise and proven capacity for original work. The top 10 applicants for ARFs are awarded QEII's. At the time of their application, applicants have more than 3 years (but not more than 8 years) professional experience since the award of their PhD. The standard tenure for a QEII fellowship is 5 years. The scheme covers all 2001–2005 publications that could be attributed to these Fellowships.

8. Special Research Centres (SRC)

Special Research Centres are funded by the ARC on the basis of research excellence. Subject to satisfactory performance, SRCs are funded for 9 years. The ARC does not fund new centres under this program but continues to fund many centres of excellent calibre. The sector covers all 2001–2005 publications that could be attributed to these centres.

9. Discovery Projects scheme

(this scheme replaced Large Grants)

The Discovery Projects scheme provides funding for research projects that can be undertaken by individual researchers or research teams. During the period covered by this analysis, grants were normally of 3 years duration, and researchers usually retained teaching duties within their institutions. This analysis also included the Discovery Indigenous Researchers Development (DIRD) scheme. Publications for 2001–2005 resulting from this scheme were identified from each final report that had been received for grants commencing between 1999 and 2003.

10. Linkage Projects scheme (this scheme replaced Collaborative/SPIRT Grants)

The Linkage Projects scheme supports collaborative research and development projects between higher education organisations and outside organisations, such as industry, to foster the application of advanced knowledge to problems. The collaborating organisation must make a significant contribution (equal to, or greater than, the ARC funding), in cash and/or in kind, to the project. Typically, research projects funded under the scheme involve risk. Under the Linkage Projects scheme, the ARC offers postgraduate awards and fellowships to provide industry-oriented research training and enable postdoctoral researchers to pursue internationally competitive research opportunities in collaboration with industry. Publications for 2001–2005 resulting from this scheme were identified from each final report that had been received for grants commencing between 1999 and 2003.

ARC total

In all analyses, data is presented in aggregate for all schemes funded by the ARC (schemes 1 to 10). Duplications due to cross-sector collaboration have been removed.

Comparator sectors:

11. Cooperative Research Centres (CRCs)

Fully-funded, single-focus research centres of 6–9 years duration employing full-time researchers. The sector covers all 2001–2005 publications from the centres that were operational during this period. This sector specifically excludes any publications identified as having ARC support (i.e. which are included in one or more of schemes 1–10), but does include publications that are collaborative works with Research Institutes.

12. Other Government departments and agencies

Full-time and part-time researchers located in federal and state government departments and agencies including ANSTO, AAO, AIMS, etc. This sector specifically excludes any publications identified as having ARC support (i.e. are included in one or more of schemes 1–10) or that are collaborative works with either the CRCs or Research Institutes (sectors 11 and 15), but may include publications that result from NHMRC support.

13. Other Hospital

Full-time and part-time researchers, funded principally through hospital general operating grants and through competitive grants obtained from other funding agencies. This sector specifically excludes any publications identified as having ARC support (i.e. which are included in one or more of schemes 1–10) or that are collaborative works with either the CRCs or Research Institutes (sectors 11 and 15), but may include publications that result from NHMRC support.

14. Other University

Full-time and part-time researchers, most of whom retain teaching and administrative responsibilities, funded principally through university general operating grants and through competitive grants obtained from other funding agencies. This sector specifically excludes any publications identified as having ARC support (i.e. which are included in one or more of schemes 1–10) or that are collaborative works with either the CRCs or Research Institutes (sectors 11 and 15), but may include publications that result from NHMRC support.

15. Research Institutes

Other block-funded research institutions employing full-time researchers, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and members of the Australian Association of Medical Research Institutes (AAMRI). The sector covers all 2001–2005 publications from these institutions. This sector specifically excludes any publications identified as having ARC support (i.e. which are included in one or more of schemes 1–10), but does include publications that are collaborative works with CRCs.

It is acknowledged that support for the research that leads to a particular publication can come from more than one source. Publications associated with the ARC schemes may well have additional funding sources that could qualify them for inclusion in one or more of sectors 11 to 14. However, it is impossible to clearly identify sets of publications when they have multiple funding sources. The aim in this study was to delineate sectors in a way that would allow us to compare ARC-funded publications with those that received little support from the agency, and to delineate sectors that had identifiable, distinctive features. The methodology chosen to do this can be regarded as successful in this respect.

1.3 Methodology overview

A full description of the methodology used to identify each scheme/sector's publications is given in the Technical Annex. In this section of the report, a limited number of specific issues are discussed and the more significant aspects of the methodology are highlighted.

In-scope publications

The analysis covered all publications, classified as articles or reviews, which appeared from 2001 to 2005 in journals indexed in WoS's three main indices: Science Citation Index (SCI), Social Sciences Citation Index (SSCI), and Arts and Humanities Citation Index (A&HCI).

Field of research classification

Publications were classified on the basis of the journal in which they appeared, using journals classified according to the RFCD classification scheme², which allows comparison across sectors.

Small numbers

Because of the skewed nature of citation distributions, analyses based on any units with less than 100 publications are too unreliable and have been omitted. Experience suggests that extra caution should also be used for analyses based on units of less than 200 publications.

Identification of each sector's publications

The methodologies used to identify the publications attributable to each of the sectors defined in section 1.2 above were:

- extracting all publications pertaining to specified 'standardised addresses' in the REPP database (schemes 4, 6, 8; sectors 11–15);
- extracting all publications for specified authors (schemes 1–3, 5, 7); and
- extracting publication details from the final reports of ARC grants (schemes 9 and 10).

Overlap of sector publication sets

Given the collaborative nature of most research, with multi-authored papers the norm, it is inevitable that there will be some double-counting. Where authors from one or more sectors collaborate on a publication, it is fully counted for each sector involved. The methods used to identify the relevant publications for each of the sectors resulted in some overlap within schemes 1 to 10, within sectors 11 and 15, and within sectors 12–14, but none between the ARC schemes 1–10 and the other groups 11–15. A detailed analysis of the extent of ARC scheme overlap, and therefore the extent of double-counting, is given in the Technical Annex. As the issue is widespread in most research disciplines, the Australian total will rarely equate to the sum of all sectors in the tables in this study.

Completeness of publication sets for the Discovery Projects and Linkage Projects schemes

To identify the publications relevant to these two schemes, the study relied on information contained in the final reports from grants that commenced between 1999 and 2003. There are two reasons why this will not have identified all publications that can be linked to these schemes. Firstly, many publications from research grants do not appear until well after the grant is completed (and the final report written). From other studies it has been estimated that approximately one-third of publications may be missed for this reason. Secondly, while grants commencing between 1999 and 2003 are likely to lead to the majority of ARC-funded publications for our target period 2001 to 2005, not all grants had submitted final reports at the time the study was undertaken. This issue must be borne in mind when interpreting the results of the study, but given the large number of publications that were identified, it is unlikely to have a significant effect on the average citation rates on which most of the analysis is based. It is of most concern when publication numbers are small.

Calculating field and subfield benchmarks

Publications attract few citations in their first year of publication, and the annual rate of attracting citations does not peak until about 3 years after publication (shorter for some fast-evolving areas of biomedicine; longer for disciplines such as mathematics and engineering). For an analysis to give a fair comparison with benchmarks based on 5-year averages, which was the methodology used in the 2004 study, the units of assessment require an even distribution across the years. However, as Table 3 below shows, the publications of a number of ARC schemes were distributed very unevenly across the study period.

² The Research Fields, Courses and Disciplines classification scheme is prepared by the Australian Bureau of Statistics for use in the measurement and analysis of research and experimental development in Australia.

To overcome problems caused by this distribution, and to enable fair and equitable comparisons to be made between schemes and comparator sectors, REPP employed yearly benchmarks rather than 5-yearly averages. For each unit of assessment, separate calculations were made for each publication year and aggregated to give an overall assessment of performance for the 5 years. For example, 2005 publications in astronomy were assessed against the world average for all astronomy publications in that year, while 2002 publications were assessed against the much higher world average for all publications in this earlier year. The data for each publication was then summed and an average calculated for the full publication set.

1.4 Performance measures

This section gives a general description of the standard bibliometric measures used in the study. Notes relevant to particular points of discussion are included throughout the report as required.

1.4.1 Relative citation and journal impact rates

An assessment of relative impact has two field-normalised components. The *relative citation impact* compares the citation rate of ARC output with the relevant world average. It is calculated by dividing the average number of citations per ARC publication in a given subfield by the average number of citations for all publications in that subfield (i.e. the world citation rate for that subfield). Thus, a relative citation impact of more than 1.0 indicates a higher/better position than the world average, while a relative citation impact of less than 1.0 indicates a relatively poorer performance.

Similarly, the *relative journal impact* compares the average impact of the journals in which ARC-supported research publishes in a particular subfield to the average impact of all journals classified to that subfield. A score of more than 1.0 indicates that ARC-supported research is publishing in high impact journals, while a score of less than 1.0 indicates the appearance of publications in relatively low impact journals.

The analysis presented focuses on the comparative performance of the ARC schemes with their comparator sectors. It comprises two parts:

- tables showing the number of publications and citations, together with the relative journal impact and the relative citation impact; and
- charts in which the relative journal impact and relative citation impact are plotted.

1.4.2 Centile distribution

Thomson Scientific provides details of the performance of each Australian article relative to all other articles in the world in the same category. For this analysis, we have profiled the publications of ARC and other comparator sectors in a way that shows the number and proportion of total output in each category according to 6 bands: those among the 1% most highly cited in the world; those in the 2–5% band; those in the 6–10% band; those in the 11–20% band; those in the 21–50% band; and those in the bottom half of cited publications.

If a publication mirrored that of the world average, the distribution one would expect to see across the 6 bands would be: 1% – 4% – 5% – 10% – 30% – 50%. A higher proportion in the top 2 or 3 bands is an indicator of strong citation performance.

1.4.3 Level of collaboration

The REPP database enables publications with different types of authorship to be distinguished, viz.:

- single author – one author only (i.e. no collaboration);
- group – more than one author from the same AOU within an institution;
- institutional – more than one AOU³ from the same institution;
- national – more than one Australian institution; and
- international – more than one country.

The classification is not hierarchical and all collaborations present in a publication will be ascribed to it. For instance, if a publication involves collaboration between a number of Australian institutions as well as an overseas institution, it will be classified as both International and National.

For this report, data are not calculated on institutional collaboration, as only addresses for universities and the CSIRO are ‘cleaned’ down to the level of department or equivalent⁴. Addresses for other institutions are generally not disaggregated.

1.5 Underlying data

The analyses presented in this report are principally in the form of graphs and tables showing percentage distributions. The data underlying the graphs and tables in the main body of the report are given in the Appendix.

³ Academic Organisational Unit or CSIRO division.

⁴ See sections T1 of the Technical Annex for an explanation of address ‘cleaning’ in the REPP database.

1.6 Comparison to methodologies in previous REPP studies

This report uses a different methodology to the analysis undertaken by REPP for the ARC in 2004. It is based on an aggregation of yearly relative citation impacts, whereas the previous study calculated relative citation impact on the basis of a 5-year window.

Using a 5-year average benchmark for the assessment of research over a 5-year window is the simplest and most efficient bibliometric method. However, its validity relies on the units of assessment having an even distribution of output across the period. If publications are concentrated in the beginning of the period (i.e. in articles published in 2001 and 2002), a sector's citation per publication rate will be inflated relative to other sectors (since their publications will, on average, have had a longer period in which to attract citations). Conversely, if publications are concentrated in the end of the period (i.e. in articles published in 2004 and 2005), a sector's citation per publication rate will be deflated relative to other sectors since their publications will, on average, have had a shorter period in which to attract citations.

During the period of this study, 2001–2005, several changes occurred to ARC schemes which had a significant impact on the distribution of output: the Federation Fellowships and Centres of Excellence schemes were introduced, there was a significant expansion to the Postdoctoral Fellowships scheme, and Key Centres and Special Research Centres were started being phased out. The net effect of the changes was more ARC-linked publications at the end of the period, giving a deflated citation impact because these later publications had less time to attract citations. In contrast, the comparator sectors exhibited a very even distribution across the 5 years. Table 3 details the distributions of publications across the study period for ARC schemes and comparator sectors.

To overcome the problems caused by this distribution, and to enable fair and equitable comparisons to be made between schemes and comparator sectors, REPP employed a variation to its standard methodology (see Section 1.3 for details). For each unit of assessment, separate calculations were made for each publication year and aggregated to give a performance across the 5 years. The resultant analyses were interpreted in an almost identical fashion to previous studies, but with the uneven distribution across the period taken into account.

Table 3. Distribution of scheme/sector publications over time period

Scheme/Sector	2001		2002		2003		2004		2005		TOTAL	
	No.	% Tot	No.	% Tot	No.	% Tot	No.	% Tot	No.	% Tot	No.	% Tot
ARC – Australian Postdoctoral Fellowships	138	9	159	10	326	20	381	24	617	38	1621	100
ARC – Australian Professorial Fellowships	292	13	308	14	451	21	458	21	669	31	2178	100
ARC – Australian Research Fellowships	161	16	184	18	194	19	237	23	252	25	1028	100
ARC – Centres Excellence							209	36	365	64	574	100
ARC – Discovery Projects	1588	15	2204	21	2479	24	2388	23	1869	18	10528	100
ARC – Federation Fellowships					159	16	299	31	519	53	977	100
ARC – Key Centres	120	30	54	13	57	14	89	22	82	20	402	100
ARC – Linkage Projects	148	9	270	17	379	24	402	25	405	25	1604	100
ARC – QEII Fellowships	164	14	215	19	236	20	243	21	301	26	1159	100
ARC – Special Research Centres	309	17	356	19	415	22	367	20	416	22	1863	100
ARC Total	2505	15	3190	18	3730	22	3853	22	3968	23	17246	100
Cooperative Research Centres	713	22	620	19	634	20	633	20	645	20	3245	100
Other Government	1590	19	1624	20	1662	20	1696	21	1675	20	8247	100
Other Hospital	2336	20	2339	20	2428	20	2447	20	2417	20	11967	100
Other University	11690	20	11231	19	11364	19	12062	20	12527	21	58874	100
Research Institutes	2860	20	2742	19	2690	19	2931	21	2976	21	14199	100
Australia	19947	19	20007	19	20560	20	21634	21	22171	21	104319	100

2. Scheme/Sector Characteristics and Performance

Characteristics

2.1 Scheme/sector research profiles

The schemes/sectors delineated in this study do not have identical research profiles – their efforts are spread across a wide variety of research fields. Different fields of research have different citation practices, so the profile of an institution is an essential piece of knowledge that needs to be taken into consideration when interpreting

results. Table 4 shows the journal output of each sector distributed across the RFCD fields and subfields. Subfields that account for more than 10% (light grey) and 20% (dark grey) of a sector's publication output have been highlighted. In addition, the second column shows the average citation per publication (cpp) rates for each field and subfield, underscoring the differences that can occur even within one field.

Table 4. Distribution of publications in schemes/sectors by RFCD (%)

Field/Subfield	cpp	ARC SCHEMES										COMPARATOR SECTORS						
		APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst	AUST
Mathematical Sciences	1.92	4.9	6.2	3.2	1.6	6.8	2.3	0.2	1.3	3.0	1.0	5.1	0.4	0.6	0.1	3.1	0.6	2.7
Mathematics	1.83	4.8	4.3	2.9	1.4	5.6	2.3	0.0	1.2	2.9	0.8	4.2	0.3	0.5	0.1	2.7	0.5	2.3
Statistics	3.10	0.2	2.0	0.2	0.3	1.4	0.0	0.0	0.2	0.2	0.2	1.0	0.2	0.2	0.0	0.6	0.3	0.6
Other Math Sci	3.06	0.2	0.4	0.1	0.2	0.5	0.2	0.2	0.1	0.3	0.1	0.4	0.2	0.1	0.0	0.3	0.2	0.3
Physical Sciences	5.22	28.4	36.5	34.8	59.1	26.4	43.8	24.4	10.5	39.0	32.4	26.6	5.2	7.3	1.0	9.0	6.7	11.1
Astronomical Sci	8.65	1.7	3.6	3.1	0.0	5.0	8.4	0.2	0.4	5.9	0.2	3.9	1.0	3.9	0.0	2.0	3.0	2.4
Condensed Matter	3.09	3.9	7.1	1.4	8.5	3.1	5.2	3.0	1.4	8.6	2.8	3.4	0.2	0.5	0.0	1.0	0.4	1.2
Atom, mol; nucl part;	4.67	5.2	6.0	11.7	15.3	5.3	3.8	1.5	0.7	5.4	18.2	6.0	0.3	1.0	0.0	1.8	0.4	2.1
Optical Physics	4.42	4.6	4.1	10.1	26.0	4.1	11.4	1.7	2.4	7.7	7.6	4.4	2.0	0.2	0.0	0.9	0.2	1.4
Other Physical Sci	4.37	4.9	4.3	3.5	2.4	3.2	2.5	4.5	2.1	2.3	1.2	3.0	1.0	1.3	0.7	1.5	1.9	1.7
General Physical Sci	4.23	15.6	19.2	17.2	41.8	11.7	22.7	17.2	5.0	21.3	15.5	12.3	1.9	2.3	0.3	3.6	1.4	4.5
Chemical Sciences	4.58	13.4	25.9	14.5	11.8	14.4	22.1	21.9	14.9	17.3	11.2	15.8	8.0	4.0	0.9	7.9	4.4	8.2
Physical Chemistry	4.60	6.5	11.0	3.8	8.4	4.9	10.2	1.7	5.3	7.1	4.2	5.7	1.9	1.0	0.0	2.4	1.1	2.5
Inorganic Chemistry	4.10	2.3	4.1	3.3	1.7	3.6	1.7	1.2	1.0	2.3	1.3	3.0	0.5	0.8	0.1	1.6	0.5	1.5
Organic Chemistry	4.51	0.9	2.2	1.3	0.0	2.2	0.8	1.0	0.9	2.2	1.3	1.8	0.4	0.2	0.1	1.0	0.3	0.9
Analytical Chemistry	4.49	1.4	2.4	5.4	0.9	1.8	2.0	0.7	3.6	2.5	0.3	2.1	1.5	1.2	0.4	1.6	0.9	1.5
Macromol Chemistry	5.67	1.5	5.1	0.6	2.3	1.1	4.8	15.4	2.1	2.2	0.8	2.0	2.0	0.1	0.0	0.6	0.6	0.8
Other Chemical Sci	4.01	0.1	0.3	0.1	0.0	0.1	0.5	0.5	0.4	0.4	0.1	0.2	1.5	0.5	0.0	0.4	0.6	0.4
General Chemical Sci	4.83	2.0	6.1	2.2	1.0	3.1	4.2	3.0	3.0	3.1	4.0	3.4	1.1	1.0	0.2	1.7	1.1	1.7
Earth Sciences	3.77	10.9	5.1	6.6	0.2	8.8	1.8	10.7	11.0	9.5	19.7	9.3	12.5	12.8	0.0	5.5	6.5	6.6
Geology	3.79	4.3	1.4	2.4	0.2	2.6	0.2	2.7	1.8	4.6	4.7	2.5	1.5	2.0	0.0	1.5	0.8	1.6
Oceanography	3.58	1.4	0.7	0.1	0.0	1.4	0.3	0.2	1.1	1.4	1.1	1.2	3.8	3.4	0.0	1.0	1.6	1.2
Atmospheric Sci	3.70	0.7	0.8	0.6	0.0	1.4	0.7	0.0	2.4	0.2	0.2	1.2	2.8	4.0	0.0	0.7	2.2	1.2
Other Earth Sci	3.72	1.4	0.0	0.4	0.0	0.6	0.0	3.7	1.2	1.1	0.2	0.7	1.2	0.8	0.0	0.6	0.5	0.6
General Earth Sci	3.31	4.4	2.3	2.0	0.0	3.4	0.8	2.5	3.9	2.4	8.8	3.7	5.9	3.8	0.0	2.3	2.2	2.6
Geosciences	4.77	2.5	2.1	1.7	0.0	3.0	1.2	4.2	3.1	2.4	6.2	3.0	2.2	2.3	0.0	1.4	1.3	1.7
Biological Sciences	6.42	22.6	20.1	30.4	16.6	22.1	11.9	21.1	22.5	14.9	17.5	21.2	31.7	25.7	10.5	17.0	29.8	19.6
Biochem & Cell Biol	8.74	7.3	9.0	16.1	12.2	7.9	5.8	2.2	4.7	4.9	6.8	7.9	6.9	2.5	4.9	5.9	14.2	7.0
Genetics	8.96	3.1	2.0	1.6	3.1	2.2	1.5	0.2	1.2	2.1	3.9	2.2	2.4	1.2	3.0	1.6	4.4	2.1
Microbiology	7.08	1.2	0.7	4.1	0.7	1.5	0.1	0.7	2.6	0.7	0.4	1.4	2.2	2.4	2.4	1.7	2.2	1.8
Botany	5.06	3.5	0.8	3.3	1.7	3.7	0.6	3.0	6.5	1.1	0.6	3.2	9.2	5.7	0.0	2.5	4.8	3.1

Table 4. Distribution of publications in schemes/sectors by RfCD (%) (continued)

Field/Subfield	ARC SCHEMES												COMPARATOR SECTORS					
	cpp	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst	AUST
Zoology	2.85	4.3	4.0	3.3	0.3	3.9	1.2	5.0	3.5	2.6	2.7	3.5	6.9	9.2	0.2	3.3	3.2	3.5
Ecology & Evolution	4.79	7.2	5.6	4.6	0.5	5.6	1.6	13.4	5.9	5.9	5.9	5.4	7.9	8.5	0.0	3.0	3.6	3.6
Biotechnology	5.70	2.2	1.3	6.2	2.3	1.9	1.7	0.5	3.7	2.2	1.8	2.2	4.3	1.8	1.4	2.0	3.5	2.3
Other Biological Sci	4.94	0.2	0.5	0.0	0.3	0.4	0.5	0.0	0.2	0.2	0.2	0.3	0.2	0.3	0.1	0.4	0.3	0.3
General Biological Sci	6.48	3.0	2.8	1.8	1.7	2.3	2.1	1.5	1.2	0.9	1.2	2.1	1.5	1.7	0.3	1.5	1.8	1.5
Inf, Comp & Comm Sci	2.38	1.4	0.6	0.4	1.0	2.0	0.3	1.7	1.7	0.8	0.9	1.6	0.6	0.3	0.2	1.5	0.5	1.3
Information Systems	2.52	0.2	0.1	0.1	0.2	0.4	0.1	1.0	0.4	0.2	0.2	0.4	0.1	0.1	0.1	0.3	0.1	0.3
Artif Int, Sig & Image Pr	2.61	0.6	0.0	0.1	0.3	0.5	0.0	0.7	0.6	0.4	0.2	0.4	0.2	0.1	0.0	0.4	0.2	0.3
Computer Software	1.52	0.2	0.0	0.0	0.0	0.3	0.1	0.0	0.5	0.0	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.2
Comp Theory & Maths	1.59	0.2	0.1	0.0	0.0	0.6	0.0	0.0	0.1	0.2	0.2	0.4	0.1	0.1	0.0	0.4	0.0	0.3
Oth Inf, Comp, Comm	2.90	0.4	0.4	0.3	0.5	0.6	0.2	0.0	0.4	0.2	0.4	0.5	0.2	0.1	0.1	0.5	0.3	0.4
Engineering & Technol	2.43	18.1	19.1	12.3	19.2	16.8	25.8	20.1	26.9	16.4	16.1	17.9	20.7	9.3	1.6	10.6	8.3	11.5
Indust Biot & Food Sci	2.75	0.0	0.0	0.1	0.2	0.2	0.1	1.2	1.5	0.0	0.2	0.3	2.5	1.7	0.0	0.8	1.6	0.9
Aerospace Engn	1.09	0.1	0.3	0.1	0.0	0.2	0.2	0.0	0.2	0.0	0.1	0.2	0.1	0.5	0.0	0.1	0.0	0.1
Manufacturing Engn	1.83	0.9	0.5	0.5	1.2	1.4	2.1	3.5	0.8	0.4	0.5	1.2	0.4	0.2	0.0	0.5	0.2	0.5
Mech & Indust Engn	1.74	0.9	0.9	0.7	0.0	1.4	0.1	0.5	2.6	0.0	0.0	1.1	0.5	0.5	0.0	0.9	0.3	0.8
Chemical Engn	2.68	2.1	0.7	0.4	1.9	2.3	1.6	1.7	5.0	2.1	4.2	2.5	3.2	0.4	0.0	1.3	0.9	1.4
Resources Engn	2.19	2.0	3.0	0.4	3.5	1.4	2.1	9.7	3.8	1.2	5.9	2.1	2.6	0.4	0.0	0.9	0.9	1.2
Civil Engn	2.17	1.4	1.0	0.9	0.5	1.8	1.1	0.7	3.6	0.1	1.8	1.7	4.7	2.4	0.0	1.8	1.5	1.8
Elect & Electron Engn	2.19	3.8	3.5	3.3	6.3	3.7	5.9	3.2	4.1	3.1	3.4	3.6	3.4	1.0	0.1	1.6	0.6	1.8
Geomatic Engn	2.34	0.5	0.0	0.4	0.0	0.2	0.2	0.2	0.7	0.0	0.3	0.3	0.2	0.2	0.0	0.1	0.3	0.2
Environmental Engn	2.70	0.7	0.1	0.5	0.5	0.2	0.2	0.0	1.7	0.3	0.1	0.4	1.3	1.1	0.0	0.5	0.4	0.6
Maritime Engn	2.20	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.2	0.2	0.0	0.4	0.0	0.1	0.1	0.1
Metallurgy	2.36	0.9	2.9	1.3	1.6	1.4	1.9	0.5	2.7	3.3	0.2	1.6	2.2	0.3	0.0	0.7	0.6	0.8
Materials Engn	2.71	6.8	8.4	5.4	8.4	5.1	12.4	7.0	6.0	10.1	2.9	5.9	4.6	2.2	0.1	2.5	1.8	2.9
Biomedical Engn	3.50	0.2	0.6	0.1	0.0	0.4	0.6	0.0	0.9	1.2	0.1	0.5	0.6	0.1	1.4	0.6	0.4	0.6
Computer Hardware	2.08	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.2	0.0	0.1
Commun Technol	1.86	0.4	0.2	0.1	0.3	0.5	0.3	0.0	0.6	0.1	2.1	0.6	0.9	0.4	0.0	0.3	0.1	0.4
Interdisciplinary Engn	2.41	1.2	2.7	1.3	0.0	2.5	1.9	0.0	1.4	1.6	0.6	2.0	0.9	0.5	0.0	1.1	0.5	1.1
Other Engn & Technol	2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.1	0.1
Nanosci & Technol	2.84	0.7	0.6	0.4	1.6	0.7	1.9	0.7	0.5	2.2	1.0	0.8	0.7	0.1	0.0	0.3	0.2	0.3
Gen Engn & Technol	2.08	1.2	1.3	0.3	1.9	1.1	2.5	0.0	0.9	0.6	0.8	1.0	0.5	0.3	0.0	0.6	0.2	0.6
Agric, Vet & Environ Sci	2.97	4.6	1.7	3.8	1.0	3.2	1.3	3.2	18.6	3.5	2.4	4.5	31.6	27.6	0.6	8.4	15.7	9.8
Soil & Water Sci	2.81	0.2	0.0	0.1	0.0	0.3	0.0	0.2	2.2	0.3	0.1	0.4	3.4	2.0	0.0	0.7	1.9	0.9
Crop & Pasture Prod	3.17	0.1	0.0	0.1	0.0	0.2	0.0	0.0	1.9	0.3	0.0	0.3	4.4	2.6	0.0	0.7	2.2	1.0
Horticulture	2.67	0.1	0.0	0.0	0.0	0.1	0.0	0.0	1.7	0.0	0.1	0.2	1.7	1.2	0.0	0.4	0.7	0.4
Animal Production	2.55	0.0	0.0	0.1	0.2	0.0	0.0	0.2	1.9	0.0	0.1	0.2	4.8	6.0	0.0	1.0	2.4	1.4
Veterinary Sci	3.09	0.5	0.6	1.0	0.0	0.4	0.2	0.0	2.8	0.0	0.3	0.7	2.8	4.5	0.5	2.0	2.7	2.0
Forestry Sci	2.74	0.3	0.0	0.0	0.0	0.1	0.0	0.0	1.7	0.1	0.0	0.2	3.3	1.0	0.0	0.3	1.2	0.5
Fisheries Sci	3.13	1.1	0.1	1.0	0.0	0.8	0.0	0.2	1.6	1.3	0.5	0.8	5.0	4.1	0.0	1.0	1.8	1.3
Environmental Sci	3.08	2.6	1.0	1.9	0.9	1.7	1.1	2.5	7.2	1.6	1.3	2.2	7.0	6.0	0.1	2.9	3.3	2.9
Gen Agr, Vet & Env Sc	3.03	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.2	0.1	0.1	0.2	8.4	6.8	0.0	0.9	2.9	1.4
Archit, Urb Env & Bldg	0.98	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.3	0.0	0.2
Medical & Health Sci	6.41	6.7	6.7	7.3	9.1	7.9	6.0	10.0	10.8	7.7	6.2	8.5	15.8	25.1	91.0	36.2	45.8	34.6
Immunology	9.60	0.4	1.0	0.5	2.1	0.3	0.0	0.0	1.0	1.2	0.4	0.6	6.3	1.1	5.0	2.2	7.3	2.7
Med Bioc & Clin Chem	4.96	0.0	1.2	0.4	0.0	0.2	0.1	0.0	0.2	0.1	0.2	0.3	0.1	0.4	0.8	0.6	0.4	0.5
Pharm & Pharmac Sci	5.29	1.0	2.1	1.6	0.7	1.0	0.5	0.2	1.6	0.2	1.0	1.1	1.1	2.4	4.1	3.3	3.1	2.8
Medical Physiology	6.08	0.7	0.7	1.8	1.0	1.8	1.0	0.7	1.1	1.0	1.0	1.5	0.9	1.2	2.1	2.7	2.6	2.3
Neurosciences	6.54	1.4	0.6	0.8	0.9	2.2	1.1	1.2	0.7	3.8	2.0	2.0	0.5	0.9	6.0	4.2	4.9	3.6

Table 4. Distribution of publications in schemes/sectors by RFCD (%) (continued)

Field/Subfield	ARC SCHEMES											COMPARATOR SECTORS						
	cpp	APD	APF	ARF	CE	Disc	FF	KC	Link	QEI	SRC	ARC TOT	CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst	AUST
Dentistry	3.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.7	0.7	0.1	0.5
Clinical Sci	6.67	2.7	2.6	2.9	4.2	3.7	2.9	3.7	5.7	3.5	2.2	3.9	8.1	15.7	77.0	22.5	30.4	23.0
Nursing	1.87	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5	1.1	0.8	0.1	0.5
Public Hlth & Hlth Serv	4.04	1.0	0.1	0.1	0.3	0.7	0.9	6.0	2.1	0.2	0.3	0.9	1.1	6.4	6.3	5.5	4.2	4.3
Compl/Alternat Med	2.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hum Mvt & Sports Sci	4.41	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.7	0.7	0.0	0.2	0.0	1.5	1.6	1.2	0.6	1.0
Other Med & Hlth Sci	5.27	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	1.2	0.3	0.2	0.3
Medicine – General	7.99	0.2	0.3	0.4	0.9	0.2	0.2	0.0	0.9	0.5	0.3	0.4	1.7	0.7	2.9	1.3	3.5	1.4
Science – general	7.81	6.8	2.6	5.4	5.2	5.4	4.2	1.7	6.8	7.2	9.6	6.0	0.0	12.1	3.3	5.7	8.2	6.3
Interdisc Life Sci	4.85	3.9	0.9	3.5	3.1	3.0	1.3	0.5	5.3	4.2	7.7	3.8	12.2	10.8	2.6	4.4	6.3	4.8
Multidisciplinary Sci	17.45	2.9	1.7	1.8	2.1	2.4	2.9	1.2	1.5	2.9	1.9	2.2	10.5	1.3	0.6	1.2	1.9	1.5
Economics	1.27	0.5	1.8	0.2	0.0	1.3	0.1	0.5	1.6	0.1	0.0	1.2	0.1	0.8	0.0	2.2	0.2	1.5
Comm, Man, Tour & Serv	1.56	0.3	0.2	0.3	0.0	0.8	0.1	1.5	1.0	0.1	0.1	0.7	0.1	0.2	0.1	2.2	0.1	1.4
Studies in Human Soc	1.32	1.1	0.5	0.4	0.0	1.3	0.9	1.0	1.7	0.3	0.6	1.2	0.2	0.8	0.4	2.8	0.3	1.9
Behav & Cogn Sci	2.90	4.8	2.9	0.7	0.0	5.7	2.0	2.7	1.7	3.5	3.9	4.5	0.4	2.0	2.8	6.2	1.0	4.6
History & Archaeology	0.44	1.1	0.5	1.3	0.0	0.5	0.0	0.0	0.4	1.4	0.2	0.6	0.0	0.3	0.0	1.2	0.0	0.8
Social Sciences	3.15	6.9	4.9	1.6	0.0	9.4	4.4	9.0	9.4	3.7	5.6	8.3	1.2	10.2	9.2	20.4	3.2	14.2
Arts and Humanities	0.48	2.0	0.9	1.4	0.0	1.7	0.3	0.5	0.8	1.9	2.0	1.7	0.1	0.6	0.1	4.1	0.2	2.7
Total	100		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Using the distribution of aggregate ARC data as a reference point, it can be seen that the focus of research across the sectors varies significantly. The Discovery Projects scheme, being the largest ARC funding scheme, closely resembles the overall ARC distribution, but most other ARC schemes have quite distinctive features. The five schemes covering the output from awards to individual researchers all show a higher-than-average concentration in the physical sciences, as do the Centres of Excellence. As a result, the proportion of their output in other fields is lower than the norm, particularly in chemical sciences (for APDs) and in earth sciences (for Federation Fellowships). As might be expected from the nature of the scheme, the output of the Linkage Grants scheme is more heavily concentrated in journals that are classified as engineering and technology. The SRCs are also more heavily focussed on the physical sciences, and less on chemical and mathematical sciences.

None of the comparator sectors have the same strong focus on the physical sciences that is exhibited by the ARC schemes. The research of the ‘other government’ sector is heavily geared towards earth sciences and towards agricultural, veterinary and environmental sciences. Their output in physical sciences is primarily in astronomy. As expected from the construction of the sector, the research of the ‘other research institutes’ has a strong biomedical focus. The research output of the ‘other hospital’ sector is, not surprisingly, very heavily concentrated in clinical sciences, with only modest amounts of research undertaken in other disciplines. The CRC sector has a strong focus on engineering and technology; earth sciences; and agricultural, veterinary and environmental sciences; with relatively few publications appearing in the physical sciences journal set.

Their research profile is similar to that of the ARC’s Linkage Projects scheme.

2.2 Collaboration

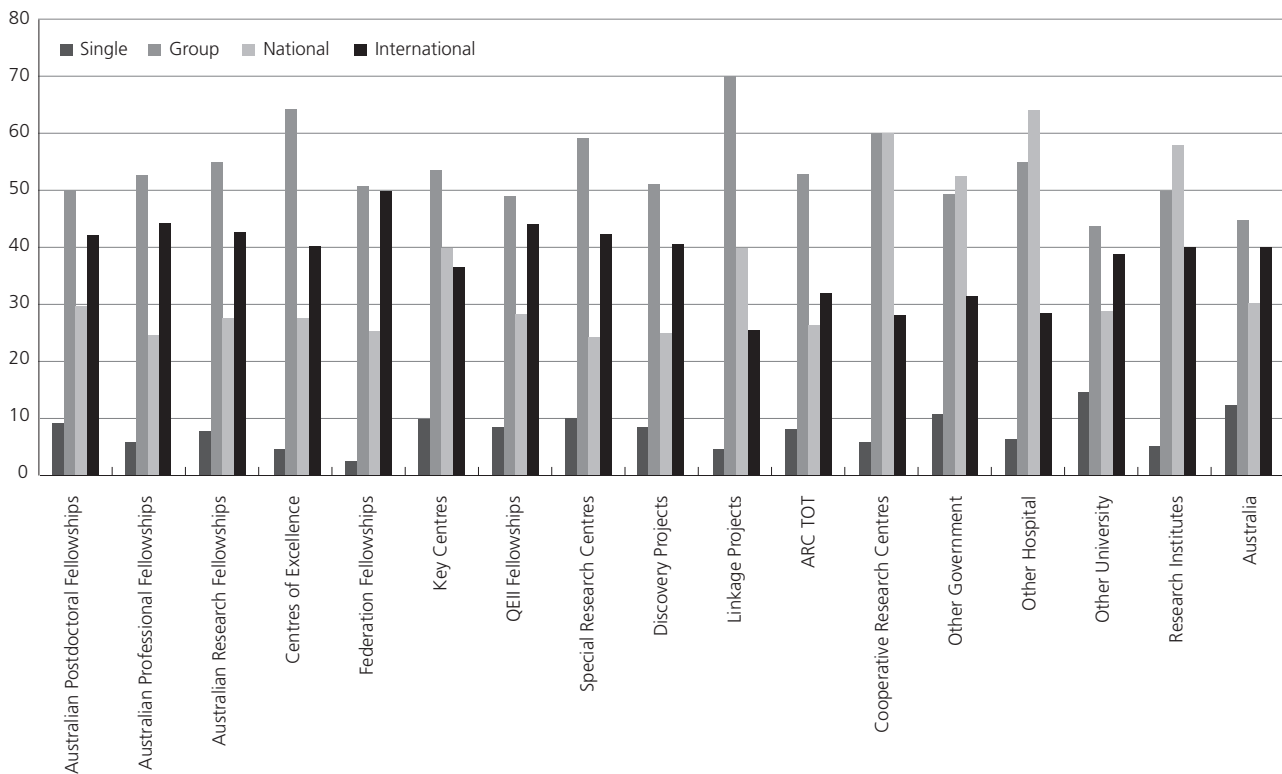
The structure of the REPP database enables the schemes/sectors to be described on the basis of their collaboration patterns. These are presented in Figure 1.

In aggregate terms, ARC research results in a smaller proportion of single-author publications than for Australia as a whole. Collaboration is stronger internationally than nationally, and multiple authorship from within the same institution (i.e. group authorship) predominates. The level of international collaboration has risen across all sectors since the previous study, reflecting world-wide trends, and now stands at 40% for all Australian output, and slightly above this for ARC in total.

As their name and nature would suggest, the Linkage Projects, along with Key Centres, have much higher levels of national collaboration than other ARC schemes (though not as high as a number of comparator sectors). They also have relatively low levels of single authorship and international collaboration. Close to half the publications from the Federation Fellowships sector involve international collaboration, the highest for any sector, and they also have the lowest levels of single authorship. This form of co-authorship is lower in the CRC, ‘other hospital’ and ‘other government’ sectors.

The direction of international collaboration for each scheme/sector is examined in detail in Table 5.

Figure 1. Collaboration patterns by scheme/sector



In aggregate terms, ARC research results in a smaller proportion of single-author publications than for Australia as a whole. Collaboration is stronger internationally than nationally, and multiple authorship from within the same institution (i.e. group authorship) predominates. The level of international collaboration has risen across all sectors since the previous study, reflecting world-wide trends, and now stands at 40% for all Australian output, and slightly above this for ARC in total.

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The direction of international collaboration for each scheme/sector is examined in detail in Table 5.

Table 5. International collaboration by scheme/sector and country (percentage distribution)

Country	ARC SCHEMES											COMPARATOR SECTORS				
	APD %	APF %	ARF %	CE %	Disc %	FF %	KC %	Link %	QEII %	SRC %	ARC Tot %	CRC %	Oth govt %	Oth hosp %	Oth univ %	Res Inst %
USA	34	36	27	32	35	35	27	35	31	39	35	36	38	37	33	45
ENGLAND	20	13	15	14	15	16	11	11	21	15	15	12	21	28	18	17
GERMANY	12	10	12	10	10	16	21	11	9	13	11	8	8	11	9	10
PEOPLES R CHINA	9	11	11	9	10	21	8	8	15	8	10	6	5	5	8	5
JAPAN	10	7	6	4	7	5	1	38	9	7	7	7	7	4	6	8
CANADA	7	4	5	8	6	7	7	7	5	11	7	7	1	0	3	8
FRANCE	8	7	6	5	7	3	1	14	4	5	6	8	7	8	5	8
SWEDEN	4	5	3	3	4	5	1	4	5	3	4	2	2	4	3	4
ITALY	4	5	6	3	4	4	3	1	3	3	4	3	3	8	4	3
NEW ZEALAND	4	4	4	3	3	1	9	7	2	2	3	7	1	17	6	6
NETHERLANDS	3	3	2	1	3	5	5	5	2	1	3	3	4	7	4	5
RUSSIA	2	3	4	0	3	2	4	1	2	3	3	1	1	0	2	1
SCOTLAND	3	2	1	1	2	2	0	3	3	2	2	2	5	5	3	2
SINGAPORE	2	3	1	3	2	2	6	1	3	1	2	1	1	2	3	1

Table 5. International collaboration by scheme/sector and country (percentage distribution) (continued)

Country	ARC SCHEMES											COMPARATOR SECTORS				
	APD %	APF %	ARF %	CE %	Disc %	FF %	KC %	Link %	QEII %	SRC %	ARC Tot %	CRC %	Oth govt %	Oth hosp %	Oth univ %	Res Inst %
SWITZERLAND	2	2	2	2	2	1	4	3	3	3	2	2	3	6	3	3
S AIN P	3	3	2	3	2	3	1	2	1	1	2	2	2	4	2	2
SOUTH OREA K	2	3	1	0	2	1	0	3	3	1	2	1	1	0	2	1
DENMARK	2	1	2	1	2	0	0	3	2	1	2	1	2	3	2	2
TAIWAN	1	1	1	2	1	2	2	1	5	1	1	0	1	1	1	0
INDIA	2	1	2	1	1	2	0	0	1	0	1	2	2	1	2	2
ISRAEL	1	1	2	3	1	2	0	1	0	3	1	0	1	2	1	1
POLAND	2	2	1	0	2	0	1	1	1	0	1	0	0	1	1	0
SOUTH FRICAA	1	1	0	0	1	0	6	1	0	0	1	2	3	2	2	1
BRAZIL	2	1	4	3	1	0	1	0	1	2	1	1	1	2	1	1
BELGIUM	1	2	2	0	1	1	0	0	2	0	1	2	1	5	2	2
WALES	3	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1
AUSTRIA	0	1	1	1	1	0	1	0	1	1	1	1	2	4	2	1
IRELAND	1	1	1	4	0	1	1	0	0	1	1	1	1	2	1	0
NORWAY	1	0	1	0	0	0	1	1	2	1	1	2	1	2	1	1
CHILE	1	1	0	1	0	3	1	0	0	0	1	0	1	0	1	0
FINLAND	1	1	0	1	1	0	0	0	0	0	1	1	1	2	1	2
THAILAND	0	0	1	0	0	1	2	1	0	0	0	1	2	1	1	1
MEXICO	0	1	1	0	0	0	1	0	0	0	0	1	1	0	0	1
ARGENTINA	0	0	0	1	0	1	1	0	1	1	0	1	1	1	0	1
CZECH REPUBLIC	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0
HUNGARY	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1
INDONESIA	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1
IRAN	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	0
UKRAINE	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Australia (no. pubs)	696	965	451	229	4503	491	141	416	526	821	7321	922	2646	3495	23073	5774

* This table only includes countries with 25 or more international collaborations for ARC total.

Over recent years, the focus of Australia's scientific collaborations has turned more to continental Europe, with a decreasing emphasis on the United States and England as partners in research. The ARC schemes appear to adhere to this pattern, though it is less true for some of the comparator sectors. The main difference between the direction of ARC international collaborations and that for most comparator sectors is stronger links to Germany and Japan, and slightly weaker links to the USA, England and New Zealand. The Federation Fellowships scheme has particularly strong links to China and Germany, and the QEII sector to China. Key Centres have stronger than average links to Germany, Japan and France.

2.3 Location of Australian research

The importance of the ARC and other sectors as sites of basic research can be demonstrated by distributing all Australian publications in RFCD fields/subfields across the sectors. The data is shown in Table 6. Subfields for which schemes/sectors (excluding the other university sector) account for 20% or more of all Australian publications are shaded.

Table 6. Distribution of publications in sectors by RfCD (percent)

FIELD/SUBFIELD APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst	AUST	
Mathematical Sciences	2.8	4.7	1.2	0.3	24.9	0.8	0.0	0.7	1.2	0.6	30.6	0.5	1.6	0.4	63.8	3.1	100
Mathematics	3.2	3.8	1.2	0.3	24.1	0.9	0.0	0.8	1.4	0.6	29.8	0.4	1.6	0.4	65.2	2.8	100
Statistics	0.5	7.6	0.3	0.3	24.6	0.0	0.0	0.7	0.3	0.5	29.4	1.0	2.2	0.9	60.2	6.7	100
Physical Sciences	4.0	6.9	3.1	2.9	24.1	3.7	0.9	1.5	3.9	5.2	39.8	1.5	5.2	1.1	46.2	8.3	100
Astronomical Sci	1.1	3.2	1.3	0.0	21.2	3.3	0.0	0.3	2.7	0.1	26.9	1.3	12.9	0.0	46.5	17.4	100
Condensed Matter	5.0	12.1	1.1	3.8	25.6	4.0	0.9	1.8	7.8	4.2	45.7	0.5	3.5	0.1	46.0	4.7	100
Atom, mol; nucl part;	3.8	5.9	5.4	4.0	25.4	1.7	0.3	0.5	2.9	15.4	46.9	0.5	3.6	0.1	46.8	2.9	100
Optical Physics	5.2	6.4	7.3	10.5	30.1	7.8	0.5	2.8	6.3	10.0	53.4	4.7	1.3	0.1	37.8	2.3	100
Other Physical Sci	4.5	5.2	2.0	0.8	19.0	1.3	1.0	1.8	1.5	1.2	28.3	1.8	5.8	4.8	49.6	14.6	100
General Physical Sci	5.4	8.9	3.8	5.1	26.3	4.7	1.5	1.7	5.3	6.2	45.3	1.3	4.0	0.7	45.6	4.2	100
Chemical Sciences	2.5	6.6	1.7	0.8	17.7	2.5	1.0	2.8	2.3	2.4	31.8	3.0	3.9	1.2	54.3	7.3	100
Physical Chemistry	4.0	9.1	1.5	1.8	19.5	3.8	0.3	3.2	3.1	3.0	37.2	2.3	3.1	0.1	52.5	5.7	100
Inorganic Chemistry	2.4	5.6	2.1	0.6	23.5	1.1	0.3	1.0	1.7	1.6	32.8	0.9	4.3	1.0	58.3	4.4	100
Organic Chemistry	1.5	5.0	1.4	0.0	23.6	0.8	0.4	1.5	2.6	2.5	32.7	1.4	1.5	1.6	59.6	3.9	100
Analytical Chemistry	1.4	3.3	3.5	0.3	12.2	1.3	0.2	3.6	1.8	0.4	22.6	3.0	6.3	3.3	58.5	7.8	100
Macromol Chemistry	2.9	12.6	0.7	1.5	12.7	5.4	7.1	3.8	3.0	1.7	39.9	7.4	0.8	0.0	42.8	9.5	100
Other Chemical Sci	0.2	1.6	0.2	0.0	3.4	1.1	0.4	1.6	1.1	0.4	8.8	11.0	9.4	0.0	55.3	18.0	100
General Chemical Sci	1.8	7.3	1.3	0.3	18.2	2.3	0.7	2.6	2.0	4.1	32.1	1.9	4.5	1.2	54.8	8.4	100
Earth Sciences	2.6	1.6	1.0	0.0	13.4	0.3	0.6	2.6	1.6	5.3	23.2	5.9	15.4	0.0	47.4	13.4	100
Geology	4.3	1.9	1.5	0.1	16.7	0.1	0.7	1.8	3.3	5.3	26.9	3.0	9.9	0.0	54.3	7.4	100
Oceanography	1.8	1.2	0.1	0.0	11.6	0.2	0.1	1.4	1.2	1.6	16.1	9.6	21.5	0.0	45.0	18.1	100
Atmospheric Sci	0.9	1.3	0.5	0.0	11.9	0.6	0.0	3.1	0.2	0.2	16.4	7.3	26.1	0.0	34.3	24.6	100
Other Earth Sci	3.7	0.0	0.7	0.0	10.8	0.0	2.5	3.4	2.2	0.5	20.3	6.4	11.7	0.0	56.3	10.8	100
General Earth Sci	2.7	1.9	0.8	0.0	13.5	0.3	0.4	2.3	1.0	6.1	23.5	7.1	11.5	0.0	51.3	11.6	100
Geosciences	2.3	2.7	1.0	0.0	18.5	0.7	1.0	2.9	1.6	6.7	29.6	4.2	10.8	0.0	48.4	10.9	100
Biological Sciences	1.8	2.1	1.5	0.5	11.4	0.6	0.4	1.8	0.8	1.6	17.9	5.0	10.4	6.2	48.9	20.8	100
Biochem & Cell Biol	1.6	2.7	2.3	1.0	11.3	0.8	0.1	1.0	0.8	1.7	18.6	3.1	2.8	8.0	47.2	27.5	100
Genetics	2.3	2.0	0.7	0.8	10.7	0.7	0.0	0.9	1.1	3.3	17.4	3.5	4.5	16.5	42.2	28.6	100
Microbiology	1.1	0.9	2.2	0.2	8.2	0.1	0.2	2.2	0.4	0.4	12.9	3.7	10.6	15.4	54.8	16.8	100
Botany	1.8	0.6	1.1	0.3	12.2	0.2	0.4	3.2	0.4	0.4	17.3	9.3	14.6	0.0	46.4	21.2	100
Zoology	1.9	2.4	0.9	0.1	11.2	0.3	0.6	1.5	0.8	1.4	16.7	6.1	21.0	0.8	53.0	12.5	100
Ecology & Evolution	3.1	3.2	1.3	0.1	15.8	0.4	1.4	2.5	1.8	2.9	24.8	6.8	18.7	0.1	46.5	13.4	100
Biotechnology	1.5	1.2	2.7	0.6	8.5	0.7	0.1	2.5	1.1	1.4	16.1	6.0	6.2	7.1	50.0	21.3	100
Other Biological Sci	0.8	2.8	0.0	0.6	12.1	1.4	0.0	1.1	0.6	1.1	15.7	1.4	6.3	2.2	65.0	13.5	100
General Biological Sci	3.0	3.8	1.1	0.6	15.2	1.3	0.4	1.2	0.7	1.4	21.9	3.0	8.6	2.4	54.0	15.7	100
Inf, Comp&Comm Sci	1.8	1.1	0.3	0.5	16.4	0.2	0.5	2.1	0.7	1.3	21.6	1.4	2.0	1.4	67.5	5.7	100
Engineering & Technol	2.4	3.5	1.1	0.9	14.8	2.1	0.7	3.6	1.6	2.5	25.7	5.6	6.4	1.6	52.2	9.8	100
Indust Biot&Food Sci	0.0	0.0	0.1	0.1	2.1	0.1	0.5	2.5	0.0	0.3	5.8	8.5	14.8	0.2	47.0	24.5	100
Aerospace Engn	0.6	3.9	0.6	0.0	13.6	1.3	0.0	2.6	0.0	0.6	21.4	2.6	26.0	0.0	51.3	4.5	100
Manufacturing Engn	2.6	1.9	0.9	1.2	25.3	3.7	2.5	2.3	0.9	1.8	35.3	2.3	2.3	0.2	55.0	4.7	100
Mech & Indust Engn	1.8	2.5	0.9	0.0	18.4	0.1	0.3	5.2	0.0	0.0	25.0	1.9	5.3	0.3	63.3	5.3	100
Chemical Engn	2.3	1.0	0.3	0.7	16.4	1.1	0.5	5.4	1.6	5.3	28.4	6.9	2.1	0.0	53.1	9.0	100
Resources Engn	2.7	5.5	0.3	1.7	12.2	1.7	3.2	5.1	1.2	9.1	29.5	7.1	3.1	0.0	46.4	10.3	100
Civil Engn	1.2	1.2	0.5	0.2	9.8	0.6	0.2	3.0	0.1	1.7	15.7	8.2	10.5	0.2	56.2	11.6	100
Elect & Electron Engn	3.2	4.0	1.8	1.9	20.5	3.1	0.7	3.4	1.9	3.3	32.7	5.7	4.3	0.5	51.0	4.5	100
Geomatic Engn	4.2	0.0	2.1	0.0	11.1	1.1	0.5	6.3	0.0	3.2	25.4	3.2	10.1	1.6	38.1	24.9	100
Environmental Engn	1.9	0.5	0.9	0.5	4.0	0.3	0.0	4.6	0.5	0.2	10.5	7.4	16.2	0.5	54.7	10.5	100
Maritime Engn	0.0	0.0	0.0	0.0	17.6	0.0	0.0	1.5	0.0	2.3	19.8	0.8	23.7	0.0	48.9	10.7	100
Metallurgy	1.7	7.2	1.5	1.0	16.4	2.2	0.2	4.9	4.3	0.3	31.9	8.1	2.4	0.0	45.0	9.7	100
Materials Engn	3.7	6.1	1.9	1.6	18.0	4.1	0.9	3.2	3.9	1.8	34.2	5.0	6.1	0.3	48.3	8.4	100
Biomedical Engn	0.7	2.4	0.2	0.0	7.4	1.0	0.0	2.4	2.4	0.2	15.0	3.5	1.5	28.3	59.4	9.1	100
Computer Hardware	1.5	0.0	0.0	0.0	12.8	0.0	0.0	0.0	0.8	4.5	15.8	0.8	0.0	0.0	76.7	0.8	100

Table 6. Distribution of publications in sectors by RfCD (percent)(continued)

FIELD/SUBFIELD APD		APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst	AUST
Commun Technol	1.5	1.3	0.3	0.5	13.3	0.8	0.0	2.3	0.3	10.2	27.1	7.2	7.7	0.0	50.1	4.3	100
Interdisciplinary Engn	1.8	5.2	1.1	0.0	23.3	1.7	0.0	2.0	1.6	1.0	29.8	2.6	3.7	0.0	57.5	6.8	100
Other Engn & Techn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	16.4	0.0	56.7	20.9	100
Nanosci & Technol	3.3	4.2	1.2	2.7	23.0	5.7	0.9	2.4	7.9	5.4	39.9	7.3	1.8	0.0	45.3	6.9	100
Gen Engn & Technol	3.4	4.8	0.5	1.9	19.4	4.1	0.0	2.4	1.2	2.4	30.6	2.9	4.5	0.0	57.5	5.9	100
Agric, Vet & Environ Sciences	0.7	0.4	0.4	0.1	3.3	0.1	0.1	2.9	0.4	0.4	7.6	10.0	22.2	0.7	48.1	21.8	100
Soil & Water Sci	0.3	0.0	0.1	0.0	3.0	0.0	0.1	3.9	0.4	0.2	7.5	12.1	18.1	0.1	45.3	29.2	100
Crop & Pasture Prod	0.1	0.0	0.1	0.0	2.3	0.0	0.0	3.1	0.3	0.0	5.7	14.3	21.4	0.0	39.2	31.1	100
Horticulture	0.5	0.0	0.0	0.0	2.5	0.0	0.0	6.1	0.0	0.2	8.8	12.2	22.9	0.0	46.8	22.4	100
Animal Production	0.0	0.0	0.1	0.1	0.1	0.0	0.1	2.2	0.0	0.1	2.6	11.1	35.1	0.3	40.8	24.5	100
Veterinary Sci	0.4	0.7	0.5	0.0	2.1	0.1	0.0	2.2	0.0	0.2	5.5	4.4	18.0	2.9	55.8	18.6	100
Forestry Sci	1.0	0.2	0.0	0.0	2.3	0.0	0.0	5.8	0.2	0.0	8.5	22.5	17.3	0.0	32.2	34.3	100
Fisheries Sci	1.4	0.2	0.8	0.0	6.4	0.0	0.1	2.0	1.1	0.8	10.5	12.3	25.6	0.2	44.9	19.3	100
Environmental Sci	1.4	0.7	0.7	0.2	5.8	0.4	0.3	3.8	0.6	0.8	12.2	7.5	16.1	0.4	55.2	15.4	100
Gen Agr, Vet&Env Sc	0.0	0.0	0.0	0.1	0.3	0.0	0.0	1.3	0.1	0.1	1.8	18.4	38.2	0.0	35.4	27.6	100
Archit, Urb Env & Bldg	1.1	0.5	0.0	0.0	3.8	0.0	0.5	1.1	0.5	1.6	9.2	0.0	2.2	0.5	82.6	2.2	100
Medical & Health Sci	0.3	0.4	0.2	0.1	2.3	0.2	0.1	0.5	0.2	0.3	4.1	1.4	5.7	30.1	58.9	18.0	100
Immunology	0.2	0.7	0.2	0.4	1.2	0.0	0.0	0.6	0.5	0.3	3.7	7.2	3.2	21.0	46.0	36.6	100
Med Bioc&Clin Chem	0.0	4.9	0.8	0.0	4.7	0.2	0.0	0.8	0.2	0.6	10.0	0.6	6.0	17.7	63.2	11.5	100
Pharm&Pharmac Sci	0.6	1.6	0.5	0.1	3.6	0.2	0.0	0.9	0.1	0.6	6.6	1.3	6.7	16.8	67.3	15.1	100
Medical Physiology	0.5	0.7	0.8	0.3	8.2	0.4	0.1	0.7	0.5	0.8	11.4	1.2	4.3	10.7	68.3	15.6	100
Neurosciences	0.6	0.3	0.2	0.1	6.2	0.3	0.1	0.3	1.2	1.0	9.3	0.4	2.1	19.0	65.5	18.6	100
Dentistry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.4	2.8	18.3	81.5	3.6	100
Clinical Sci	0.2	0.2	0.1	0.1	1.6	0.1	0.1	0.4	0.2	0.2	2.8	1.1	5.4	38.4	55.2	18.0	100
Nursing	0.7	0.0	0.0	0.0	0.4	0.0	0.0	0.5	0.0	0.0	1.4	0.0	7.5	24.5	87.3	2.5	100
Public Hlth&Hlth Serv	0.4	0.0	0.0	0.0	1.7	0.2	0.5	0.7	0.0	0.1	3.3	0.8	11.7	16.7	71.0	13.0	100
Compl/Alternat Med	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7	92.6	3.7	100
Hum Mvt&Sports Sci	0.0	0.0	0.0	0.0	2.7	0.0	0.0	1.1	0.8	0.0	4.3	0.1	12.6	19.0	73.8	8.8	100
Other Med & Hlth Sci	0.0	0.7	1.0	0.0	1.0	0.0	0.0	0.3	0.0	0.3	2.4	0.3	3.8	50.2	55.1	11.8	100
Medicine – General	0.3	0.4	0.3	0.3	1.5	0.1	0.0	1.0	0.4	0.3	4.1	3.7	3.7	23.0	49.1	32.6	100
Economics	0.5	2.5	0.1	0.0	8.4	0.1	0.1	1.6	0.1	0.0	12.5	0.2	3.8	0.0	81.3	1.6	100
Comm, Man,Tour & Serv	0.3	0.3	0.2	0.0	5.4	0.1	0.4	1.1	0.1	0.1	7.6	0.2	1.1	1.1	87.3	0.7	100
Studies in Human Soc	0.9	0.5	0.2	0.0	6.9	0.4	0.2	1.3	0.1	0.6	10.5	0.2	3.2	2.5	82.7	2.0	100
Behav & Cogn Sci	1.6	1.3	0.1	0.0	12.5	0.4	0.2	0.6	0.8	1.5	16.2	0.3	3.5	7.0	77.4	2.8	100
History & Archaeology	2.1	1.2	1.5	0.0	6.7	0.0	0.0	0.7	1.9	0.5	13.0	0.0	3.1	0.0	82.0	0.0	100
Science – general	1.7	0.9	0.8	0.5	8.5	0.6	0.1	1.6	1.3	2.7	15.6	0.0	15.2	5.9	50.3	17.6	100
Interdisc Life Sci	1.3	0.4	0.7	0.4	6.2	0.3	0.0	1.7	1.0	2.8	12.8	6.0	17.7	6.2	51.4	17.7	100
Multidisciplinary Sci	3.0	2.4	1.2	0.8	15.9	1.8	0.3	1.5	2.2	2.3	24.5	6.7	6.9	4.8	46.8	17.3	100
Social Sciences	0.8	0.7	0.1	0.0	6.7	0.3	0.2	1.0	0.3	0.7	9.7	0.3	5.7	7.5	81.0	3.1	100
Arts and Humanities	1.1	0.7	0.5	0.0	6.2	0.1	0.1	0.5	0.8	1.3	10.4	0.1	1.8	0.4	84.0	0.8	100

In aggregate, the ARC is linked to 16.5% of the total Australian journal output. The centrality of the ARC to the Australian research effort in a number of disciplines, particularly in the enabling sciences, is highlighted in Table 6. The proportion of output linked to ARC funding in the Social Sciences and Humanities is quite low, with most research supported through alternative university funds.

2.4 Citation performance

Table 7 and Table 8 show the total output and the citation and journal impact for each ARC scheme and comparator sector. Table 4 above showed the distribution of publications across fields and subfields of research for each scheme/sector. Although disciplines vary widely in their average citation per publication rates, we have taken the discipline mix for each sector and scheme into account when calculating relative citation and journal impact, so comparisons across schemes and sectors remain valid.

The research institutes have the highest relative citation impact of any sector, even after accounting for the high impact fields in which they are active. Of the ARC schemes, those with the strongest performance are the Federation Fellowships and the Special Research Centres. In this time frame, the publications of APDs also perform very strongly and at a similar level to Professorial Fellows. This is a somewhat surprising result, given how early in their career the researchers are, and it warrants further investigation. Of ARC schemes, only Linkage Projects fall below parity with world benchmarks – perhaps a reflection of their emphasis on collaborative applied research. The detailed analysis at the field and subfield level (see Section 3 below) will bring into sharper focus the relative performance of each sector and scheme.

Citation distributions are highly skewed, and high citation averages are often driven by a few highly cited publications. Analysing the centile distribution of publications identifies where the highest impact research is to be found. The Federation Fellowships stand out in this analysis, with more than 4 times the number of very high impact (top 1%) publications (given the size of their output), and double the number expected in the second-highest band (top 2–5%). In terms of the aims of this particular ARC scheme, the results are not surprising. Other areas achieving more than double the expected number of very high impact publications are the Key Centres, Special Research Centres and APDs.

The use of relative rather than actual impact analyses means that it is valid to compare across disciplines for ARC as a whole, and for individual disciplines. The analysis for the ARC in total for selected science and social science fields is illustrated in Figure 2 and Figure 3 below.

ARC performance in science is above the world benchmark in all fields except Information, Computing and Communication Sciences. It is important to note that for this field, journal articles are less important than refereed conference proceedings as outlets for research.

A similar caveat needs to be applied to the interpretation of ARC performance in the social sciences and humanities: for all disciplines except Behavioural Sciences, journals represent only a small proportion of publication output. With this in mind, Figure 3 shows that ARC publications in all disciplines in the social sciences and humanities (which had sufficient numbers for analysis) were well above world and Australian benchmarks.

Table 7. Number of publications and relative impact: all publications, 2001–2005

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	CITATIONS	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	1621	7001	1.36
ARC – Australian Professorial Fellowships	2178	11085	1.31
ARC – Australian Research Fellowships	1028	5599	1.27
ARC – Centres Excellence	574	878	1.35
ARC – Discovery Projects	10528	57064	1.17
ARC – Federation Fellowships	977	2694	1.59
ARC – Key Centres	402	2284	1.13
ARC – Linkage Projects	1604	5761	0.92
ARC – QEII Fellowships	1159	5473	1.12
ARC – Special research Centres	1863	12902	1.53
ARC Total	17246	88912	1.19
Cooperative Research Centres	3245	15728	0.99
Other Government	8247	31813	0.81
Other Hospital	11967	74046	1.30
Other University	58874	253521	0.91
Research Institutes	14199	116314	1.73
Australia	104319	541243	1.11
World	3782695	17649566	1.00

Table 8. Centile distribution of publications: all publications, 2001–2005

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	37	2.3%	107	6.6%	152	9.4%	222	13.7%	458	28.3%	644	39.8%	1620
ARC – Aust Profess Fellows	41	1.9%	149	6.8%	190	8.7%	283	13.0%	719	33.0%	795	36.5%	2177
ARC – Aust Research Fellows	13	1.3%	57	5.5%	93	9.0%	151	14.7%	323	31.4%	391	38.0%	1028
ARC – Centres Excellence	12	2.1%	27	4.7%	63	11.0%	75	13.1%	186	32.4%	211	36.8%	574
ARC – Discovery Projects	158	1.5%	654	6.2%	852	8.1%	1426	13.5%	3391	32.2%	4045	38.4%	10526
ARC – Federation Fellows	45	4.6%	86	8.8%	98	10.0%	137	14.0%	283	29.0%	328	33.6%	977
ARC – Key Centres	12	3.0%	28	7.0%	36	9.0%	49	12.2%	127	31.6%	150	37.3%	402
ARC – Linkage Projects	22	1.4%	83	5.2%	104	6.5%	215	13.4%	509	31.7%	671	41.8%	1604
ARC – QEII Fellows	16	1.4%	83	7.2%	79	6.8%	130	11.2%	360	31.1%	490	42.3%	1158
ARC – Special Res Ctrs	43	2.3%	142	7.6%	154	8.3%	212	11.4%	595	31.9%	717	38.5%	1863
ARC Total	285	1.7%	1061	6.2%	1355	7.9%	2246	13.0%	5471	31.7%	6825	39.6%	17243
Cooperative Res Centres	50	1.5%	190	5.9%	210	6.5%	405	12.5%	1071	33.0%	1319	40.6%	3245
Other Government	99	1.2%	296	3.6%	367	4.5%	779	9.4%	2307	28.0%	4398	53.3%	8246
Other Hospital	185	1.5%	514	4.3%	629	5.3%	1246	10.4%	3445	28.8%	5948	49.7%	11967
Other University	605	1.0%	2297	3.9%	3061	5.2%	5924	10.1%	16628	28.2%	30350	51.6%	58865
Research Institutes	248	1.7%	946	6.7%	1094	7.7%	1852	13.0%	4432	31.2%	5626	39.6%	14198
Australia	1352	1.3%	4867	4.6%	6157	5.9%	11327	10.8%	30260	28.8%	50343	47.9%	104306

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 2. Relative citation and journal impact: Selected Science Fields, Total ARC

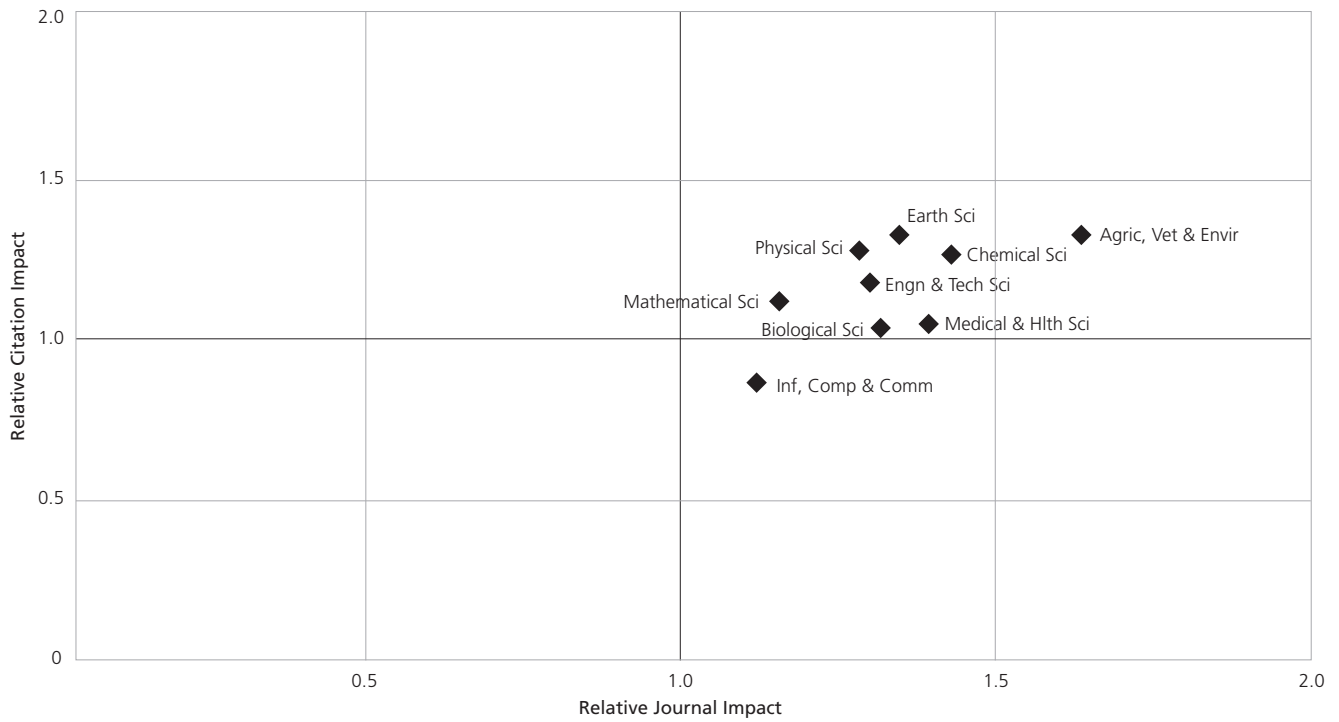


Figure 3. Relative citation and journal impact: Selected Social Sciences Fields, Total ARC

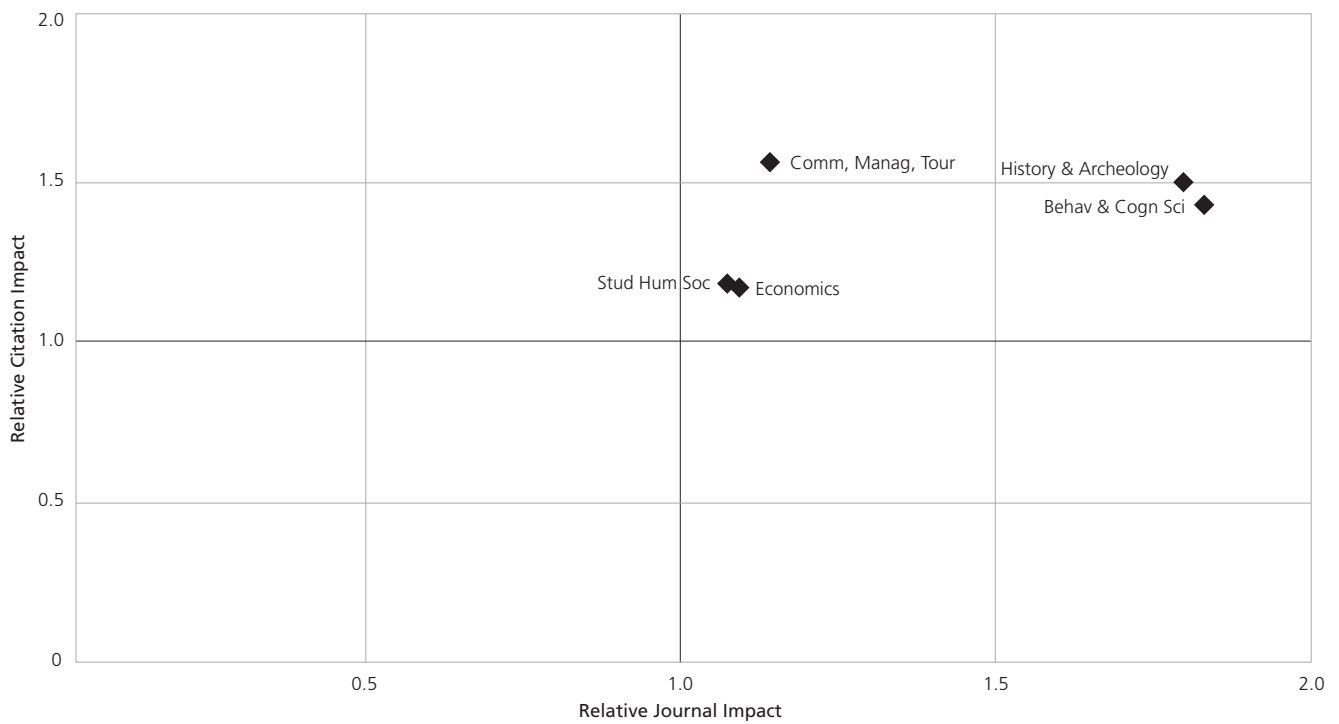


Figure 4 and Figure 5 compare the performance across disciplines of the two project schemes – Discovery Projects and Linkage Projects. As the largest scheme, Discovery Projects mirror the overall ARC performance in most respects, with relative citation impact above the world benchmark for most fields, and a high relative journal impact in all cases. For Linkage Projects, the outcomes

were more diverse. Their journal impact was low in both the Physical and Biological Sciences, but in the former case they have a very high relative citation impact. Their output in all other disciplines was in higher impact journals, but with a varied success in attracting citations compared to the field benchmark.

Figure 4. Relative citation and journal impact: Selected Science & Social Sciences Fields, ARC Discovery Projects

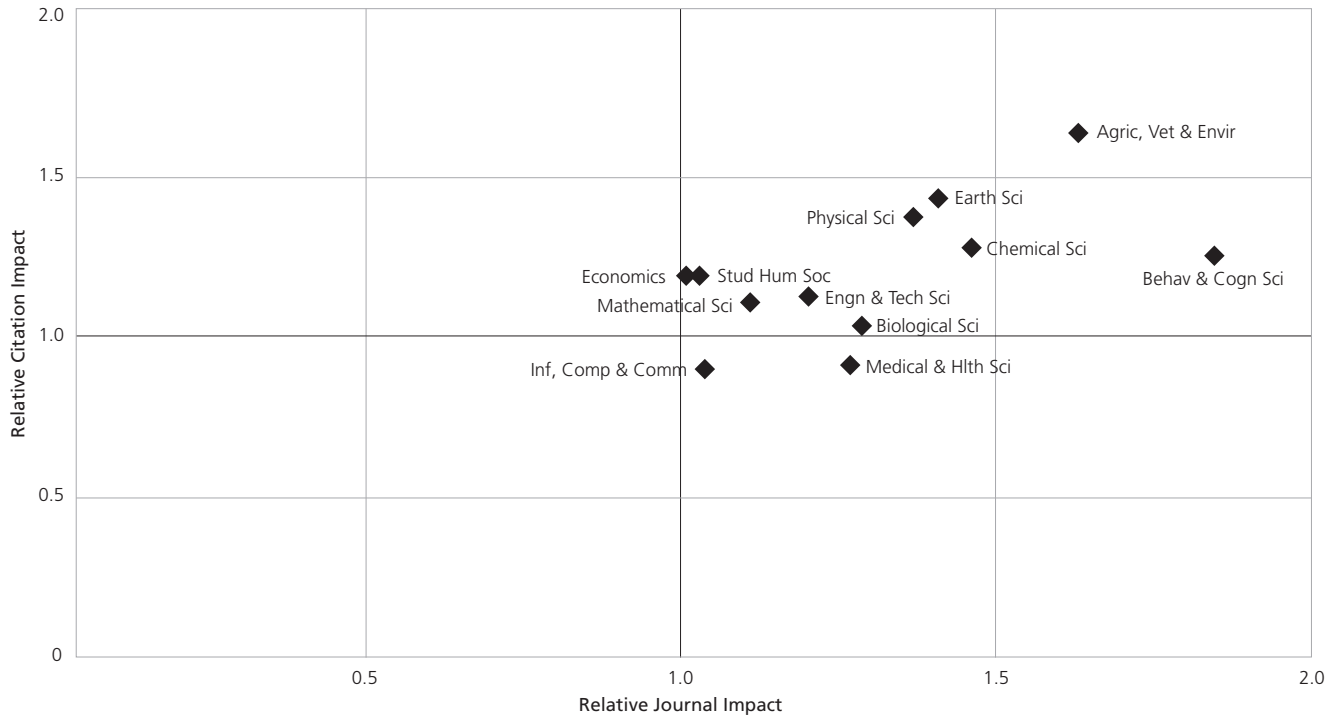
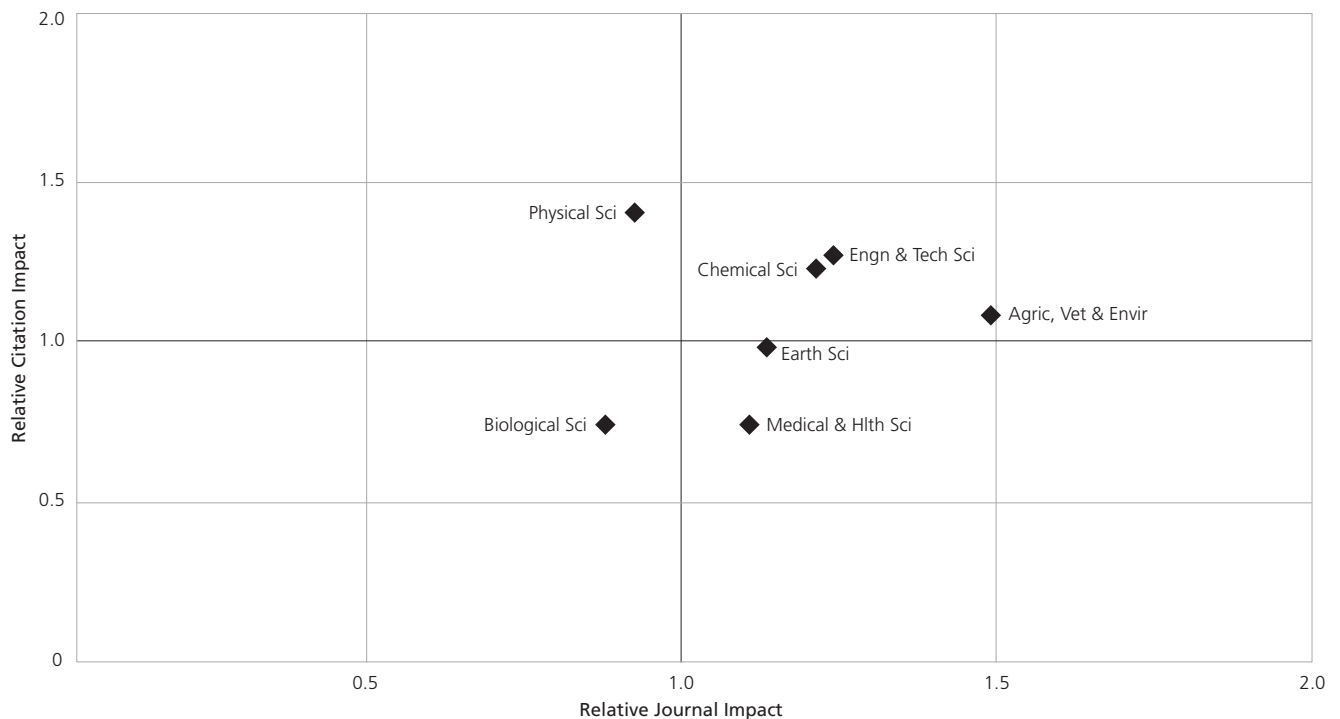


Figure 5. Relative citation and journal impact: Selected Sciences Fields, ARC Linkage Projects



3. RFCD Fields and Subfields of Research

Fields & Subfields

Analyses detailing relative citation and journal impact, and highly cited Australian publications, are presented in this section for all fields and subfields of the RFCD for which the ARC schemes in total produce more than 100 publications.

The fields covered in this section are constructed using journal sets; that is, publications are classified to a field or subfield on the basis of the journal in which they were published. Details of the relevant translation of WoS journal sets into the fields and subfields of the RFCD is given at the start of each section.

3.1 Field: Mathematical Sciences

WoS journal sets analysed: journals from all subject categories used for the subfield analyses in sections 3.1 to 3.3.

Table 9. Relative Citation and Journal Impact Rates, 2001–2005: Mathematical Sciences

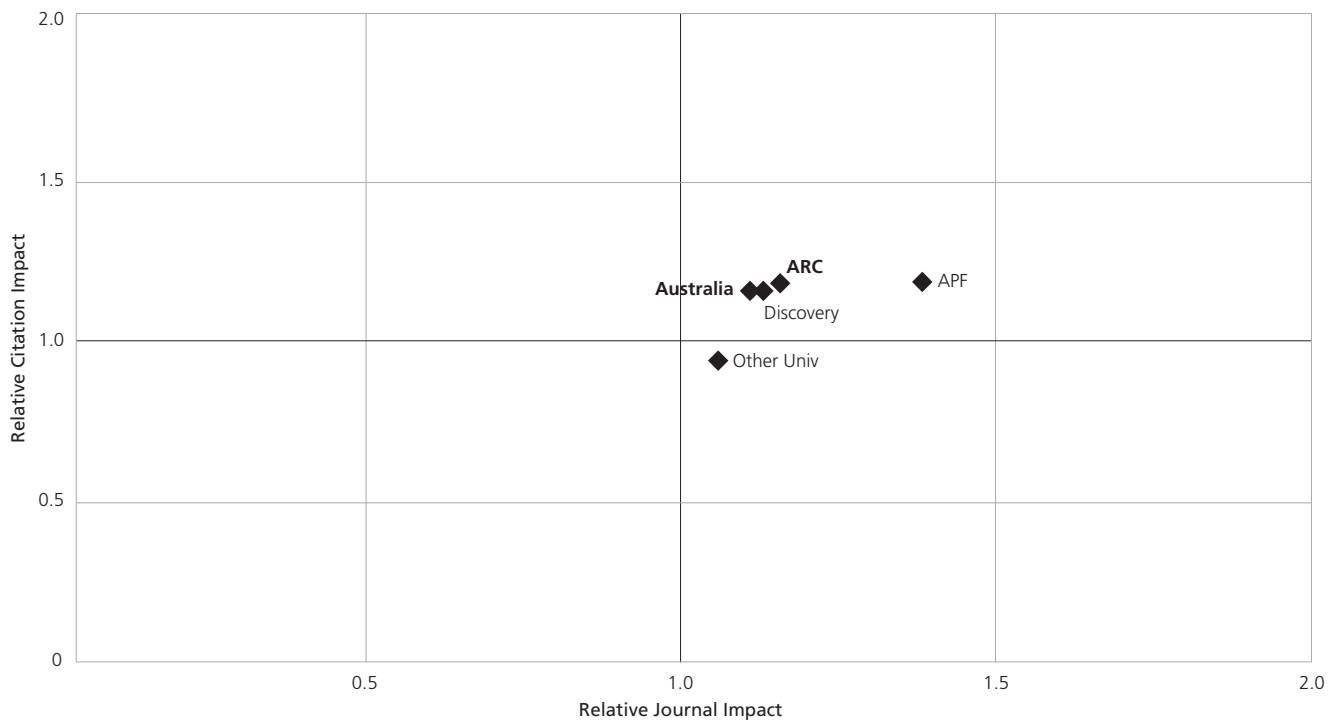
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Professorial Fellowships	134	171	1.35	1.16
ARC – Discovery Projects	712	1269	1.12	1.12
ARC Total	878	1547	1.16	1.14
Other University	1827	3110	1.06	0.95
Australia	2865	5511	1.10	1.13

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 10. Centile Distribution of Publications, 2001–2005: Mathematical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Prof Fellows	1	0.7%	6	4.5%	10	7.5%	17	12.7%	33	24.6%	67	50.0%	134
ARC – Discovery Projects	4	0.6%	37	5.2%	37	5.2%	96	13.5%	176	24.7%	362	50.8%	712
ARC Total	6	0.7%	43	4.9%	50	5.7%	121	13.8%	212	24.1%	446	50.8%	878
Other University	12	0.7%	57	3.1%	67	3.7%	189	10.3%	429	23.5%	1073	58.7%	1827
Australia	25	0.9%	106	3.7%	126	4.4%	320	11.2%	677	23.6%	1611	56.2%	2865

Figure 6. Relative Citation and Journal Impact: Mathematical Sciences



Comments

While conferences represent an important medium for publishing research results in the mathematical sciences, journal publications are an important outlet. More importantly, most articles in journals resulting from ARC-funded research are indexed by WoS, and the coverage for journal articles from other research sectors active in this field is also comprehensive. The use of bibliometric analysis as one measure of research performance is therefore justified for mathematical sciences.

The performance of ARC-funded research is in line with the overall Australian performance. Australian Professorial Fellows are publishing in high impact journals, but this does not result in a higher citation rate. The reason for this can be seen in Table 10 where the number of high impact publications (top 1%) is relatively low for the total output. It is these high impact articles that drive citation rates due to the highly skewed nature of the citation distribution, which occurs in all disciplines.

3.2 Subfield: Mathematics

Field: Mathematical Sciences

WoS journal sets analysed: Mathematics; Mathematics, applied; Operations research and management science.

Table 11. Relative Citation and Journal Impact Rates, 2001–2005: Mathematics

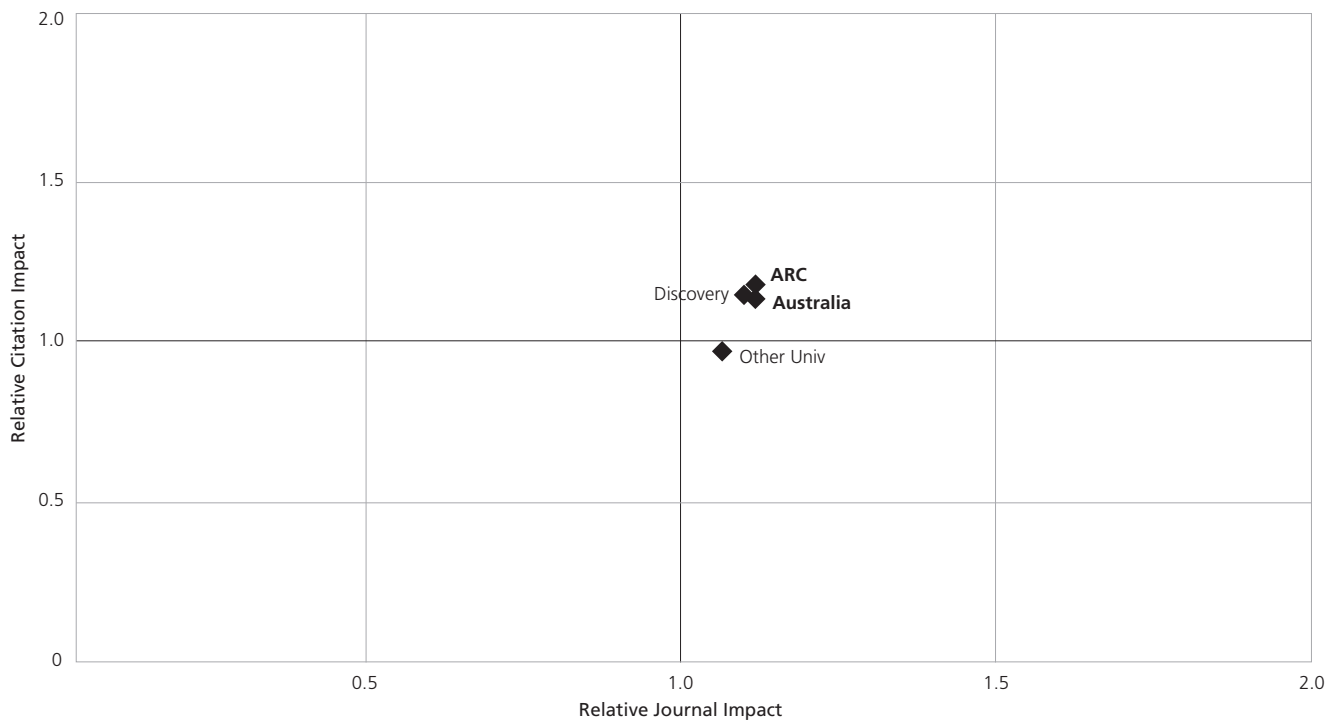
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	585	1009	1.08	1.12
ARC Total	725	1254	1.10	1.15
Other University	1585	2670	1.07	0.97
Australia	2432	4446	1.10	1.10

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 12. Centile Distribution of Publications, 2001–2005: Mathematics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	0.5%	28	4.8%	33	5.6%	81	13.8%	148	25.3%	292	49.9%	585
ARC Total	5	0.7%	34	4.7%	44	6.1%	105	14.5%	176	24.3%	361	49.8%	725
Other University	12	0.8%	50	3.2%	59	3.7%	156	9.8%	368	23.2%	940	59.3%	1585
Australia	21	0.9%	90	3.7%	109	4.5%	270	11.1%	577	23.7%	1365	56.1%	2432

Figure 7. Relative Citation and Journal Impact: Mathematics



Comments

Only one scheme and one comparator sector have sufficient publications to be included in this analysis. All performance points are clustered around the world average. Discovery Projects have a relatively low presence in the top 1% band of publications compared to the Other University sector, but a higher proportion in the next highly cited band (2–5%) and less below the median, hence they have a slightly better overall performance.

3.3 Subfield: Statistics

Field: Mathematical Sciences

WoS journal set analysed: Statistics and probability.

Table 13. Relative Citation and Journal Impact Rates, 2001–2005: Statistics

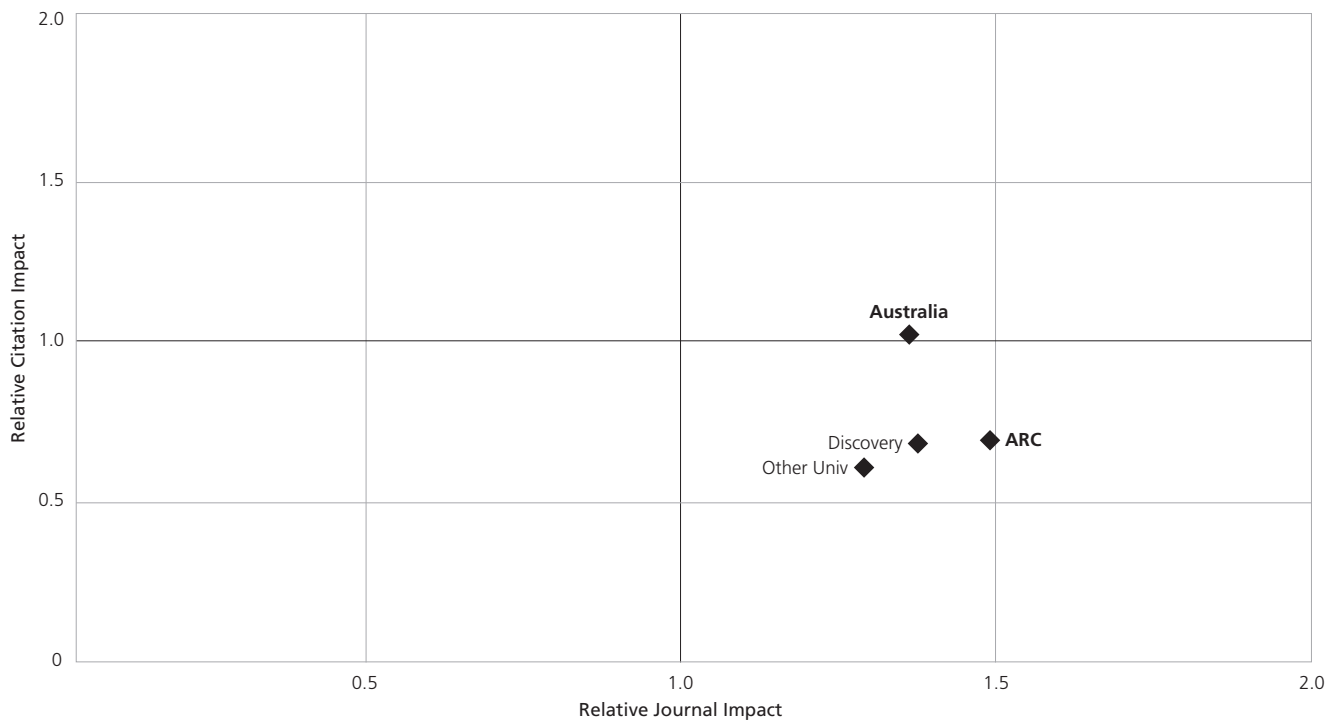
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	143	292	1.37	0.71
ARC Total	171	336	1.49	0.71
Other University	350	755	1.26	0.66
Australia	581	1800	1.36	1.02

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 14. Centile Distribution of Publications, 2001–2005: Statistics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	1	0.7%	7	4.9%	4	2.8%	18	12.6%	38	26.6%	75	52.4%	143
ARC Total	1	0.6%	8	4.7%	6	3.5%	18	10.5%	47	27.5%	91	53.2%	171
Other University		0.0%	9	2.6%	10	2.9%	42	12.0%	88	25.1%	201	57.4%	350
Australia	8	1.4%	19	3.3%	21	3.6%	64	11.0%	146	25.1%	323	55.6%	581

Figure 8. Relative Citation and Journal Impact: Statistics



Comments

As with the preceding subfield, output in the statistics journal set can only be analysed for the Discovery Projects and Other University sectors. The citation performance of both the ARC (including Discovery Projects) and Other University publications is well below the world benchmark. It is also below that achieved by the publications not covered by these sectors, as can be seen by the higher performance for Australia in aggregate. Their presence in the most highly cited band of publications is low (or non-existent in the case of the Other University sector), and they have more than 50% of their output below the world median.

3.4 Field: Physical Sciences

WoS journal sets analysed: journals from all subject categories used for the subfield analyses in sections 3.5 to 3.10.

Table 15. Relative Citation and Journal Impact Rates, 2001–2005: Physical Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	461	1861	1.24	1.47
ARC – Australian Professorial Fellowships	795	4301	1.12	1.39
ARC – Australian Research Fellowships	358	1651	1.27	1.23
ARC – Centres Excellence	339	517	1.28	1.23
ARC – Discovery Projects	2777	16182	1.32	1.39
ARC – Federation Fellowships	428	1443	1.42	1.93
ARC – Key Centres	98	477	0.93	0.99
ARC – Linkage Projects	169	1016	0.94	1.43
ARC – QEII Fellowships	452	1745	1.20	0.98
ARC – Special Research Centres	604	3710	1.25	1.59
ARC Total	4584	24158	1.26	1.35
Cooperative Research Centres	169	641	0.85	0.78
Other Government	600	5461	1.33	2.09
Other Hospital	122	386	0.97	0.82
Other University	5325	26861	1.19	1.21
Research Institutes	957	5772	1.43	1.35
Australia	11528	60129	1.23	1.27

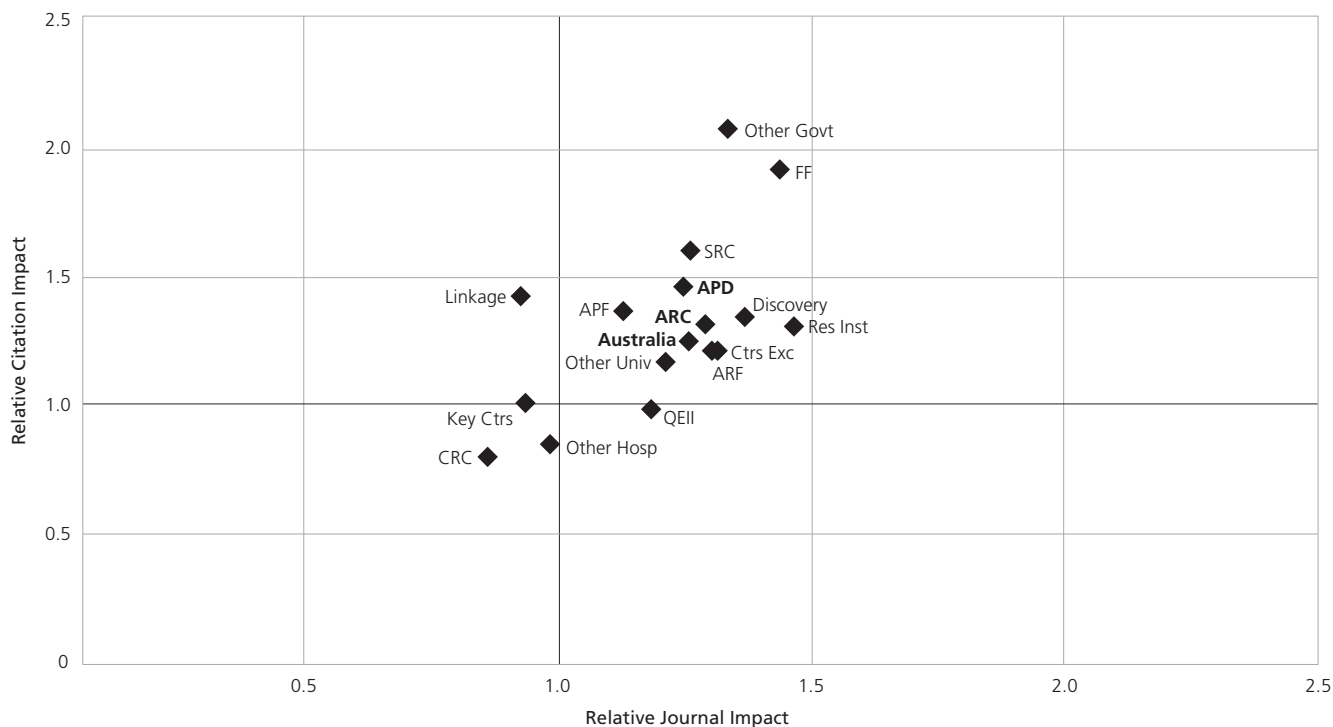
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 16. Centile Distribution of Publications, 2001–2005: Physical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	9	2.0%	39	8.5%	42	9.1%	52	11.3%	116	25.2%	203	44.0%	461
ARC – Aust Prof Fellows	12	1.5%	49	6.2%	55	6.9%	106	13.3%	265	33.3%	308	38.7%	795
ARC – Aust Res Fellows	3	0.8%	13	3.6%	32	8.9%	54	15.1%	110	30.7%	146	40.8%	358
ARC – Centres Excellence	8	2.4%	13	3.8%	42	12.4%	44	13.0%	111	32.7%	121	35.7%	339
ARC – Discovery Projects	24	0.9%	138	5.0%	220	7.9%	369	13.3%	902	32.5%	1123	40.5%	2776
ARC – Federation Fellows	17	4.0%	40	9.3%	40	9.3%	57	13.3%	125	29.2%	149	34.8%	428
ARC – Key Centres		0.0%	8	8.2%	5	5.1%	17	17.3%	29	29.6%	39	39.8%	98
ARC – Linkage Projects	3	1.8%	14	8.3%	16	9.5%	32	18.9%	49	29.0%	55	32.5%	169
ARC – QEII Fellows	2	0.4%	16	3.5%	20	4.4%	43	9.5%	143	31.6%	228	50.4%	452
ARC – Special Res Ctrs	8	1.3%	46	7.6%	64	10.6%	71	11.8%	190	31.5%	225	37.3%	604
ARC Total	54	1.2%	241	5.3%	368	8.0%	581	12.7%	1460	31.9%	1879	41.0%	4583
Cooperative Res Ctrs		0.0%	5	3.0%	11	6.5%	18	10.7%	56	33.1%	79	46.7%	169
Other Government	18	3.0%	26	4.3%	36	6.0%	68	11.3%	154	25.7%	298	49.7%	600
Other Hospital	1	0.8%	8	6.6%	11	9.0%	11	9.0%	25	20.5%	66	54.1%	122
Other University	71	1.3%	199	3.7%	312	5.9%	514	9.7%	1495	28.1%	2734	51.3%	5325
Research Institutes	7	0.7%	43	4.5%	50	5.2%	94	9.8%	282	29.5%	481	50.3%	957
Australia	139	1.2%	505	4.4%	772	6.7%	1259	10.9%	3408	29.6%	5444	47.2%	11527

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 9. Relative Citation and Journal Impact: Physical Sciences



Comments

As 40% of all journal publication output in the physical sciences results from research that is supported by the ARC, it is not surprising that the ARC’s performance is close to the Australian average, but it is perhaps surprising to see little difference to the Other University sector. This may be due to the progressive inclusion of researchers from the Institute of Advanced Studies at the Australian National University (ANU) in ARC schemes. The ANU is one the most active universities in the physical sciences.

Of some note is the relatively modest performance of the publications from recipients of QEII Fellowships which, despite appearing in relatively high impact journals, fell just short of the world benchmark for the field. This is also reflected in relatively low publication numbers in the most highly cited clusters of publications.

Over half the physical science publications from the Other Government sector are in astronomical sciences, and this goes a long way to explaining its relative position. Astronomical sciences publications are cited much more often than other fields in the physical sciences, hence it is not surprising to see the sector highly visible in this aggregate analysis. The Federation Fellowships scheme also performs extremely well, not just in relative citation and journal impact terms, but also in the extent to which their publications are found in the most highly cited cluster.

3.5 Subfield: Astronomical Sciences

Field: Physical Sciences

WoS journal set analysed: Astronomy and astrophysics.

Table 17. Relative Citation and Journal Impact Rates, 2001–2005: Astronomical Sciences

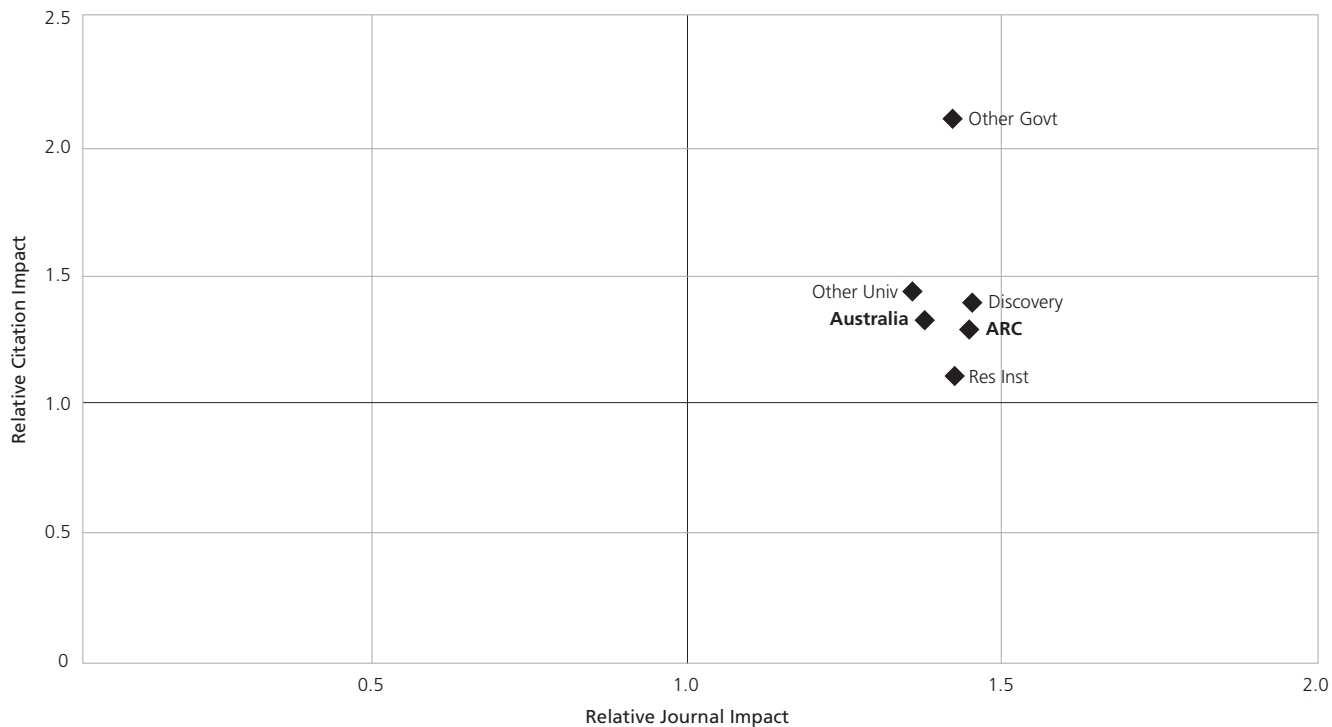
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	525	4526	1.46	1.42
ARC Total	668	5176	1.46	1.33
Other Government	319	4720	1.41	2.10
Other University	1153	10933	1.38	1.45
Research Institutes	433	3330	1.44	1.10
Australia	2482	21472	1.40	1.33

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 18. Centile Distribution of Publications, 2001–2005: Astronomical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	4	0.8%	26	5.0%	44	8.4%	73	13.9%	181	34.5%	197	37.5%	525
ARC Total	6	0.9%	33	4.9%	51	7.6%	84	12.6%	228	34.1%	266	39.8%	668
Other Government	16	5.0%	15	4.7%	24	7.5%	43	13.5%	94	29.5%	127	39.8%	319
Other University	22	1.9%	47	4.1%	74	6.4%	130	11.3%	345	29.9%	535	46.4%	1153
Research Institutes	4	0.9%	23	5.3%	20	4.6%	49	11.3%	136	31.4%	201	46.4%	433
Australia	35	1.4%	108	4.4%	165	6.6%	296	11.9%	771	31.1%	1107	44.6%	2482

Figure 10. Relative Citation and Journal Impact: Astronomical Sciences



Comments

Australia’s citation performance in astronomical sciences is very strong, with a citation rate well above the world average. All sectors and schemes with sufficient publication output to be analysed are publishing in journals with a similar relative impact, although in terms of relative citation impact it is the Other Government sector that stands out. The bulk of these publications come from the Anglo-Australian Observatory.

ARC’s Discovery Projects scheme displays a very strong performance, with citation and journal impact nearly 50% above world benchmarks, and ahead of the high Australian average. This is despite having relatively few publications in the most highly cited clusters compared to the Other Government and Other University sectors.

3.6 Subfield: Condensed Matter Physics

Field: Physical Sciences

WoS journal set analysed: Physics, condensed matter.

Table 19. Relative Citation and Journal Impact Rates, 2001–2005: Condensed Matter Physics

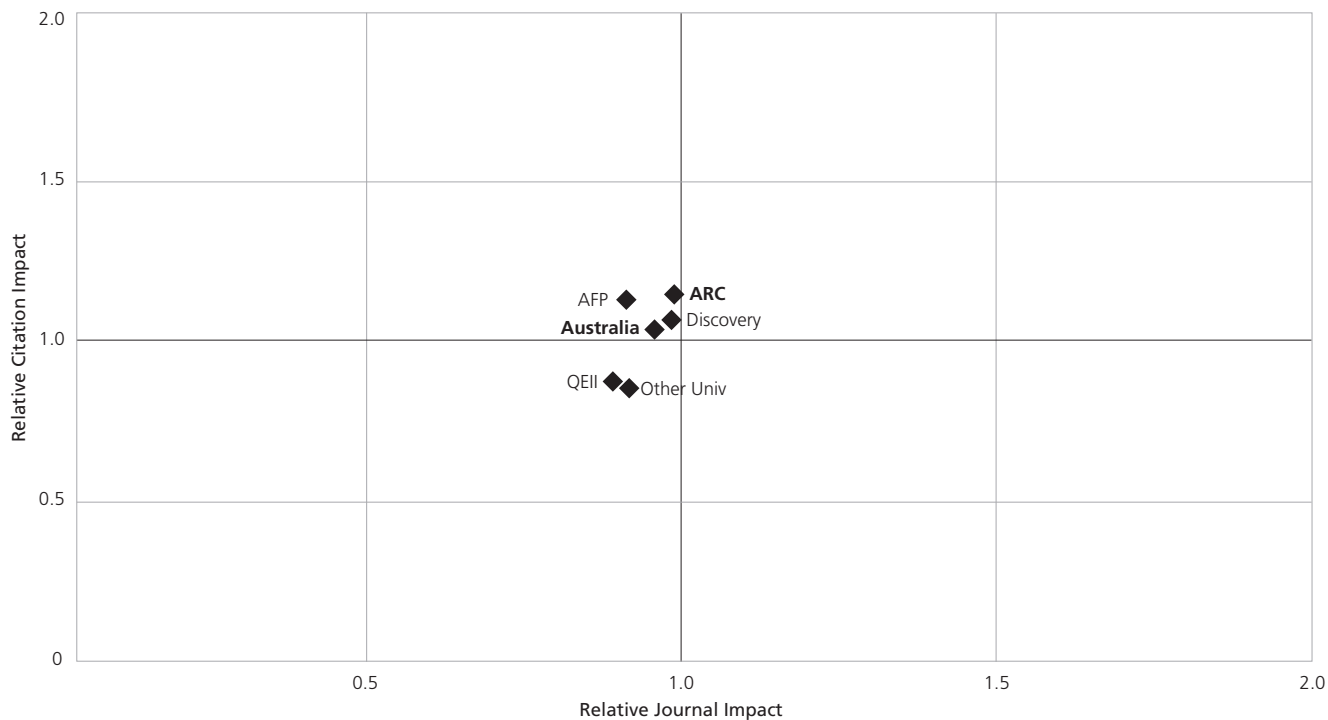
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Professorial Fellowships	154	525	0.87	1.13
ARC – Discovery Projects	327	1103	0.98	1.06
ARC – QEII Fellowships	100	328	0.89	0.89
ARC Total	583	1985	0.98	1.15
Other University	588	1507	0.92	0.87
Australia	1277	3952	0.94	1.04

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 20. Centile Distribution of Publications, 2001–2005: Condensed Matter Physics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		BOTTOM 50%		BOTTOM 50%		TOTAL
ARC – Aust Prof Fellows		0.0%	8	5.2%	12	7.8%	18	11.7%	41	26.6%	75	48.7%	154
ARC – Discovery Projects	1	0.3%	14	4.3%	25	7.6%	28	8.6%	85	26.0%	174	53.2%	327
ARC – QEII Fellows		0.0%	4	4.0%	3	3.0%	7	7.0%	27	27.0%	59	59.0%	100
ARC Total	5	0.9%	31	5.3%	44	7.5%	58	9.9%	155	26.6%	290	49.7%	583
Other University	3	0.5%	14	2.4%	36	6.1%	49	8.3%	126	21.4%	360	61.2%	588
Australia	8	0.6%	51	4.0%	91	7.1%	120	9.4%	303	23.7%	704	55.1%	1277

Figure 11. Relative Citation and Journal Impact: Condensed Matter Physics



Comments

In aggregate, ARC publications are appearing in journals of average impact, but are achieving citations slightly above the world and Australian benchmarks. The QEII scheme is associated with relatively low performance, in terms of both relative citation and journal rates. This is reflected in Table 20 where the scheme is not associated with any of the most highly cited publications in the discipline.

3.7 Subfield: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics

Field: Physical Sciences

WoS journal sets analysed: Physics, atomic, molecular and chemical; Physics, nuclear; Physics, particles and fields.

Table 21. Relative Citation and Journal Impact Rates, 2001–2005: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics

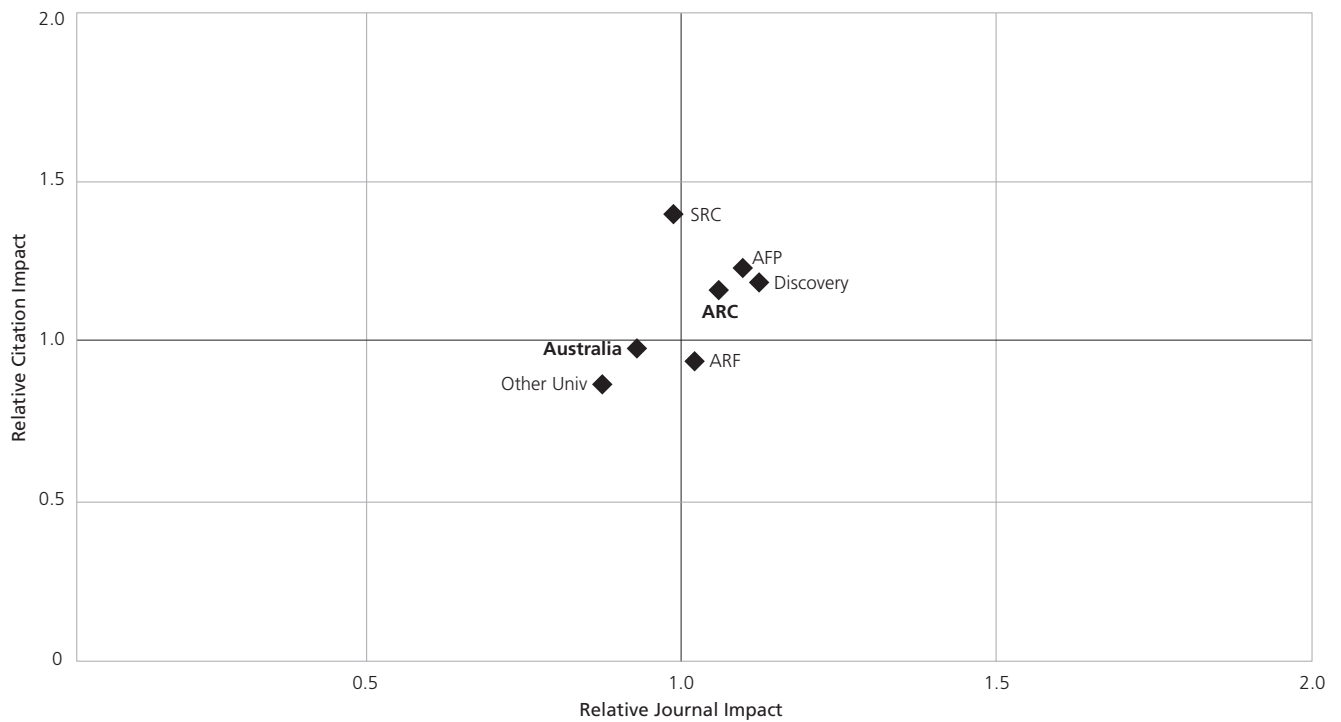
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Professorial Fellowships	130	537	1.10	1.23
ARC – Australian Research Fellowships	120	572	1.03	0.94
ARC – Discovery Projects	559	3234	1.14	1.21
ARC – Special Research Centres	339	2196	0.99	1.39
ARC Total	1034	5593	1.06	1.18
Other University	1032	4255	0.89	0.83
Australia	2204	10283	0.95	0.98

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 22. Centile Distribution of Publications, 2001–2005: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Prof Fellows	1	0.8%	5	3.8%	8	6.2%	18	13.8%	54	41.5%	44	33.8%	130
ARC – Aust Res Fellows		0.0%	1	0.8%	6	5.0%	13	10.8%	47	39.2%	53	44.2%	120
ARC – Discovery Projects	5	0.9%	20	3.6%	46	8.2%	86	15.4%	212	37.9%	190	34.0%	559
ARC – Special Res Ctrs	3	0.9%	19	5.6%	32	9.4%	35	10.3%	112	33.0%	138	40.7%	339
ARC Total	9	0.9%	39	3.8%	88	8.5%	132	12.8%	361	34.9%	405	39.2%	1034
Other University	7	0.7%	35	3.4%	45	4.4%	95	9.2%	325	31.5%	525	50.9%	1032
Australia	17	0.8%	79	3.6%	141	6.4%	232	10.5%	720	32.7%	1015	46.1%	2204

Figure 12. Relative Citation and Journal Impact: Atomic and Molecular Physics; Nuclear and Particle Physics; Plasma Physics



Comments

This discipline has seen a sizeable increase in publication output linked to ARC support (40%), and the ARC performance is well above that for Australia as a whole, which in turn falls slightly below the world benchmark.

One point of interest is that this discipline is one of only a handful where ARC's journal impact is below the average for the discipline. This is true even for the ARC's most strongly performing scheme, the SRC.

3.8 Subfield: Optical Physics

Field: Physical Sciences

WoS journal set analysed: Optics.

Table 23. Relative Citation and Journal Impact Rates, 2001–2005: Optical Physics

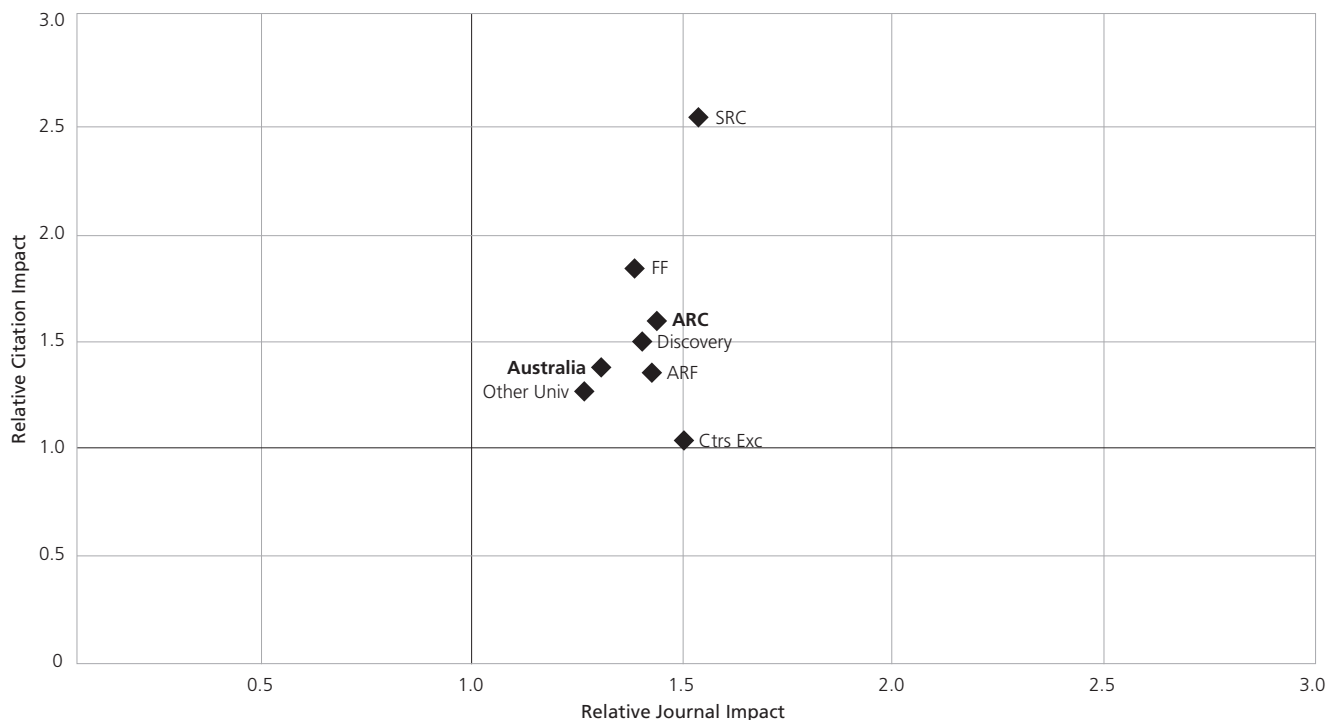
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Research Fellowships	104	416	1.41	1.36
ARC – Centres Excellence	149	148	1.50	1.04
ARC – Discovery Projects	427	2344	1.37	1.51
ARC – Federation Fellowships	111	252	1.36	1.83
ARC – Special Research Centres	142	892	1.53	2.54
ARC Total	756	3621	1.41	1.59
Other University	536	2342	1.23	1.29
Australia	1417	6262	1.30	1.38

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 24. Centile Distribution of Publications, 2001–2005: Optical Physics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Res Fellows	1	1.0%	5	4.8%	10	9.6%	14	13.5%	35	33.7%	39	37.5%	104
ARC – Centres Excellence	4	2.7%	4	2.7%	16	10.7%	18	12.1%	61	40.9%	46	30.9%	149
ARC – Discovery Projects	7	1.6%	19	4.4%	39	9.1%	70	16.4%	157	36.8%	135	31.6%	427
ARC – Federation Fellows	7	6.3%	7	6.3%	13	11.7%	11	9.9%	32	28.8%	41	36.9%	111
ARC – Special Res Ctrs	3	2.1%	8	5.6%	15	10.6%	22	15.5%	52	36.6%	42	29.6%	142
ARC Total	15	2.0%	39	5.2%	73	9.7%	106	14.0%	270	35.7%	253	33.5%	756
Other University	9	1.7%	20	3.7%	41	7.6%	67	12.5%	181	33.8%	218	40.7%	536
Australia	25	1.8%	62	4.4%	120	8.5%	183	12.9%	493	34.8%	534	37.7%	1417

Figure 13. Relative Citation and Journal Impact: Optical Physics



Comments

There has been a doubling of output linked to ARC funding since the last study, and it now accounts for over half of all Australian publications in optical physics. Increased activity has not come at the cost of impact – that has also increased significantly since the last study. The performance of the SRC scheme demonstrates the effect a highly skewed citation distribution can have on the average rate of a relatively small number of publications (in this case 142). Its most highly cited publication received 204 cites. Yet its performance does not rely entirely on a single high impact publication – it had another two that were also in the top 1% in the world for the discipline, and eight others in the top 5%.

Federation Fellowships also performed highly. Most of their publications are in the latter part of the window, and as yet they do not have the very highly cited publications of the SRCs (simply because their citation window is much smaller), yet when judged against other publications from the same period, Table 24 shows that a very high proportion of its output is in the top 5%.

ARC Centres of Excellence publish in high impact journals, but their actual citation performance does not match this potential and their publications hover just above the world average for this set of journals.

3.9 Subfield: Other Physical Sciences

Field: Physical Sciences

WoS journal sets analysed: Biophysics; Instruments and instrumentation; Microscopy.

Table 25. Relative Citation and Journal Impact Rates, 2001–2005: Other Physical Sciences

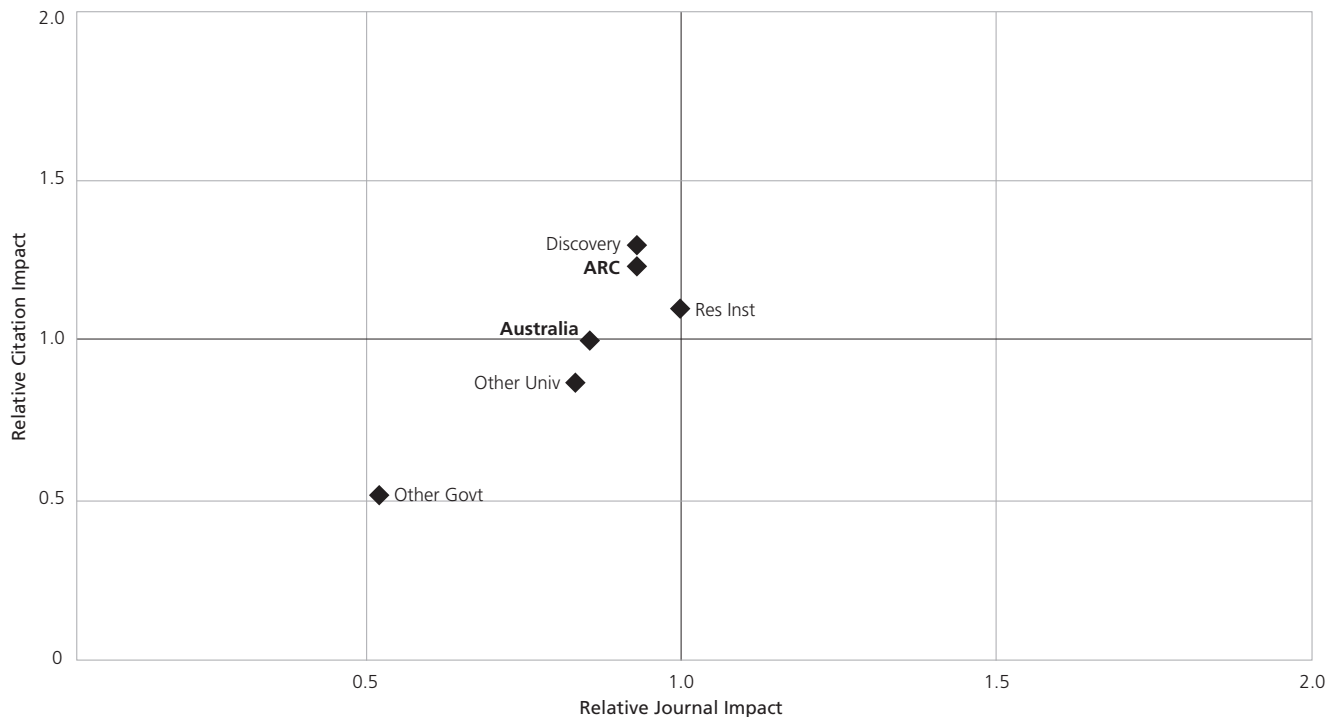
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	341	1956	0.91	1.31
ARC Total	509	2587	0.90	1.25
Other Government	104	249	0.51	0.50
Other University	892	3322	0.82	0.85
Research Institutes	263	1440	1.00	1.11
Australia	1797	7849	0.85	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 26. Centile Distribution of Publications, 2001–2005: Other Physical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	0.9%	11	3.2%	26	7.6%	41	12.0%	108	31.7%	152	44.6%	341
ARC Total	4	0.8%	15	2.9%	37	7.3%	65	12.8%	160	31.4%	228	44.8%	509
Other Government		0.0%	3	2.9%	2	1.9%	7	6.7%	32	30.8%	60	57.7%	104
Other University	3	0.3%	23	2.6%	45	5.0%	70	7.8%	278	31.2%	473	53.0%	892
Research Institutes		0.0%	10	3.8%	15	5.7%	20	7.6%	68	25.9%	150	57.0%	263
Australia	9	0.5%	52	2.9%	102	5.7%	166	9.2%	545	30.3%	923	51.4%	1797

Figure 14. Relative Citation and Journal Impact: Other Physical Sciences



Comments

Even though the ARC output in the research area defined by this set of journals are appearing in journals of an average impact lower than the full set, it is achieving an actual citation rate well above both the world and Australian benchmarks. Discovery Project output is at a level slightly higher than aggregate ARC.

Output from the Other Government sector is well below the world benchmark, and that from the Other University sector also performs below average. Both are publishing in low impact sets of journals.

3.10 Subfield: General Physical Sciences

Field: Physical Sciences

WoS journal sets analysed: Physics; Physics, applied; Physics, fluids and plasmas; Nuclear science and technology. These WoS subject categories are either comprised of journals that have a wide discipline coverage, or comprised of journals that span more than one of the subfields specified in the RFCD classification scheme. For this reason, they are analysed as a separate set within the physical sciences field. Examples are *Australian Journal of Physics*, *American Journal of Physics* and *Applied Physics Letters*.

Table 27. Relative Citation and Journal Impact Rates, 2001–2005: General Physical Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	253	1157	1.62	2.05
ARC – Australian Professorial Fellowships	418	2107	1.27	1.51
ARC – Australian Research Fellowships	177	884	1.50	1.41
ARC – Centres Excellence	240	381	1.80	1.50
ARC – Discovery Projects	1230	6393	1.48	1.46
ARC – Federation Fellowships	222	847	1.78	2.60
ARC – QEII Fellowships	247	949	1.50	1.30
ARC – Special Research Centres	289	1999	1.75	2.23
ARC Total	2120	10604	1.52	1.52
Other Government	187	447	0.79	0.66
Other University	2134	8004	1.23	1.05
Research Institutes	196	619	0.98	0.89
Australia	4680	19810	1.32	1.23

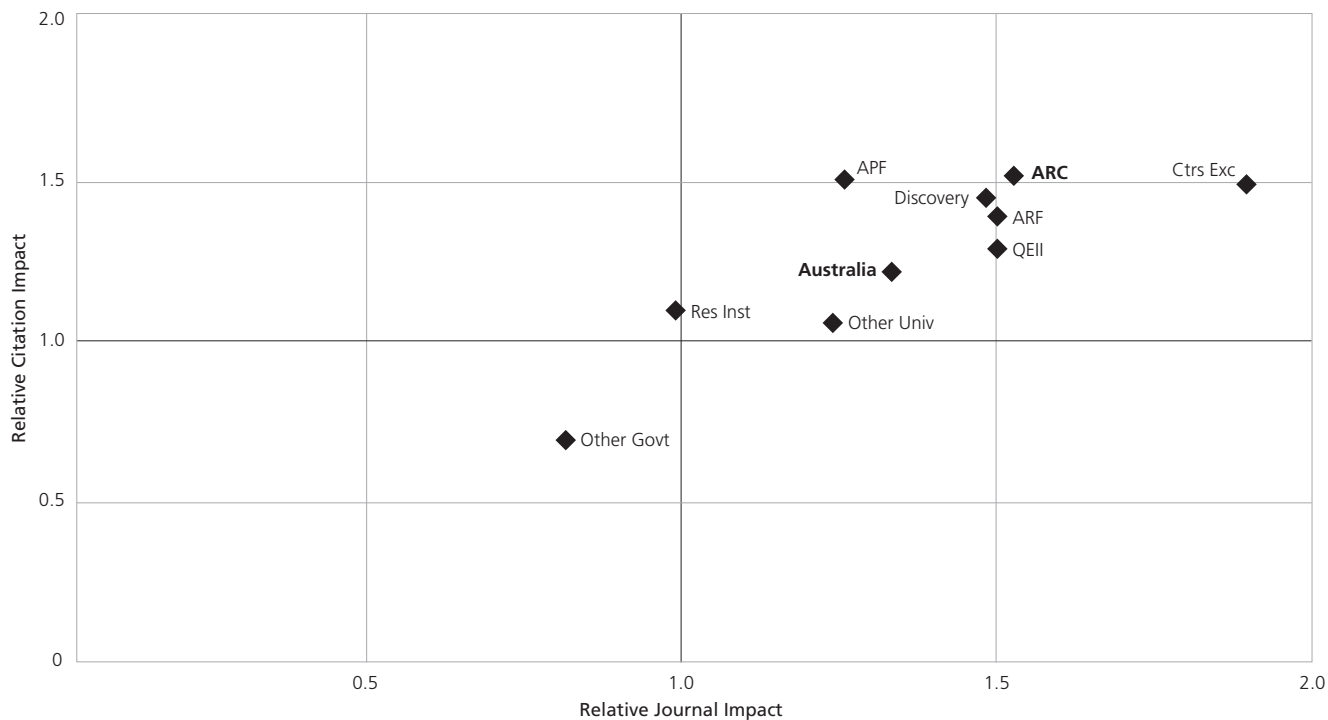
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 28. Centile Distribution of Publications, 2001–2005: General Physical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	7	2.8%	26	10.3%	20	7.9%	33	13.0%	62	24.5%	105	41.5%	253
ARC – Aust Prof Fellows	7	1.7%	30	7.2%	29	6.9%	50	12.0%	136	32.5%	166	39.7%	418
ARC – Aust Res Fellows	1	0.6%	6	3.4%	17	9.6%	26	14.7%	56	31.6%	71	40.1%	177
ARC – Centres Excellence	5	2.1%	9	3.8%	29	12.1%	36	15.0%	70	29.2%	91	37.9%	240
ARC – Discovery Projects	14	1.1%	67	5.5%	90	7.3%	165	13.4%	393	32.0%	500	40.7%	1229
ARC – Federation Fellows	9	4.1%	25	11.3%	18	8.1%	36	16.2%	60	27.0%	74	33.3%	222
ARC – QEII Fellows	2	0.8%	12	4.9%	9	3.6%	31	12.6%	83	33.6%	110	44.5%	247
ARC – Special Res Ctrs	5	1.7%	27	9.3%	30	10.4%	45	15.6%	89	30.8%	93	32.2%	289
ARC Total	32	1.5%	124	5.9%	162	7.6%	288	13.6%	671	31.7%	842	39.7%	2119
Other Government	2	1.1%	8	4.3%	6	3.2%	15	8.0%	39	20.9%	117	62.6%	187
Other University	31	1.5%	78	3.7%	124	5.8%	213	10.0%	564	26.4%	1124	52.7%	2134
Research Institutes	1	0.5%	8	4.1%	12	6.1%	18	9.2%	64	32.7%	93	47.4%	196
Australia	66	1.4%	219	4.7%	306	6.5%	537	11.5%	1358	29.0%	2193	46.9%	4679

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 15. Relative Citation and Journal Impact: General Physical Sciences



Comments

All ARC schemes that are active in this set of journals have a strong citation impact and are appearing in high impact journals. In terms of actual citations received, there is little to distinguish them – what differences there are lie in the set of journals in which they publish. Publications from Centres of Excellence are appearing in particularly high impact journals, while those from the APF scheme have a lower impact than the average for ARC journals, though still well above the average for the full set.

Australia as a whole performs strongly in this set of general physical journals, and even after excluding publications that have ARC support, the Other University sector has a relative citation rate above world parity.

3.11 Field: Chemical Sciences

In addition to journals from the WoS subject category sets used for the subfield analyses in sections 3.12 to 3.17, the set for Chemical Sciences as a whole also includes journals from the Chemistry, applied journal set.

Table 29. Relative Citation and Journal Impact Rates, 2001–2005: Chemical Sciences

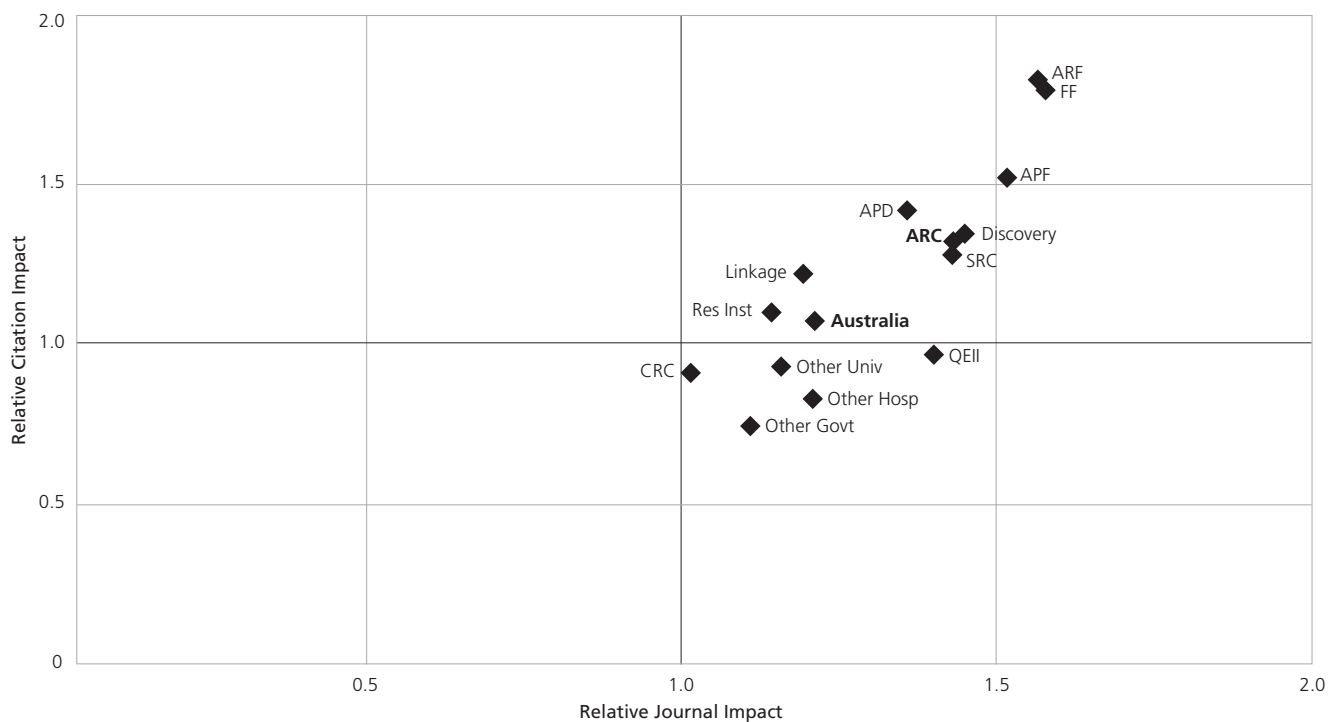
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	217	925	1.36	1.40
ARC – Australian Professorial Fellowships	565	3180	1.52	1.50
ARC – Australian Research Fellowships	149	1063	1.56	1.81
ARC – Discovery Projects	1521	9173	1.45	1.33
ARC – Federation Fellowships	216	621	1.58	1.79
ARC – Linkage Projects	239	1208	1.20	1.22
ARC – QEII Fellowships	201	801	1.38	0.97
ARC – Special Research Centres	209	1145	1.43	1.27
ARC Total	2732	14824	1.44	1.30
Cooperative Research Centres	258	1190	1.01	0.92
Other Government	333	1063	1.13	0.74
Other Hospital	102	376	1.23	0.83
Other University	4664	19103	1.15	0.94
Research Institutes	630	3158	1.13	1.10
Australia	8582	39340	1.23	1.06

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 30. Centile Distribution of Publications, 2001–2005: Chemical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	11	5.1%	11	5.1%	18	8.3%	35	16.1%	61	28.1%	81	37.3%	217
ARC – Aust Prof Fellows	13	2.3%	55	9.7%	60	10.6%	84	14.9%	191	33.8%	162	28.7%	565
ARC – Aust Res Fellows	5	3.4%	14	9.4%	9	6.0%	29	19.5%	48	32.2%	44	29.5%	149
ARC – Discovery Projects	28	1.8%	97	6.4%	120	7.9%	177	11.6%	553	36.4%	546	35.9%	1521
ARC – Federation Fellows	9	4.2%	31	14.4%	29	13.4%	29	13.4%	65	30.1%	53	24.5%	216
ARC – Linkage Projects	3	1.3%	12	5.0%	23	9.6%	30	12.6%	91	38.1%	80	33.5%	239
ARC – QEII Fellows	3	1.5%	9	4.5%	18	9.0%	19	9.5%	75	37.3%	77	38.3%	201
ARC – Special Res Ctrs	2	1.0%	6	2.9%	18	8.6%	14	6.7%	80	38.3%	89	42.6%	209
ARC Total	56	2.0%	186	6.8%	224	8.2%	328	12.0%	958	35.1%	980	35.9%	2732
Cooperative Res Ctrs	3	1.2%	13	5.0%	7	2.7%	27	10.5%	91	35.3%	117	45.3%	258
Other Government	3	0.9%	9	2.7%	13	3.9%	34	10.2%	90	27.0%	184	55.3%	333
Other Hospital	0.0%		2	2.0%	0.0%		5	4.9%	34	33.3%	61	59.8%	102
Other University	38	0.8%	160	3.4%	218	4.7%	435	9.3%	1441	30.9%	2372	50.9%	4664
Research Institutes	13	2.1%	29	4.6%	24	3.8%	61	9.7%	196	31.1%	307	48.7%	630
Australia	112	1.3%	400	4.7%	484	5.6%	890	10.4%	2737	31.9%	3959	46.1%	8582

Figure 16. Relative Citation and Journal Impact: Chemical Sciences



Comments

Close to one-third of all Australian WoS publications in the chemical sciences are linked to one of ARC's research funding schemes. As the WoS journal set is the primary outlet for chemistry research in Australia, it is therefore reasonable to assume this proportion also relates to the total output for the field.

ARC publications in chemical sciences are highly cited and are appearing in high impact journals. The stand-out schemes for the ARC are the Australian Research Fellows and Federation Fellows, both achieving a citation rate around 80% above the level for the yearly distribution of publications they produce. Australian Professorial Fellows' publications are also cited 50% higher than the world benchmark. Australian Postdoctoral Fellows are publishing in slightly lower impact journals (though still well above the average for the set), as would be expected for researchers relatively early in their career – but they are achieving very high citation rates. These four ARC schemes are also highly prominent in the most highly cited bands of Table 30.

The QEII scheme is the ARC outlier in this analysis. While publishing in high impact journals, their citation rate falls just short of the world benchmark.

3.12 Subfield: Physical Chemistry

Field: Chemical Sciences

WoS journal sets analysed: Chemistry, physical; Electrochemistry.

Table 31. Relative Citation and Journal Impact Rates, 2001–2005: Physical Chemistry

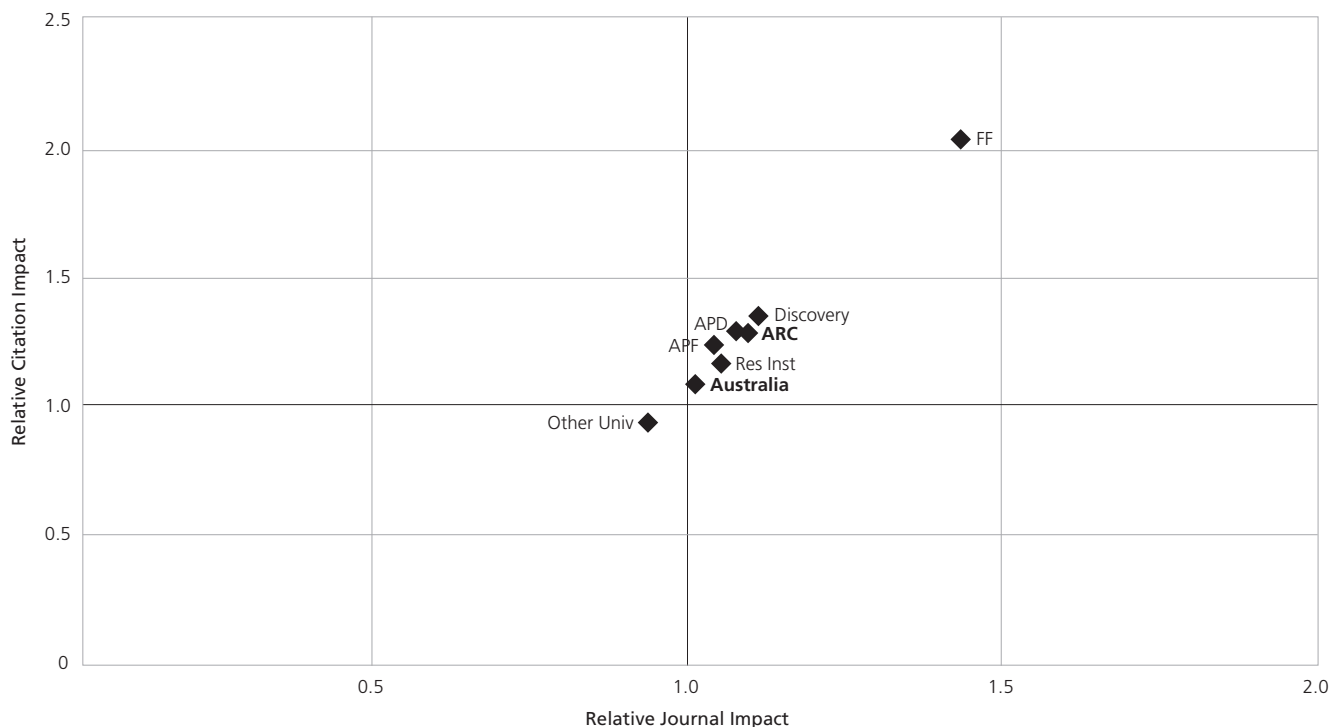
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	106	330	1.11	1.29
ARC – Australian Professorial Fellowships	239	1072	1.05	1.25
ARC – Discovery Projects	514	3289	1.14	1.38
ARC – Federation Fellowships	100	336	1.41	2.03
ARC Total	981	5042	1.13	1.29
Other University	1386	5766	0.95	0.94
Research Institutes	151	867	1.06	1.15
Australia	2640	12133	1.02	1.07

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 32. Centile Distribution of Publications, 2001–2005: Physical Chemistry

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	4	3.8%	8	7.5%	10	9.4%	21	19.8%	25	23.6%	38	35.8%	106
ARC – Aust Prof Fellows	3	1.3%	19	7.9%	31	13.0%	41	17.2%	72	30.1%	73	30.5%	239
ARC – Discovery Projects	10	1.9%	42	8.2%	53	10.3%	65	12.6%	181	35.2%	163	31.7%	514
ARC – Federation Fellows	7	7.0%	15	15.0%	13	13.0%	18	18.0%	26	26.0%	21	21.0%	100
ARC Total	21	2.1%	77	7.8%	98	10.0%	129	13.1%	322	32.8%	334	34.0%	981
Other University	13	0.9%	59	4.3%	81	5.8%	149	10.8%	432	31.2%	652	47.0%	1386
Research Institutes	3	2.0%	14	9.3%	9	6.0%	18	11.9%	42	27.8%	65	43.0%	151
Australia	38	1.4%	161	6.1%	195	7.4%	309	11.7%	829	31.4%	1108	42.0%	2640

Figure 17. Relative Citation and Journal Impact: Physical Chemistry



Comments

As with many fields of research, the publications of Federation Fellows stand out above those from other ARC schemes. In physical chemistry, their publications attract citations at double the discipline average. This is also reflected in Table 32, which highlights that a massive 22% of their output is classified as being among the top 5% most highly cited in the world for their year of publication.

Overall, ARC-linked publications are in the top 5% cluster of highly cited publications at double the rate expected for the size of their output, and this strong performance is also reflected in a relative citation impact well above the world benchmark. Though linked to only 37% of Australian output in physical chemistry, 55% of the highest impact publications are linked to ARC support.

3.13 Subfield: Inorganic Chemistry

Field: Chemical Sciences

WoS journal sets analysed: Chemistry, inorganic and nuclear; Crystallography.

Table 33. Relative Citation and Journal Impact Rates, 2001–2005: Inorganic Chemistry

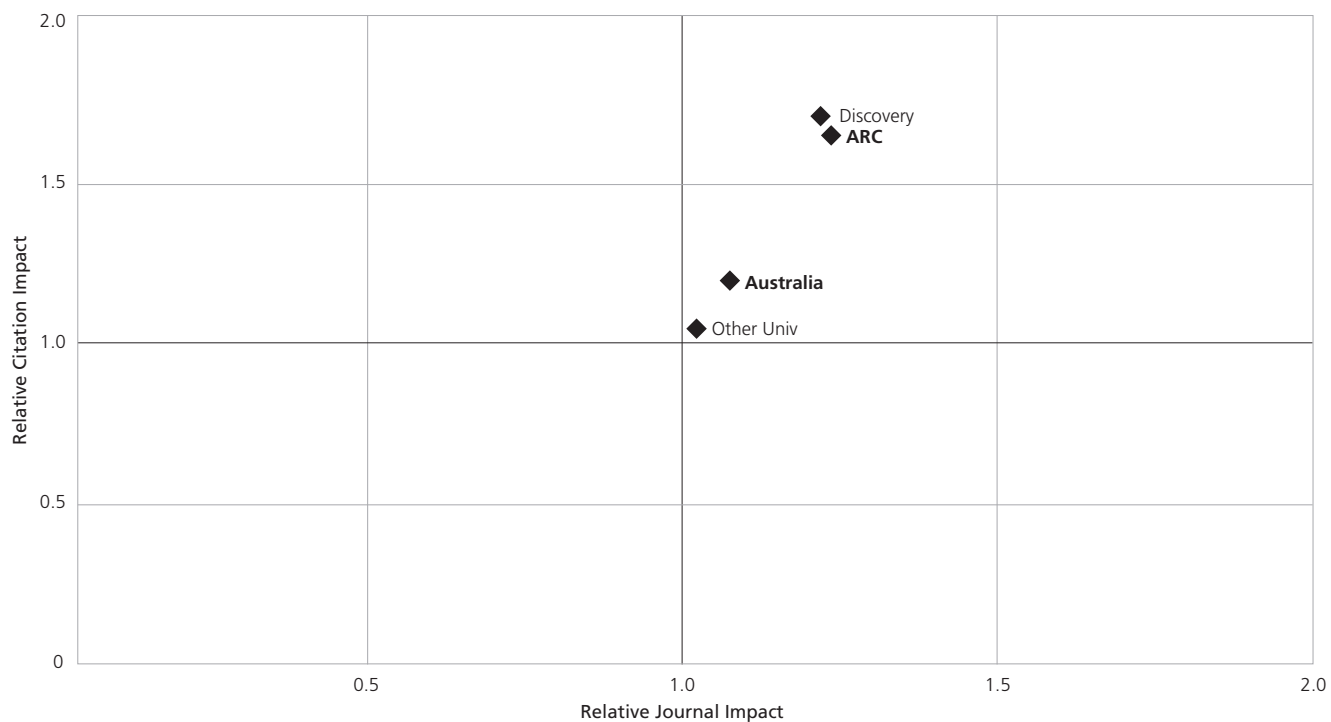
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	375	2264	1.20	1.69
ARC Total	524	2906	1.22	1.62
Other University	931	3283	1.02	1.04
Australia	1597	6553	1.08	1.21

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 34. Centile Distribution of Publications, 2001–2005: Inorganic Chemistry

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	8	2.1%	25	6.7%	26	6.9%	38	10.1%	131	34.9%	147	39.2%	375
ARC Total	12	2.3%	34	6.5%	33	6.3%	46	8.8%	184	35.1%	215	41.0%	524
Other University	4	0.4%	35	3.8%	39	4.2%	83	8.9%	290	31.1%	480	51.6%	931
Australia	17	1.1%	69	4.3%	75	4.7%	135	8.5%	505	31.6%	796	49.8%	1597

Figure 18. Relative Citation and Journal Impact: Inorganic Chemistry



Comments

The majority of ARC-linked publications are from the Discovery Projects scheme, and the citation performance of its publications is particularly strong. Its relative citation rate is well above the world benchmark at 1.69. ARC publications are appearing in high impact journals, though not as high above world benchmarks as in some other disciplines.

3.14 Subfield: Organic Chemistry

Field: Chemical Sciences

WoS journal set analysed: Chemistry, organic.

Table 35. Relative Citation and Journal Impact Rates, 2001–2005: Organic Chemistry

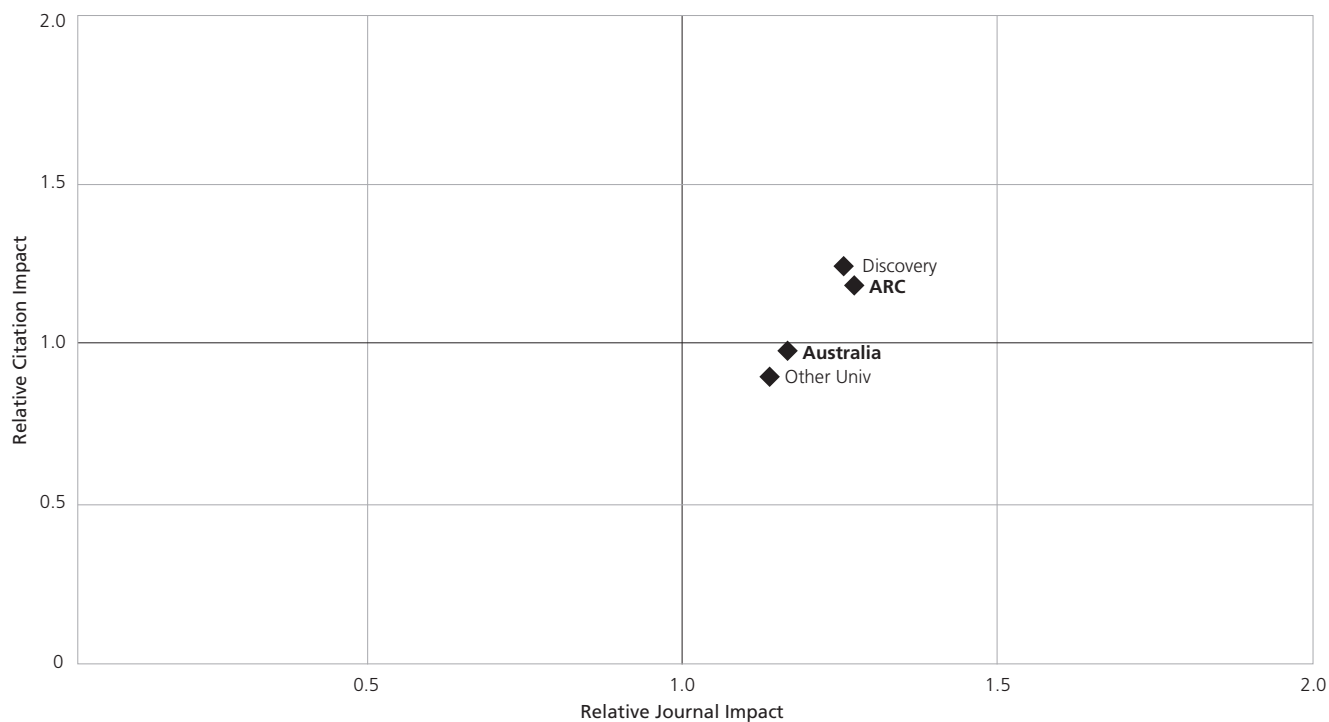
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	227	1320	1.22	1.23
ARC Total	314	1749	1.24	1.17
Other University	572	2245	1.13	0.88
Australia	960	4331	1.16	0.98

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 36. Centile Distribution of Publications, 2001–2005: Organic Chemistry

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.9%	13	5.7%	25	11.0%	32	14.1%	68	30.0%	87	38.3%	227
ARC Total	2	0.6%	16	5.1%	30	9.6%	41	13.1%	95	30.3%	130	41.4%	314
Other University	2	0.3%	13	2.3%	25	4.4%	44	7.7%	216	37.8%	272	47.6%	572
Australia	4	0.4%	30	3.1%	56	5.8%	99	10.3%	331	34.5%	440	45.8%	960

Figure 19. Relative Citation and Journal Impact: Organic Chemistry



Comments

As with inorganic chemistry, ARC output in organic chemistry is primarily linked to the Discovery Projects scheme. Relative citation and journal impact rates are both above world parity, and above the aggregate Australian levels. However, the ARC's presence in the top 1% cluster of publications is on the low side. In general, Australia has few very high impact publications from this period, explaining its position marginally below the world benchmarks.

3.15 Subfield: Analytical Chemistry

Field: Chemical Sciences

WoS journal sets analysed: Chemistry, analytical; Spectroscopy.

Table 37. Relative Citation and Journal Impact Rates, 2001–2005: Analytical Chemistry

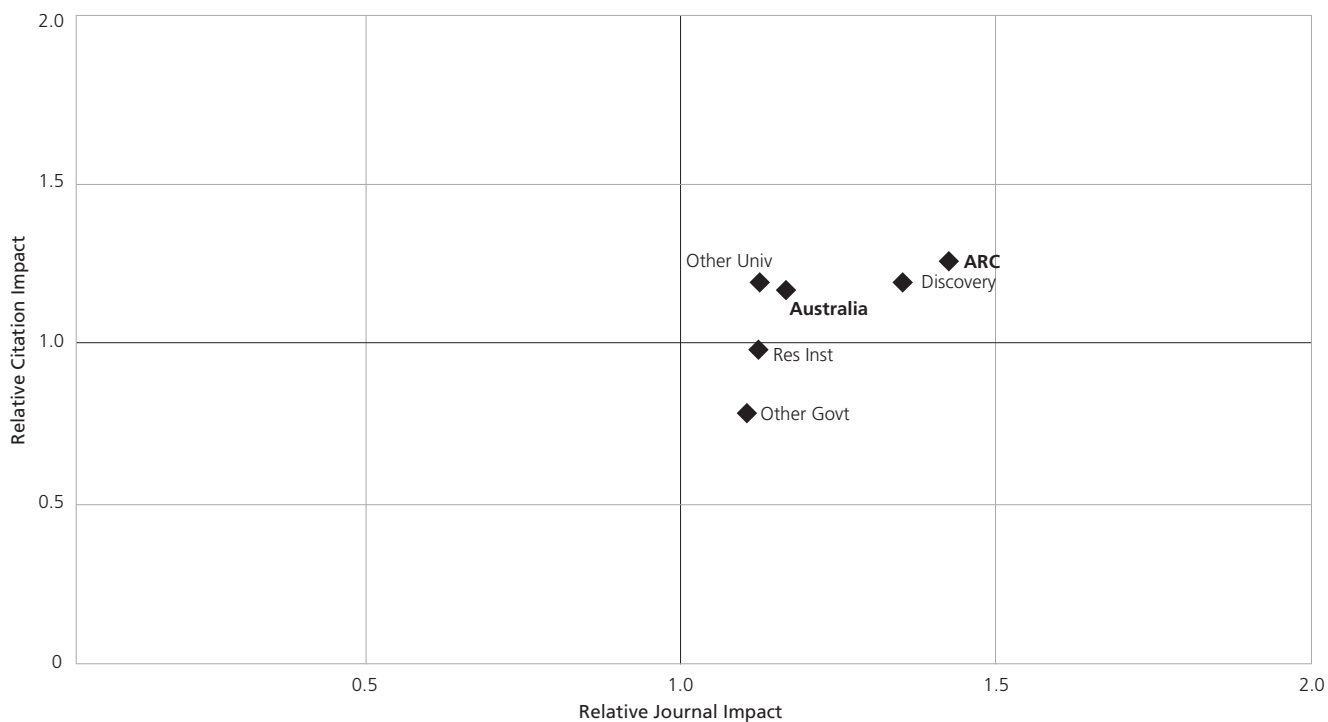
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	194	948	1.33	1.20
ARC Total	358	1623	1.43	1.26
Other Government	100	305	1.10	0.77
Other University	926	4302	1.16	1.22
Research Institutes	123	445	1.13	0.99
Australia	1584	7119	1.21	1.19

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 38. Centile Distribution of Publications, 2001–2005: Analytical Chemistry

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	1.0%	9	4.6%	10	5.2%	18	9.3%	85	43.8%	70	36.1%	194
ARC Total	2	0.6%	17	4.7%	18	5.0%	44	12.3%	147	41.1%	130	36.3%	358
Other Government	1	1.0%	1	1.0%	4	4.0%	8	8.0%	27	27.0%	59	59.0%	100
Other University	9	1.0%	45	4.9%	58	6.3%	116	12.5%	295	31.9%	403	43.5%	926
Research Institutes	1	0.8%	4	3.3%	2	1.6%	5	4.1%	41	33.3%	70	56.9%	123
Australia	13	0.8%	73	4.6%	85	5.4%	190	12.0%	519	32.8%	704	44.4%	1584

Figure 20. Relative Citation and Journal Impact: Analytical Chemistry



Comments

The ARC has a smaller presence in the analytical chemistry journal set than for most other subfields of the chemical sciences, with 22.6% of the Australian output. ARC publications are appearing in high impact journals, and have a relative citation impact more than 25% above parity.

The other university sector also has a similar relative citation impact, but its publications are appearing in journals with a lower relative impact. Most of Australia's highest impact publications come from this sector.

3.16 Subfield: Macromolecular Chemistry

Field: Chemical Sciences

WoS journal sets analysed: Polymer science.

Table 39. Relative Citation and Journal Impact Rates, 2001–2005: Macromolecular Chemistry

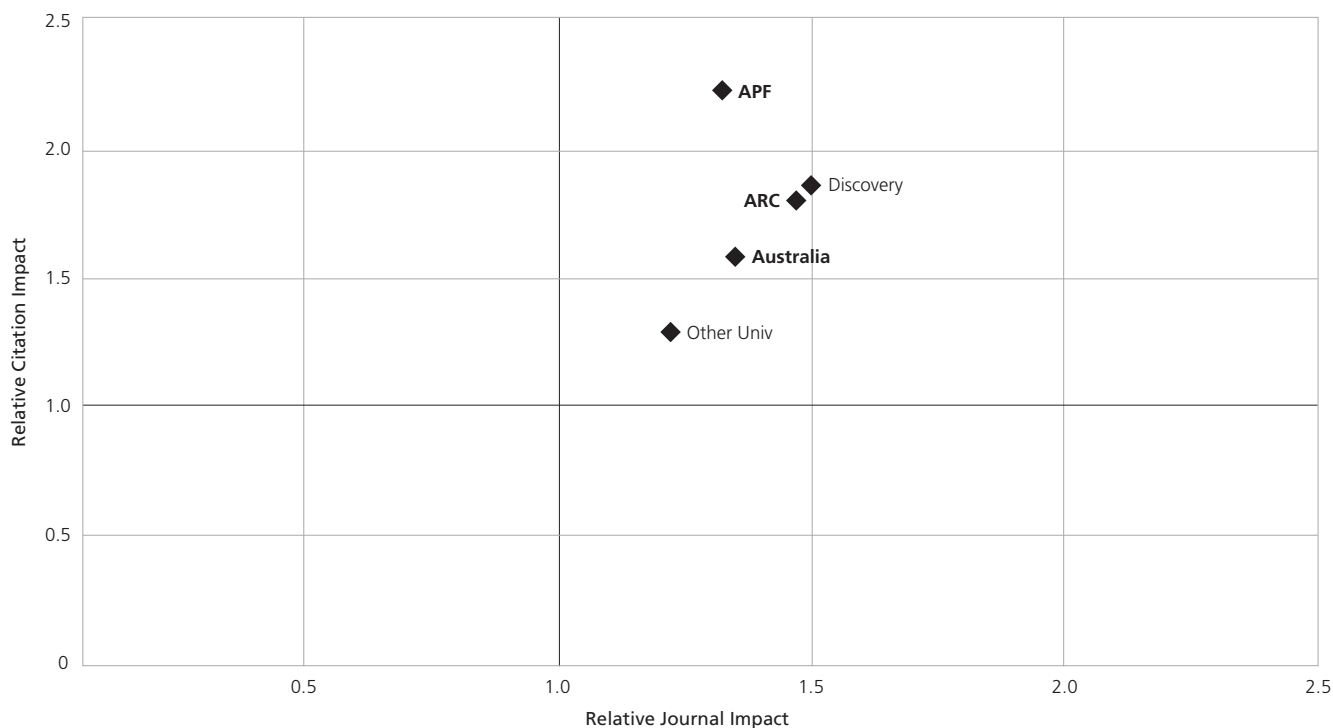
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Professorial Fellowships	110	661	1.34	2.23
ARC – Discovery Projects	111	712	1.51	1.91
ARC Total	349	2010	1.47	1.85
Other University	374	1795	1.21	1.28
Australia	874	4959	1.30	1.59

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 40. Centile Distribution of Publications, 2001–2005: Macromolecular Chemistry

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Prof Fellows	6	5.5%	16	14.5%	10	9.1%	19	17.3%	25	22.7%	34	30.9%	110
ARC – Discovery Projects	5	4.5%	10	9.0%	10	9.0%	15	13.5%	33	29.7%	38	34.2%	111
ARC Total	17	4.9%	43	12.3%	31	8.9%	50	14.3%	91	26.1%	117	33.5%	349
Other University	9	2.4%	14	3.7%	18	4.8%	35	9.4%	113	30.2%	185	49.5%	374
Australia	33	3.8%	69	7.9%	52	5.9%	98	11.2%	260	29.7%	362	41.4%	874

Figure 21. Relative Citation and Journal Impact: Macromolecular Chemistry



Comments

With only 874 Australian publications in this journal set, the sector analysis for macro-molecular chemistry is based on small numbers, and only one individual sector and two ARC schemes attain the cut-off threshold of 100 publications.

The output from all analysed units is appearing in journals of a similar average impact, but the relative citation impact of the publications covers a wide range. All are above parity, but Australian Professorial Fellowships achieved the highest relative impact at over double the discipline benchmarks.

In aggregate, the ARC has a very strong relative citation impact, and its strong performance can also be seen in the very high proportion of publications in the top two clusters of highly cited publications.

3.17 Subfield: General Chemical Sciences

Field: Chemical Sciences

A number of journals classified by WoS as 'Chemistry, multidisciplinary' cannot be allocated to a specific subfield as they have a wide discipline coverage. Examples are the *Australian Journal of Chemistry*, *Chemical Communications*, *Journal of the American Chemical Society*, and the like. This section separately analyses this set of journals.

Table 41. Relative Citation and Journal Impact Rates, 2001–2005: General Chemical Sciences

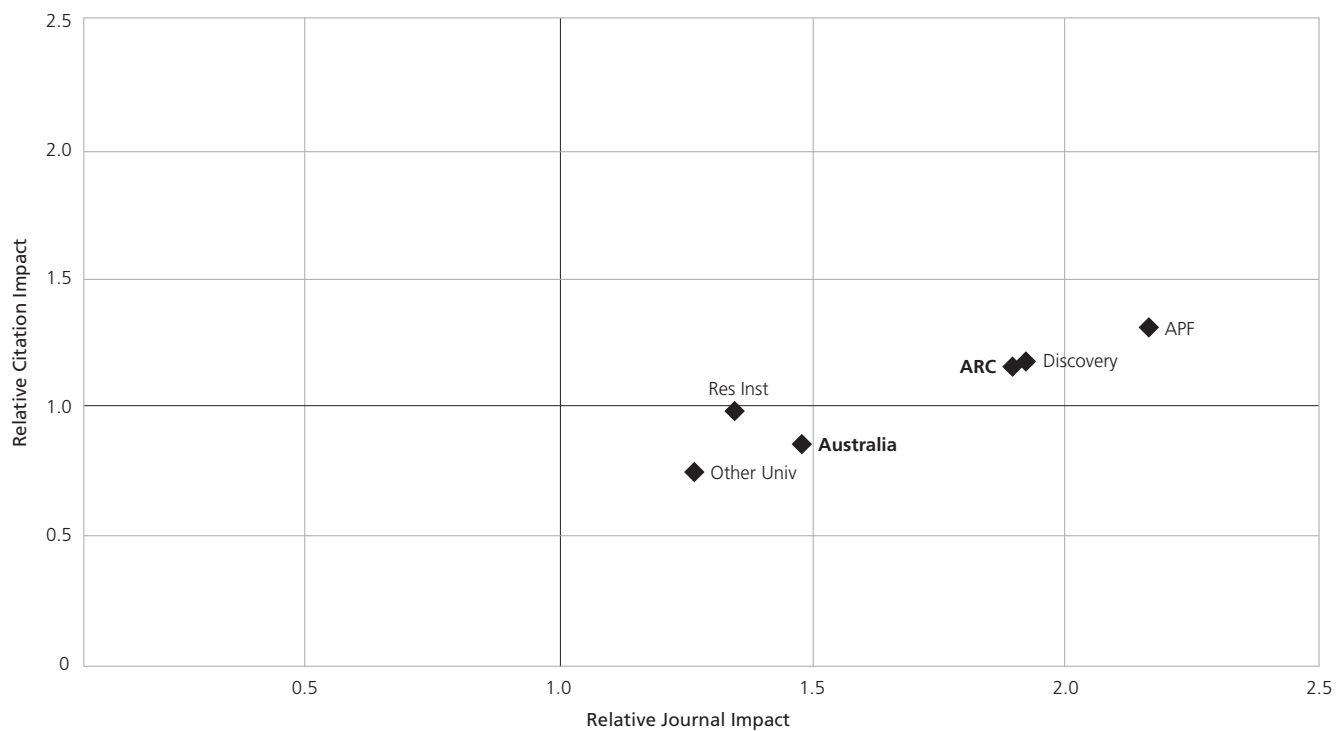
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Professorial Fellowships	133	990	2.12	1.29
ARC – Discovery Projects	330	2180	1.90	1.13
ARC Total	583	3635	1.87	1.10
Other University	996	4076	1.29	0.72
Research Institutes	152	764	1.34	0.99
Australia	1818	8788	1.47	0.86

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 42. Centile Distribution of Publications, 2001–2005: General Chemical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Prof Fellows	2	1.5%	8	6.0%	12	9.0%	19	14.3%	60	45.1%	32	24.1%	133
ARC – Discovery Projects	4	1.2%	19	5.8%	21	6.4%	34	10.3%	139	42.1%	113	34.2%	330
ARC Total	7	1.2%	31	5.3%	50	8.6%	60	10.3%	240	41.2%	195	33.4%	583
Other University	5	0.5%	28	2.8%	26	2.6%	63	6.3%	285	28.6%	589	59.1%	996
Research Institutes	3	2.0%	7	4.6%	11	7.2%	25	16.4%	50	32.9%	56	36.8%	152
Australia	17	0.9%	67	3.7%	88	4.8%	158	8.7%	600	33.0%	888	48.8%	1818

Figure 22. Relative Citation and Journal Impact: General Chemical Sciences



Comments

Australia's overall performance in these general chemistry journals falls below the world average, even though its publications are appearing in relatively high impact journals. The ARC publications appear in an even higher impact journal set but, as is the case for Australia in total, this has not translated into a high relative citation impact.

3.18 Field: Earth Sciences

In addition to journals from the WoS subject category sets used for the subfield analyses in sections 3.19 to 3.24, the set for Earth Sciences as a whole also includes journals from the Geography (SCI) journal set.

Table 43. Relative Citation and Journal Impact Rates, 2001–2005: Earth Sciences

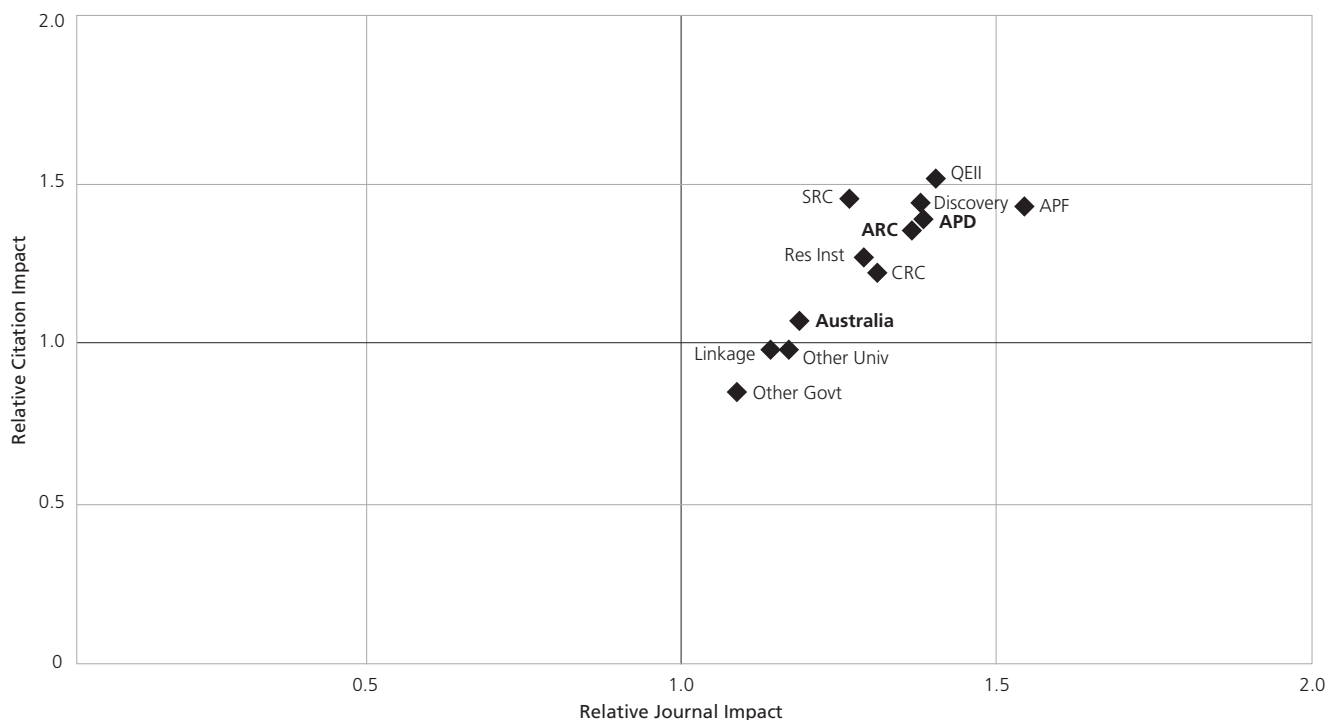
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	177	566	1.36	1.42
ARC – Australian Professorial Fellowships	111	428	1.55	1.39
ARC – Discovery Projects	922	4242	1.35	1.45
ARC – Linkage Projects	176	486	1.13	0.98
ARC – QEII Fellowships	110	520	1.38	1.52
ARC – Special Research Centres	367	1950	1.27	1.46
ARC Total	1596	7211	1.34	1.39
Cooperative Research Centres	405	1886	1.30	1.23
Other Government	1058	3003	1.09	0.84
Other University	3259	11158	1.16	0.98
Research Institutes	921	4398	1.27	1.28
Australia	6881	25933	1.20	1.09

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 44. Centile Distribution of Publications, 2001–2005: Earth Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	3	1.7%	11	6.2%	13	7.3%	22	12.4%	48	27.1%	80	45.2%	177
ARC – Aust Prof Fellows	2	1.8%	3	2.7%	4	3.6%	13	11.7%	43	38.7%	46	41.4%	111
ARC – Discovery Projects	15	1.6%	73	7.9%	56	6.1%	134	14.5%	320	34.7%	324	35.1%	922
ARC – Linkage Projects	2	1.1%	11	6.3%	10	5.7%	23	13.1%	47	26.7%	83	47.2%	176
ARC – QEII Fellows	2	1.8%	14	12.7%	6	5.5%	19	17.3%	35	31.8%	34	30.9%	110
ARC – Special Res Ctrs	6	1.6%	41	11.2%	24	6.5%	53	14.4%	109	29.7%	134	36.5%	367
ARC Total	26	1.6%	125	7.8%	98	6.1%	218	13.7%	520	32.6%	609	38.2%	1596
Cooperative Res Ctrs	8	2.0%	17	4.2%	37	9.1%	49	12.1%	141	34.8%	153	37.8%	405
Other Government	7	0.7%	24	2.3%	44	4.2%	83	7.8%	305	28.8%	595	56.2%	1058
Other University	34	1.0%	127	3.9%	189	5.8%	309	9.5%	961	29.5%	1639	50.3%	3259
Research Institutes	18	2.0%	59	6.4%	65	7.1%	120	13.0%	296	32.1%	363	39.4%	921
Australia	87	1.3%	337	4.9%	412	6.0%	746	10.8%	2109	30.6%	3190	46.4%	6881

Figure 23. Relative Citation and Journal Impact: Earth Sciences



Comments

ARC funding is linked to just under one-quarter of Australian publications in earth sciences. This represents a significant increase since the previous study. Relative citation impact has also increased strongly and earth sciences has risen from one of the lower performers in the previous study to now be among the strongest performers for the ARC. The increased output has not been at the cost of citation impact. The CRC and Research Institute sectors also perform strongly in this field.

For the individual ARC schemes, it is the output of QEII scholars that emerges slightly above others in terms of relative citation impact, while Australian Professorial Fellowships are publishing in the highest impact journals. All schemes except Linkage Projects have a similar presence in the highly cited clusters of publications.

As would be expected for a scheme with a strong applied focus (in which collaboration with industry is sought), publications from Linkage Project grants are appearing in a lower impact set of journals than other ARC schemes. This is expected because it has been shown that journals with a strong applied focus have, on average, lower citation impact than those with a strong basic focus.

3.19 Subfield: Geology

Field: Earth Sciences

WoS journal sets analysed: Geology; Paleontology; Mineralogy.

Table 45. Relative Citation and Journal Impact Rates, 2001–2005: Geology

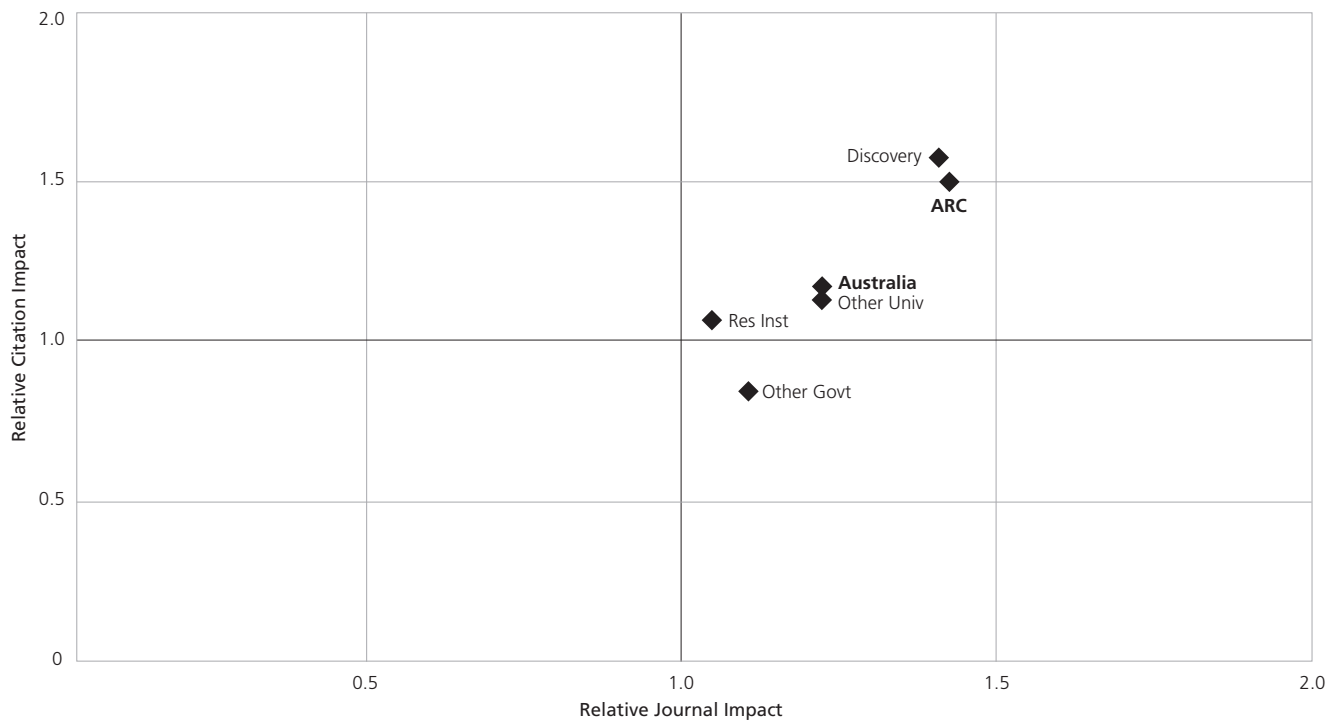
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	272	1238	1.40	1.57
ARC Total	438	1924	1.42	1.49
Other Government	161	479	1.09	0.84
Other University	883	3320	1.19	1.14
Research Institutes	120	455	1.05	1.09
Australia	1627	6166	1.19	1.17

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 46. Centile Distribution of Publications, 2001–2005: Geology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	4	1.5%	30	11.0%	15	5.5%	37	13.6%	102	37.5%	84	30.9%	272
ARC Total	8	1.8%	48	11.0%	27	6.2%	63	14.4%	145	33.1%	147	33.6%	438
Other Government	2	1.2%	4	2.5%	3	1.9%	12	7.5%	42	26.1%	98	60.9%	161
Other University	12	1.4%	41	4.6%	61	6.9%	96	10.9%	276	31.3%	397	45.0%	883
Research Institutes	2	1.7%	13	10.8%	7	5.8%	17	14.2%	38	31.7%	43	35.8%	120
Australia	25	1.5%	104	6.4%	104	6.4%	194	11.9%	509	31.3%	691	42.5%	1627

Figure 24. Relative Citation and Journal Impact: Geology



Comments

Nearly two-thirds of publications linked to ARC funding are from the Discovery Projects scheme, so it is to be expected that their citation performance is very similar. Interestingly, only 4 of the 8 of the ARC’s most highly cited publications come from this scheme. Geology is a very high impact field for the ARC – their publications have a relative citation impact of close to 1.5 – and they are appearing in very high impact journals.

3.20 Subfield: Geosciences

Field: Earth Sciences

WoS maintains one journal set, 'Geochemistry and geophysics', which does not allow for a separate analysis of the two RFCD subfields of Geophysics and Geochemistry. Instead, a combined analysis for the two fields, known as Geosciences, is undertaken.

Table 47. Relative Citation and Journal Impact Rates, 2001–2005: Geosciences

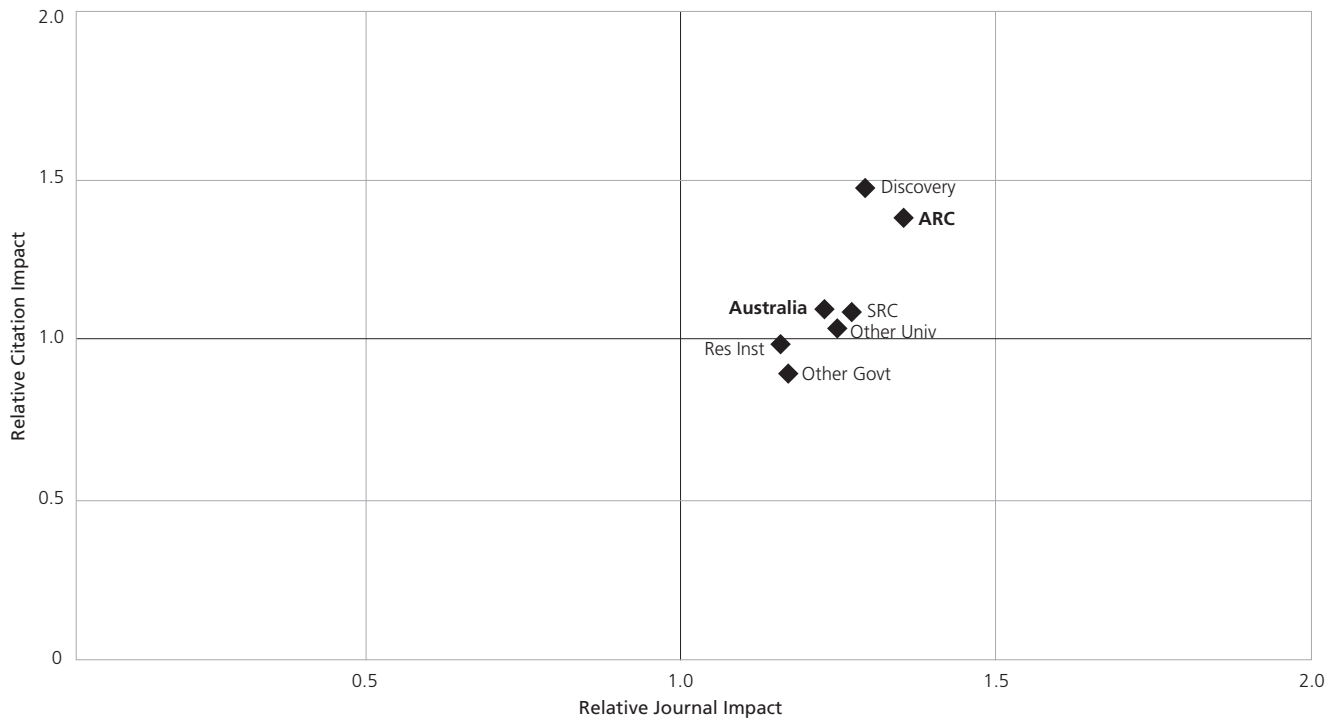
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	320	1818	1.27	1.48
ARC – Special Research Centres	115	637	1.31	1.08
ARC Total	512	2930	1.31	1.36
Other Government	186	676	1.18	0.86
Other University	837	3818	1.27	1.04
Research Institutes	188	819	1.17	0.98
Australia	1729	8250	1.26	1.10

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 48. Centile Distribution of Publications, 2001–2005: Geosciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	7	2.2%	27	8.4%	21	6.6%	53	16.6%	102	31.9%	110	34.4%	320
ARC – Special Res Ctrs		0.0%	12	10.4%	6	5.2%	22	19.1%	38	33.0%	37	32.2%	115
ARC Total	9	1.8%	42	8.2%	31	6.1%	83	16.2%	173	33.8%	174	34.0%	512
Other Government	3	1.6%	6	3.2%	12	6.5%	17	9.1%	57	30.6%	91	48.9%	186
Other University	10	1.2%	41	4.9%	70	8.4%	88	10.5%	286	34.2%	342	40.9%	837
Research Institutes	1	0.5%	8	4.3%	14	7.4%	25	13.3%	61	32.4%	79	42.0%	188
Australia	21	1.2%	97	5.6%	129	7.5%	215	12.4%	580	33.5%	687	39.7%	1729

Figure 25. Relative Citation and Journal Impact: Geosciences



Comments

The output of the sectors and schemes most active in geosciences is appearing in journal outlets with a very similar impact – above the world average, but not as high as for a number of other disciplines. Publications from the Discovery Projects scheme have the highest impact, and this is also borne out in Table 48 where Discovery Projects have double the expected number of publications in the most highly cited clusters for geosciences. In contrast, the Special Research Centres have no publications in the top 1%, which goes some way to explaining their lower overall relative citation impact.

3.21 Subfield: Oceanography

Field: Earth Sciences

WoS journal set analysed: Oceanography.

Table 49. Relative Citation and Journal Impact Rates, 2001–2005: Oceanography

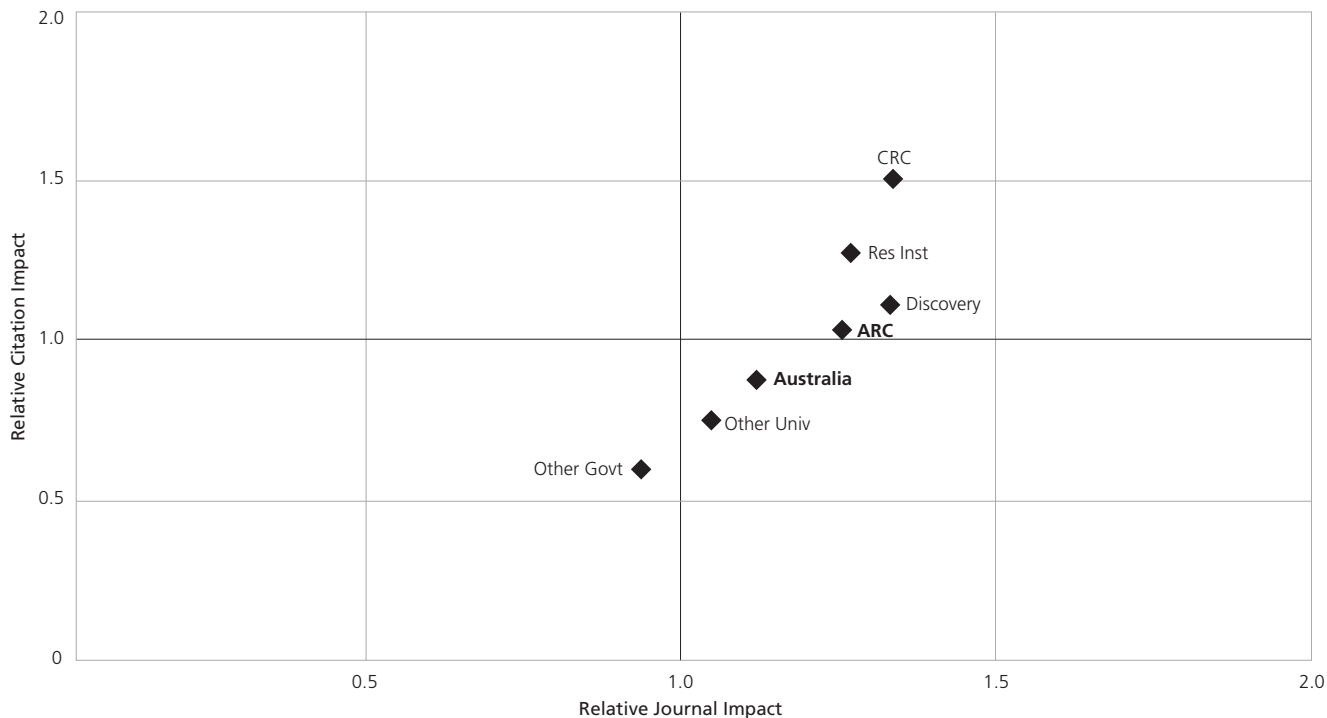
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	150	636	1.33	1.13
ARC Total	207	761	1.23	1.04
Cooperative Res Centres	124	825	1.32	1.50
Other Government	277	640	0.94	0.59
Other University	580	1709	1.05	0.73
Research Institutes	233	1423	1.25	1.27
Australia	1289	4613	1.13	0.88

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 50. Centile Distribution of Publications, 2001–2005: Oceanography

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	2.0%	7	4.7%	10	6.7%	16	10.7%	47	31.3%	67	44.7%	150
ARC Total	3	1.4%	10	4.8%	13	6.3%	22	10.6%	60	29.0%	99	47.8%	207
Cooperative Res Ctrs	4	3.2%	7	5.6%	10	8.1%	24	19.4%	38	30.6%	41	33.1%	124
Other Government	1	0.4%	3	1.1%	7	2.5%	23	8.3%	92	33.2%	151	54.5%	277
Other University	1	0.2%	16	2.8%	26	4.5%	59	10.2%	153	26.4%	325	56.0%	580
Research Institutes	6	2.6%	11	4.7%	19	8.2%	34	14.6%	67	28.8%	96	41.2%	233
Australia	12	0.9%	43	3.3%	67	5.2%	148	11.5%	361	28.0%	658	51.0%	1289

Figure 26. Relative Citation and Journal Impact: Oceanography



Comments

ARC output in this discipline has almost doubled since the last study, and the relative citation impact of that output has also increased more than for any other field or subfield. Over half the output in Oceanography comes from the Other Government and University sectors, and its relative citation impact remains very low; hence the aggregate Australian impact is also below the world benchmark. However, the CRC and Research Institutes sectors perform significantly above this level, and ARC-funded output also has a stronger performance.

3.22 Subfield: Atmospheric Sciences

Field: Earth Sciences

WoS journal set analysed: Meteorology and atmospheric sciences.

Table 51. Relative Citation and Journal Impact Rates, 2001–2005: Atmospheric Sciences

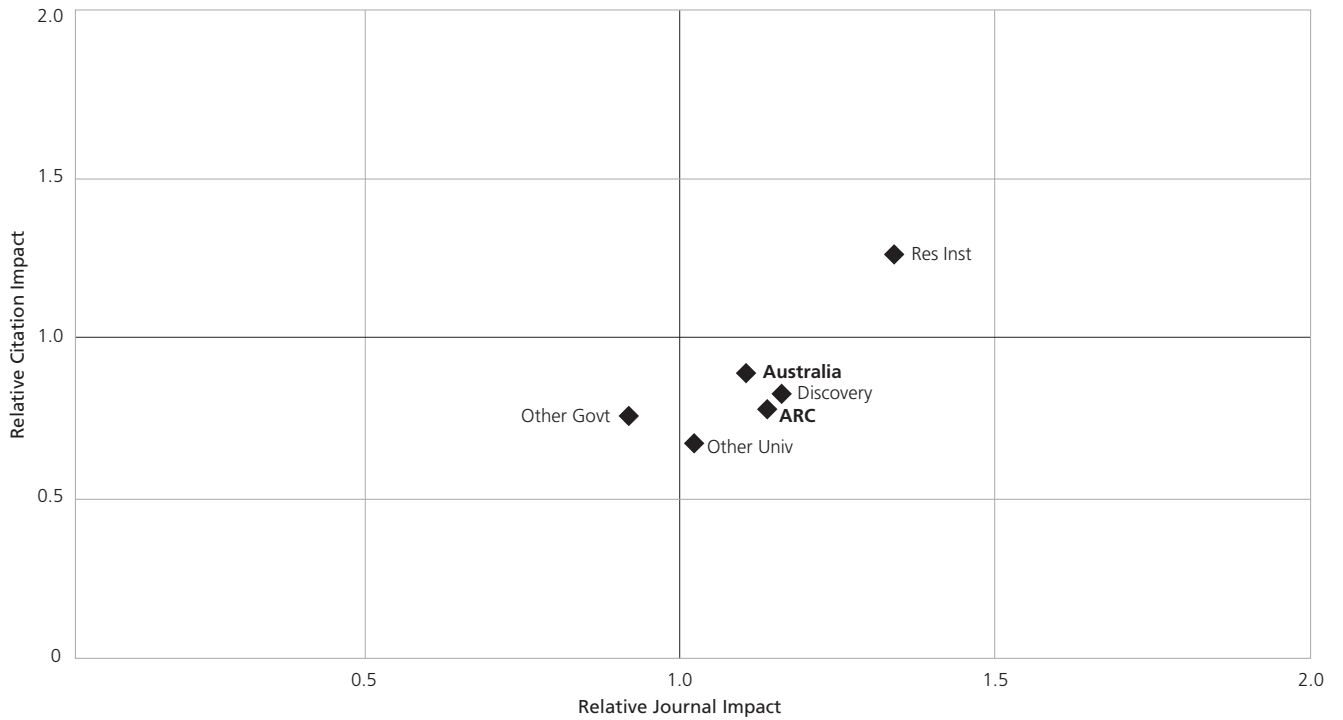
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	151	510	1.19	0.83
ARC Total	208	645	1.16	0.81
Other Government	330	1038	0.92	0.78
Other University	434	1200	1.02	0.68
Research Institutes	311	1736	1.29	1.25
Australia	1266	4684	1.10	0.89

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 52. Centile Distribution of Publications, 2001–2005: Atmospheric Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects		0.0%	4	2.6%	7	4.6%	10	6.6%	49	32.5%	81	53.6%	151
ARC Total	1	0.5%	4	1.9%	12	5.8%	14	6.7%	66	31.7%	111	53.4%	208
Other Government	2	0.6%	9	2.7%	15	4.5%	28	8.5%	83	25.2%	193	58.5%	330
Other University	1	0.2%	13	3.0%	16	3.7%	35	8.1%	105	24.2%	264	60.8%	434
Research Institutes	9	2.9%	19	6.1%	16	5.1%	49	15.8%	108	34.7%	110	35.4%	311
Australia	14	1.1%	44	3.5%	60	4.7%	126	10.0%	370	29.2%	652	51.5%	1266

Figure 27. Relative Citation and Journal Impact: Atmospheric Sciences



Comments

While ARC output in Atmospheric Science journals has increased by 40% since the last study, there has been little movement in citation performance. Its relative citation impact remains 20% below the world benchmarks, even though its publications appear in journals of above-average impact for the discipline. The lack of many high impact publications in the top clusters in Table 52 reinforces this relatively poor performance.

Most of Australia’s high impact research in oceanography journals comes from the Research Institutes sector, specifically CSIRO. Its authors are on 9 of the 14 highly cited Australian publications, and they have overall relative citation and journal impacts above the world benchmark.

3.23 Subfield: Other Earth Sciences

Field: Earth Sciences

WoS journal set analysed: Geography.

Table 53. Relative Citation and Journal Impact Rates, 2001–2005: Other Earth Sciences

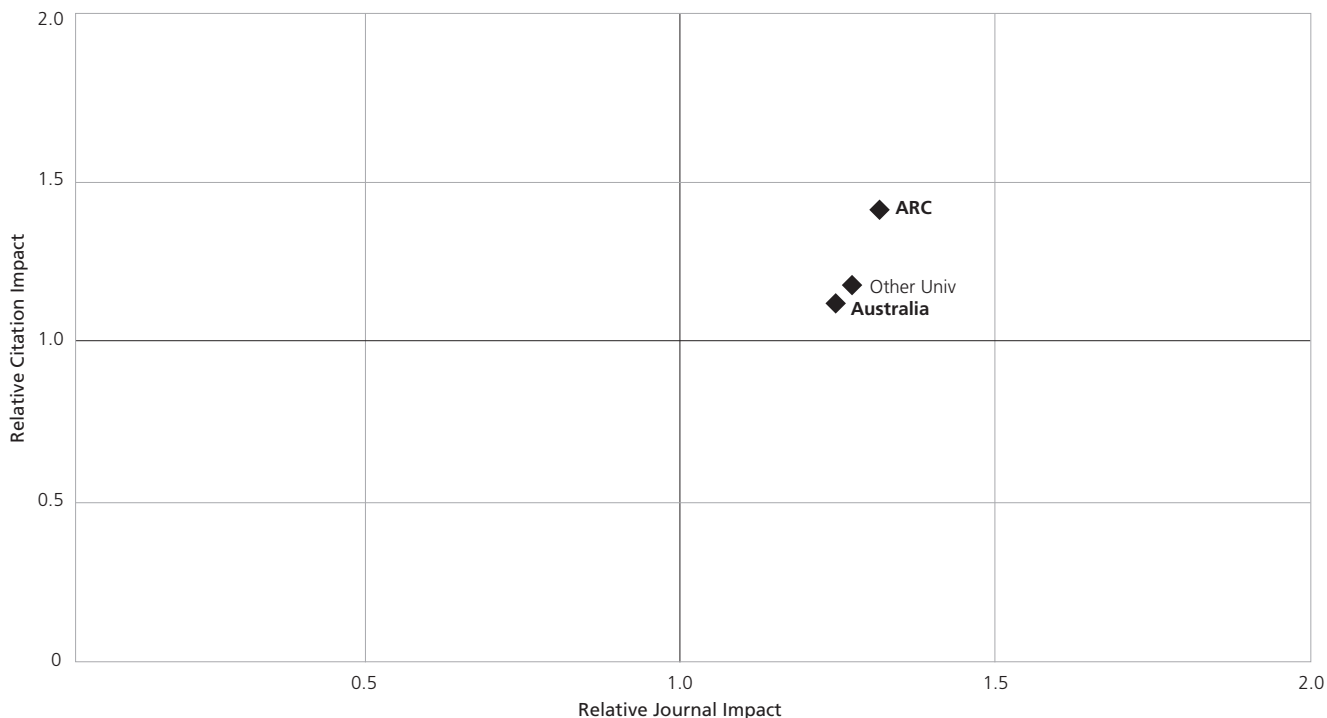
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	120	461	1.28	1.41
Other University	333	1351	1.24	1.18
Australia	591	2200	1.21	1.12

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 54. Centile Distribution of Publications, 2001–2005: Other Earth Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total		0.0%	9	7.5%	10	8.3%	16	13.3%	36	30.0%	49	40.8%	120
Other University	4	1.2%	9	2.7%	20	6.0%	30	9.0%	114	34.2%	156	46.8%	333
Australia	4	0.7%	19	3.2%	36	6.1%	56	9.5%	202	34.2%	274	46.4%	591

Figure 28. Relative Citation and Journal Impact: Other Earth Sciences



Comments

This journal set, based on the WoS subject category Geography, is primarily related to physical geography, rather than human geography, and as such sits within Earth Sciences under the RFCD classification scheme. In our previous studies, there were insufficient publications linked to ARC funding to allow us to analyse this journal set separately. The Other University sector is the only other unit with sufficient publications for analysis.

Publications linked to ARC funding demonstrate high relative citation and journal impact, and sit well above the Australian aggregate performance in terms of citations. All points in Figure 28 demonstrate the placement of articles in journals of similar, relatively high impact.

3.24 Subfield: General Earth Science

Field: Earth Sciences

A number of journals classified by WoS as ‘Geosciences, interdisciplinary’ cannot be allocated to a specific subfield as they have a wide discipline coverage. Examples are the *Australian Journal of Earth Sciences*, *Earth Planets and Space*, and the like. This section separately analyses this set of journals.

Table 55. Relative Citation and Journal Impact Rates, 2001–2005: General Earth Sciences

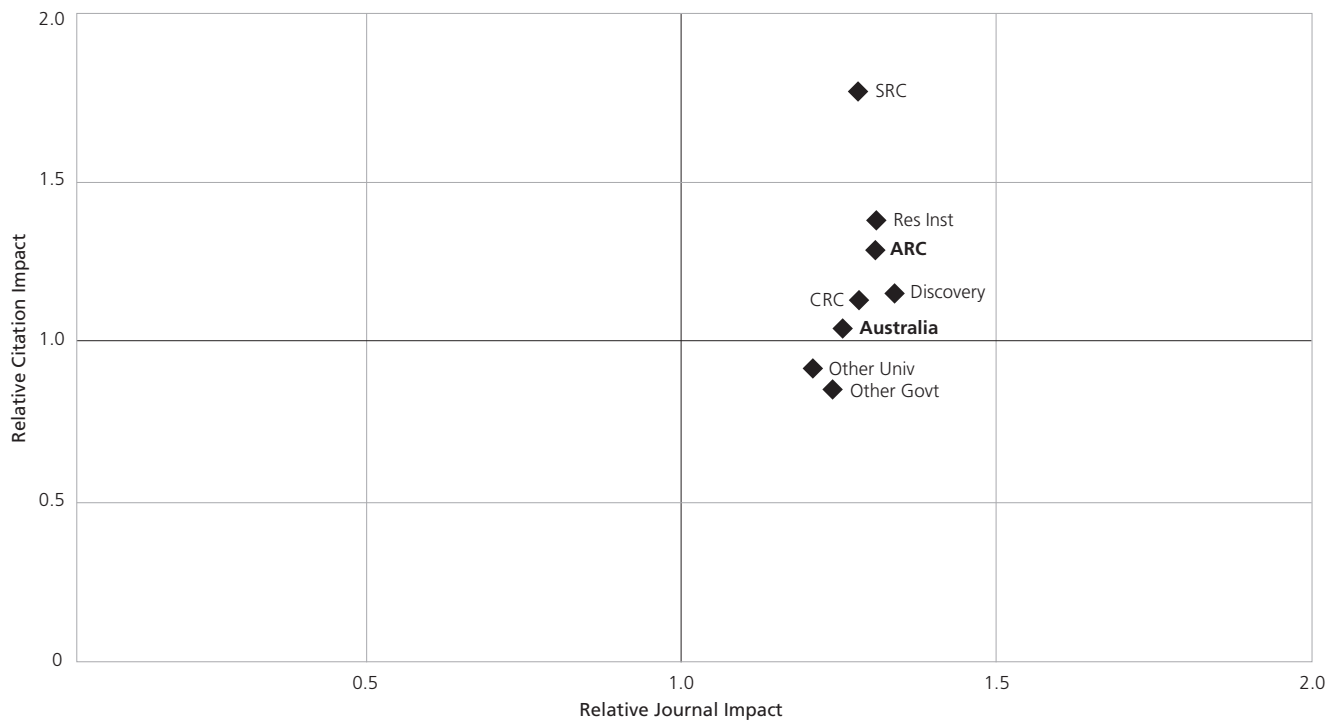
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	363	1287	1.34	1.17
ARC – Special Research Centres	164	983	1.29	1.76
ARC Total	633	2448	1.29	1.28
Cooperative Research Centres	191	786	1.26	1.14
Other Government	310	729	1.24	0.85
Other University	1379	4021	1.19	0.90
Research Institutes	312	1453	1.30	1.38
Australia	2690	8893	1.22	1.04

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 56. Centile Distribution of Publications, 2001–2005: General Earth Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.6%	16	4.4%	19	5.2%	53	14.6%	124	34.2%	149	41.0%	363
ARC – Special Res Ctrs	5	3.0%	12	7.3%	9	5.5%	19	11.6%	51	31.1%	68	41.5%	164
ARC Total	7	1.1%	33	5.2%	34	5.4%	79	12.5%	207	32.7%	273	43.1%	633
Cooperative Res Ctrs	1	0.5%	6	3.1%	16	8.4%	19	9.9%	79	41.4%	70	36.6%	191
Other Government		0.0%	5	1.6%	12	3.9%	24	7.7%	96	31.0%	173	55.8%	310
Other University	15	1.1%	48	3.5%	58	4.2%	116	8.4%	403	29.2%	739	53.6%	1379
Research Institutes	6	1.9%	29	9.3%	20	6.4%	41	13.1%	98	31.4%	118	37.8%	312
Australia	29	1.1%	117	4.3%	132	4.9%	272	10.1%	824	30.6%	1316	48.9%	2690

Figure 29. Relative Citation and Journal Impact: General Earth Sciences



Comments

All sectors and schemes publishing actively in this interdisciplinary journal set have a very similar relative journal impact, but there is a marked difference in relative citation rates. The ARC’s Special Research Centres return a very high relative citation score of 1.76 and, as expected from this result, have a very high presence in the most highly cited clusters of publications. The Research Institute sector also performs very strongly in this journal set, and Australia in aggregate is above world benchmarks.

3.25 Field: Biological Sciences

WoS journal sets analysed: journals from all subject categories used for the subfield analyses in sections 3.26 to 3.33.

Table 57. Relative Citation and Journal Impact Rates, 2001–2005: Biological Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	367	2260	1.34	1.26
ARC – Australian Professorial Fellowships	437	2510	1.38	1.06
ARC – Australian Research Fellowships	312	2384	1.54	1.13
ARC – Discovery Projects	2326	16785	1.31	1.04
ARC – Federation Fellowships	116	204	1.42	1.04
ARC – Linkage Projects	361	1359	0.89	0.73
ARC – QEII Fellowships	173	1238	1.55	1.10
ARC – Special Research Centres	326	2949	1.56	1.45
ARC Total	3663	24434	1.33	1.04
Cooperative Res Centres	1029	5899	0.89	0.79
Other Government	2117	7395	0.66	0.50
Other Hospital	1260	10054	1.40	1.09
Other University	9983	55288	1.08	0.78
Research Institutes	4237	38940	1.47	1.27
Australia	20407	130967	1.17	0.92

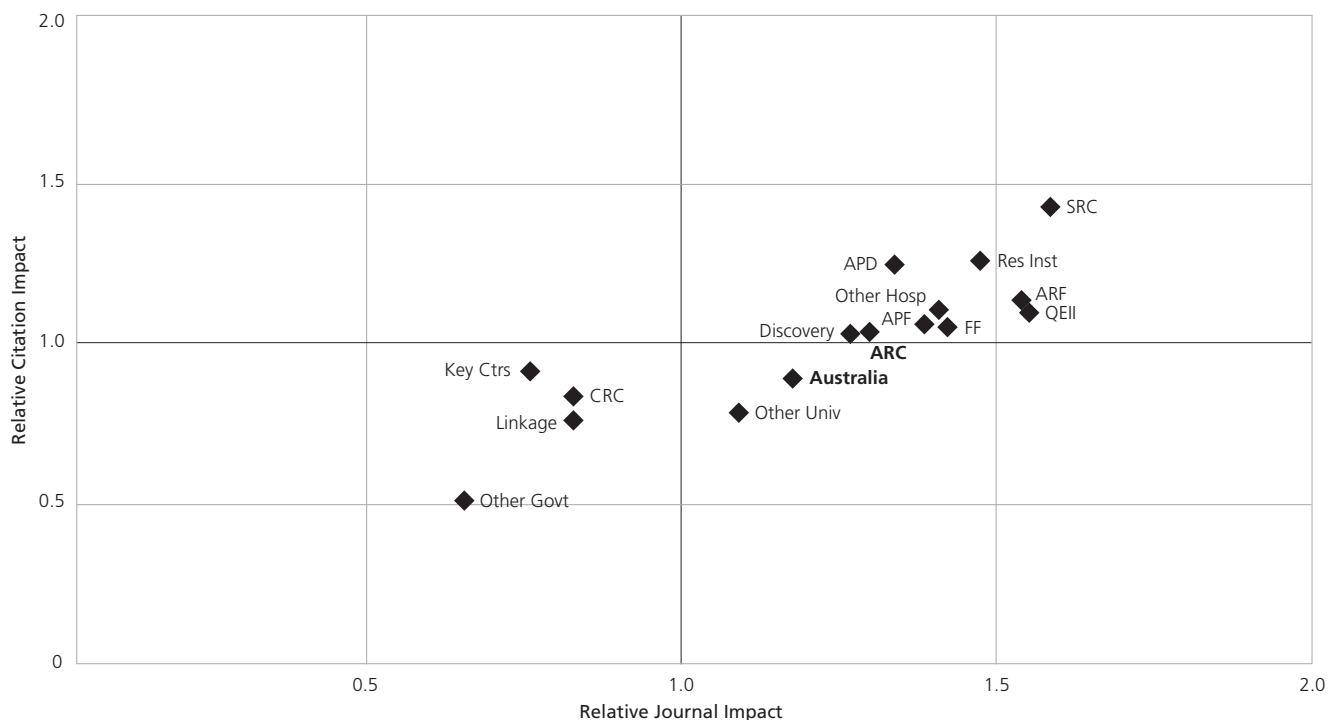
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 58. Centile Distribution of Publications, 2001–2005: Biological Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	5	1.4%	32	8.7%	35	9.6%	66	18.0%	118	32.2%	110	30.1%	366
ARC – Aust Prof Fellows	5	1.1%	29	6.7%	42	9.6%	61	14.0%	146	33.5%	153	35.1%	436
ARC – Aust Res Fellows	2	0.6%	24	7.7%	30	9.6%	38	12.2%	114	36.5%	104	33.3%	312
ARC – Discovery Projects	33	1.4%	167	7.2%	212	9.1%	355	15.3%	768	33.0%	790	34.0%	2325
ARC – Federation Fellows	6	5.2%	9	7.8%	4	3.4%	22	19.0%	34	29.3%	41	35.3%	116
ARC – Linkage Projects	5	1.4%	17	4.7%	28	7.8%	50	13.9%	124	34.3%	137	38.0%	361
ARC – QEII Fellows	3	1.7%	22	12.8%	16	9.3%	25	14.5%	56	32.6%	50	29.1%	172
ARC – Special Res Ctrs	10	3.1%	24	7.4%	21	6.4%	42	12.9%	121	37.1%	108	33.1%	326
ARC Total	52	1.4%	248	6.8%	308	8.4%	539	14.7%	1230	33.6%	1284	35.1%	3661
Cooperative Res Ctrs	17	1.7%	53	5.2%	65	6.3%	132	12.8%	345	33.5%	417	40.5%	1029
Other Government	15	0.7%	87	4.1%	94	4.4%	178	8.4%	585	27.6%	1157	54.7%	2116
Other Hospital	12	1.0%	51	4.0%	50	4.0%	118	9.4%	390	31.0%	639	50.7%	1260
Other University	73	0.7%	410	4.1%	518	5.2%	1005	10.1%	3150	31.6%	4823	48.3%	9979
Research Institutes	65	1.5%	246	5.8%	298	7.0%	534	12.6%	1349	31.8%	1744	41.2%	4236
Australia	213	1.0%	1017	5.0%	1237	6.1%	2326	11.4%	6429	31.5%	9178	45.0%	20400

Note: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 30. Relative Citation and Journal Impact: Biological Sciences



Comments

Biological sciences is the second field in which the citation rates of its constituent subfields vary significantly (see Table 4). While the field citations per publication rate is 6.42, subfield rates vary from 2.85 (zoology) to 8.96 (genetics). The distribution of publications across the subfields varies markedly from the norm for a number of sectors analysed in this study, and for this reason care should be taking in interpreting the relative performance of sectors in biological sciences as a whole. The sectors and schemes which have relatively low activity in the high impact subfields are: Key Centres, Linkage Projects, CRCs and Other Government.

As expected from their focus on the low impact subfields of biological sciences, the Key Centres, Linkage Projects, CRCs and the Other Government sector all appear to have a relatively low performance in the field of biological sciences as a whole. This is misleading due to their disciplinary focus, and their performance at the subfield level provides a more reliable guide.

Special Research Centres are the outliers in terms of high performance, with relative citation and journal impact both well above world benchmarks. The ARC aggregate result is composed of both high and low performers – the latter primarily explained in the preceding paragraph – and as a result rests very close to world benchmarks. Even at this higher level of aggregation it is necessary to drill down to subdisciplines to gain an accurate assessment of research performance in this disparate field.

3.26 Subfield: Biochemistry and Cell Biology

Field: Biological Sciences

WoS journal sets analysed: Biochemistry and molecular biology; Cell biology.

Table 59. Relative Citation and Journal Impact Rates, 2001–2005: Biochemistry and Cell Biology

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	119	857	1.26	1.14
ARC – Australian Professorial Fellowships	195	1616	1.34	0.99
ARC – Australian Research Fellowships	166	1372	1.39	0.98
ARC – Discovery Projects	834	7267	1.26	0.96
ARC – Special Research Centres	126	1531	1.62	1.66
ARC Total	1364	11149	1.30	1.00
Cooperative Research Centres	225	2292	0.97	1.04
Other Government	204	1256	0.82	0.64
Other Hospital	591	4262	1.01	0.75
Other University	3467	25610	1.05	0.81
Research Institutes	2019	24017	1.38	1.29
Australia	7351	64256	1.17	0.97

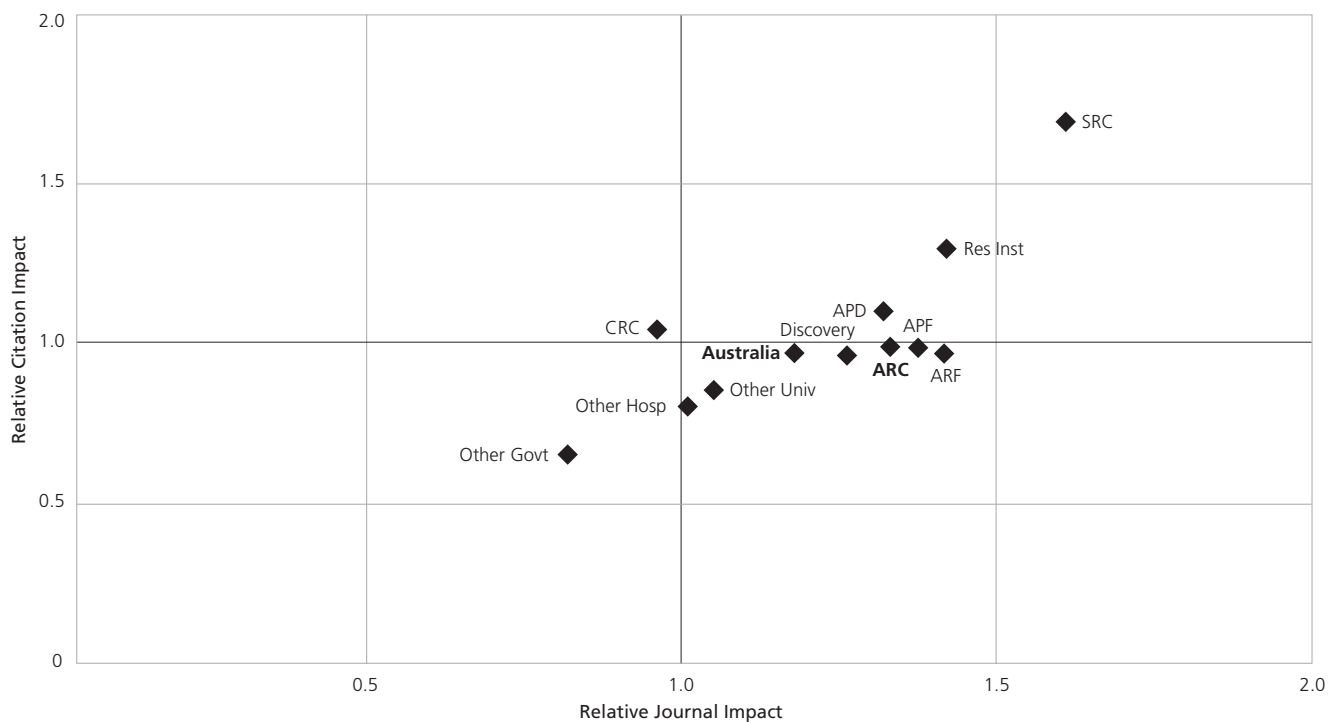
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 60. Centile Distribution of Publications, 2001–2005: Biochemistry and Cell Biology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows		0.0%	8	6.7%	14	11.8%	15	12.6%	45	37.8%	37	31.1%	119
ARC – Aust Prof Fellows	1	0.5%	12	6.2%	18	9.2%	25	12.8%	66	33.8%	73	37.4%	195
ARC – Aust Res Fellows	1	0.6%	15	9.0%	16	9.6%	13	7.8%	61	36.7%	60	36.1%	166
ARC – Discovery Projects	11	1.3%	48	5.8%	61	7.3%	114	13.7%	281	33.7%	319	38.2%	834
ARC – Special Res Ctrs	6	4.8%	12	9.5%	9	7.1%	15	11.9%	39	31.0%	45	35.7%	126
ARC Total	15	1.1%	80	5.9%	104	7.6%	183	13.4%	457	33.5%	525	38.5%	1364
Cooperative Res Ctrs	7	3.1%	7	3.1%	13	5.8%	26	11.6%	70	31.1%	102	45.3%	225
Other Government		0.0%	15	7.4%	16	7.8%	17	8.3%	64	31.4%	92	45.1%	204
Other Hospital	2	0.3%	19	3.2%	22	3.7%	48	8.1%	188	31.8%	312	52.8%	591
Other University	19	0.5%	132	3.8%	201	5.8%	326	9.4%	1105	31.9%	1683	48.6%	3466
Research Institutes	29	1.4%	122	6.0%	137	6.8%	264	13.1%	648	32.1%	819	40.6%	2019
Australia	68	0.9%	354	4.8%	463	6.3%	814	11.1%	2356	32.1%	3295	44.8%	7350

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 31. Relative Citation and Journal Impact: Biochemistry and Cell Biology



Comments

For the whole period covered by the REPP database (1981–2000), Australia’s performance in this subfield of the biological sciences has been below the world average, but in this recent 5-year period (2001–2005) it has climbed to near parity with world benchmarks. The ARC aggregate performance is slightly above the Australian level, although in higher impact journals. Most ARC schemes hover around the ARC aggregate performance, with the Special Research Centres being the outlier. The output from this scheme is appearing in very high impact journals and achieving a very high relative citation impact of 1.66. It is also the scheme excelling in the most highly cited band of publications, with nearly 5% of its output in the top 1% cluster, and close to 10% in the 2–5% cluster. Australian Professorial Fellowships and Australian Research Fellowships have few of the highest cited articles, but a strong presence in the 2–5% cluster.

3.27 Subfield: Genetics

Field: Biological Sciences

WoS journal set analysed: Genetics and heredity.

Table 61. Relative Citation and Journal Impact Rates, 2001–2005: Genetics

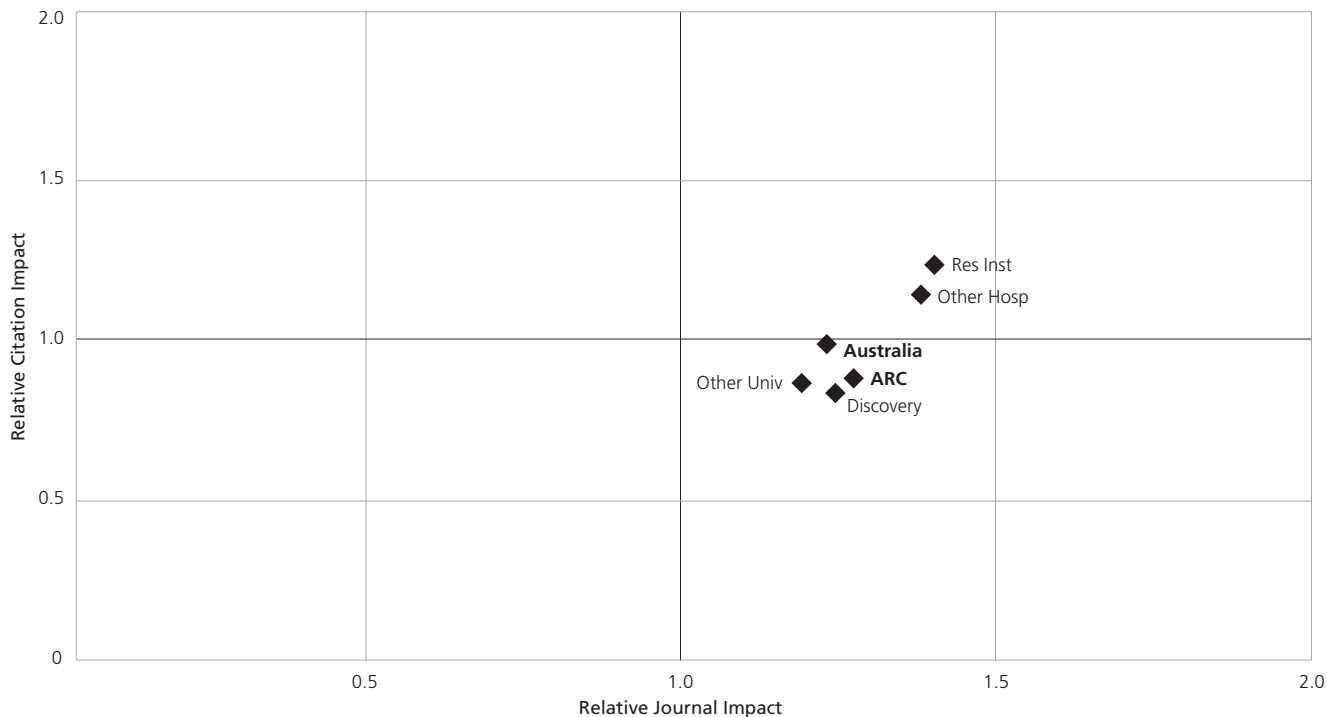
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	234	1883	1.21	0.83
ARC Total	382	2991	1.24	0.88
Other Hospital	362	4005	1.33	1.13
Other University	927	7407	1.14	0.88
Research Institutes	627	6954	1.36	1.23
Australia	2195	19661	1.21	0.98

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 62. Centile Distribution of Publications, 2001–2005: Genetics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	4	1.7%	11	4.7%	14	6.0%	41	17.5%	86	36.8%	78	33.3%	234
ARC Total	7	1.8%	17	4.5%	24	6.3%	60	15.7%	138	36.1%	136	35.6%	382
Other Hospital	3	0.8%	25	6.9%	24	6.6%	39	10.8%	92	25.4%	179	49.4%	362
Other University	7	0.8%	50	5.4%	62	6.7%	99	10.7%	270	29.1%	439	47.4%	927
Research Institutes	13	2.1%	32	5.1%	43	6.9%	82	13.1%	180	28.7%	277	44.2%	627
Australia	30	1.4%	119	5.4%	141	6.4%	274	12.5%	662	30.2%	969	44.1%	2195

Figure 32. Relative Citation and Journal Impact: Genetics



Comments

Genetics is one of only a small number of subfields in which the ARC’s citation performance falls significantly below world benchmark levels. This is despite that output appearing in relatively high impact journals. This aggregate performance rests primarily on the output from the Discovery Projects that appears in genetics journals.

A large proportion of genetics research is undertaken in hospitals and universities, often with the support of NHMRC, and ARC-supported research in this discipline may have a focus on areas not as highly cited as those related to human genetics research. It would be necessary to delve more deeply into the detailed focus of ARC research to determine if this contributed in any significant way to the relative ARC performance.

3.28 Subfield: Microbiology

Field: Biological Sciences

WoS journal set analysed: Microbiology.

Table 63. Relative Citation and Journal Impact Rates, 2001–2005: Microbiology

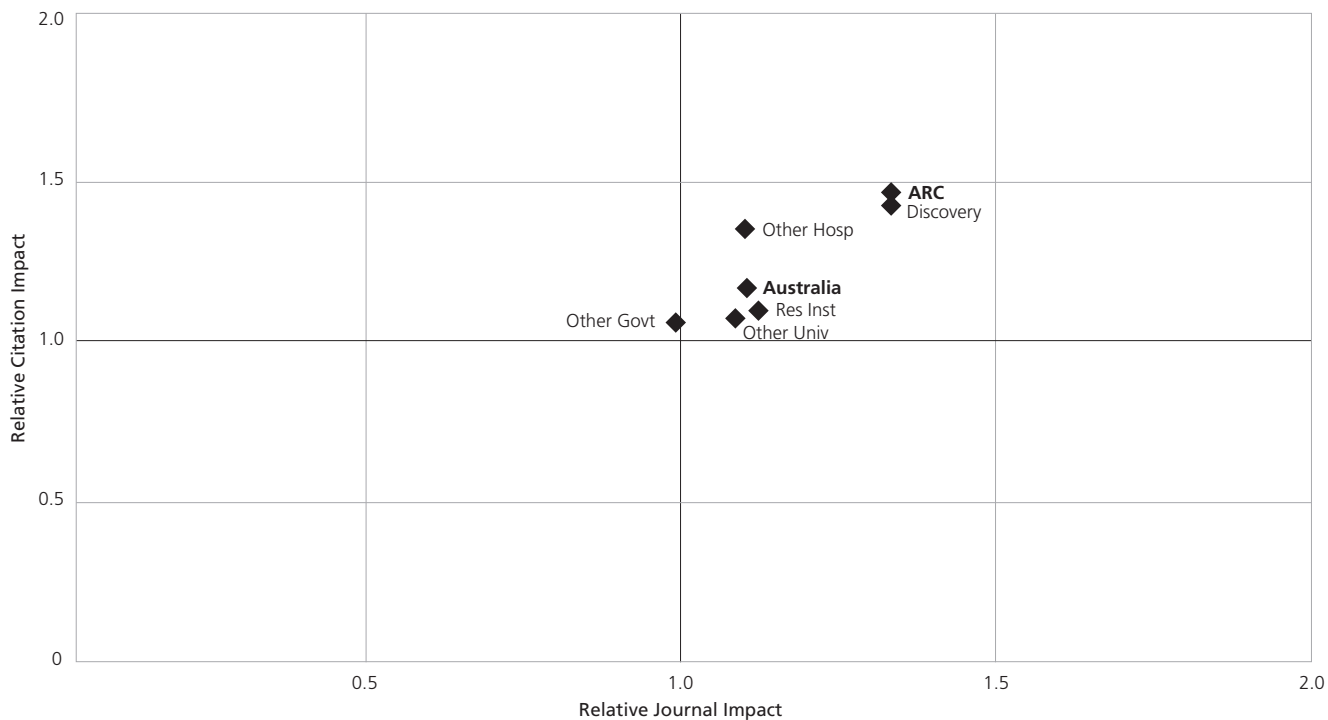
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	154	1469	1.25	1.44
ARC Total	241	2174	1.24	1.47
Other Government	198	1256	0.99	1.05
Other Hospital	288	2351	1.09	1.36
Other University	1026	6711	1.06	1.09
Research Institutes	314	2111	1.11	1.11
Australia	1871	13252	1.08	1.16

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 64. Centile Distribution of Publications, 2001–2005: Microbiology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	1.9%	8	5.2%	14	9.1%	21	13.6%	49	31.8%	59	38.3%	154
ARC Total	4	1.7%	13	5.4%	23	9.5%	35	14.5%	77	32.0%	89	36.9%	241
Other Government	4	2.0%	10	5.1%	8	4.0%	26	13.1%	50	25.3%	100	50.5%	198
Other Hospital	6	2.1%	12	4.2%	7	2.4%	29	10.1%	105	36.5%	129	44.8%	288
Other University	10	1.0%	36	3.5%	41	4.0%	105	10.2%	328	32.0%	506	49.3%	1026
Research Institutes	2	0.6%	9	2.9%	23	7.3%	35	11.1%	106	33.8%	139	44.3%	314
Australia	20	1.1%	71	3.8%	101	5.4%	216	11.5%	594	31.7%	869	46.4%	1871

Figure 33. Relative Citation and Journal Impact: Microbiology



Comments

In contrast to the previous two high impact subfields of biological sciences that were previously analysed, ARC performance in microbiology journals is very strong, though it accounts for an even smaller proportion of total Australian output than those two disciplines. As in many disciplines, the bulk of output comes from the Discovery Projects scheme, and in this case that scheme’s performance almost mirrors that of the ARC in aggregate.

Most remaining sectors, and Australia as a whole, are clustered together slightly above the world average; the Other Hospital sector performs almost as strongly as the ARC, though in journals of lower average impact.

3.29 Subfield: Botany

Field: Biological Sciences

WoS journal set analysed: Plant sciences.

Table 65. Relative Citation and Journal Impact Rates, 2001–2005: Botany

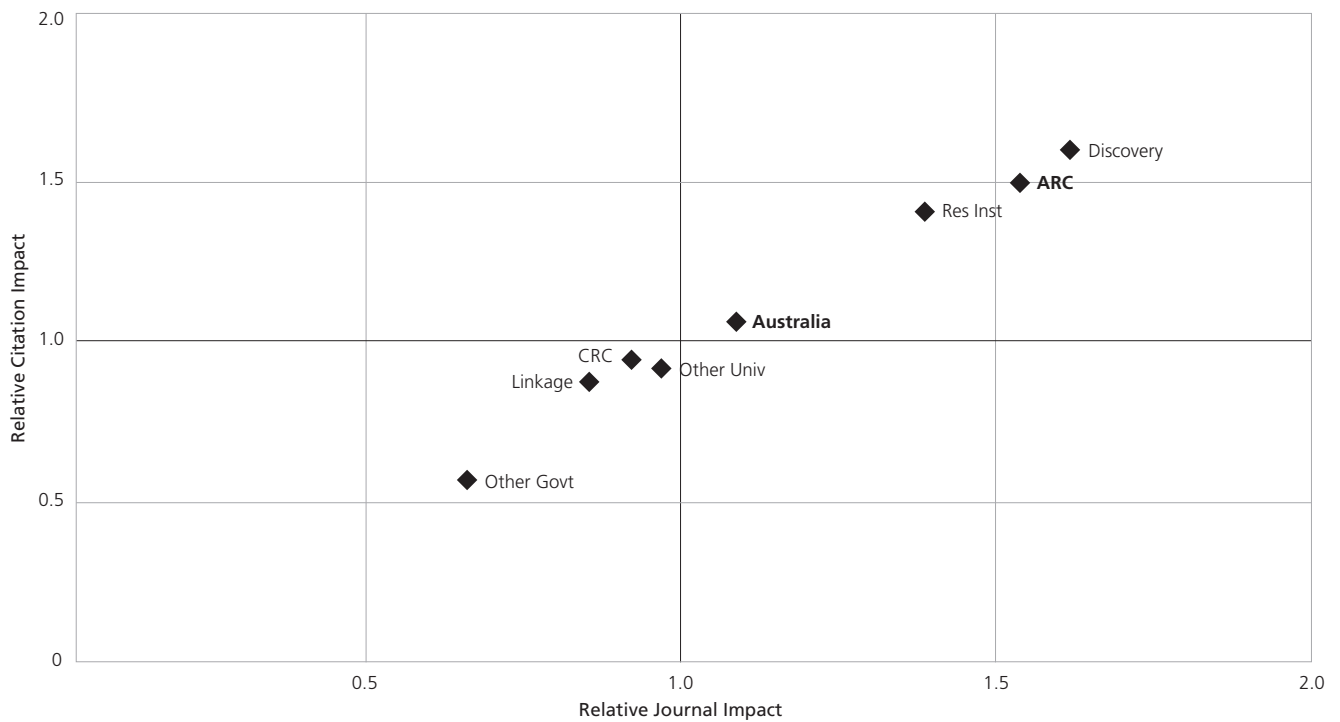
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	392	2928	1.63	1.58
ARC – Linkage Projects	104	303	0.85	0.87
ARC Total	557	3629	1.54	1.50
Cooperative Research Centres	300	1374	0.92	0.94
Other Government	471	1189	0.65	0.57
Other University	1492	6519	0.97	0.91
Research Institutes	681	4639	1.36	1.39
Australia	3218	16274	1.11	1.07

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 66. Centile Distribution of Publications, 2001–2005: Botany

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	10	2.6%	34	8.7%	44	11.2%	80	20.4%	121	30.9%	103	26.3%	392
ARC – Linkage Projects	1	1.0%	3	2.9%	8	7.7%	13	12.5%	35	33.7%	44	42.3%	104
ARC Total	14	2.5%	43	7.7%	58	10.4%	101	18.1%	172	30.9%	169	30.3%	557
Cooperative Res Ctrs	2	0.7%	10	3.3%	14	4.7%	43	14.3%	107	35.7%	124	41.3%	300
Other Government	1	0.2%	9	1.9%	13	2.8%	36	7.6%	121	25.7%	291	61.8%	471
Other University	7	0.5%	59	4.0%	75	5.0%	151	10.1%	444	29.8%	756	50.7%	1492
Research Institutes	8	1.2%	58	8.5%	54	7.9%	102	15.0%	203	29.8%	256	37.6%	681
Australia	31	1.0%	167	5.2%	201	6.2%	408	12.7%	945	29.4%	1466	45.6%	3218

Figure 34. Relative Citation and Journal Impact: Botany



Comments

In the subfield of botany, Australia’s overall performance is close to the world benchmark, but two units stand out: the Research Institutes (primarily CSIRO), and Discovery Project Grants. Both publish in high impact journals and have very high relative citation impact. The citation impact of the CRC and Linkage Projects – just below the world benchmark – is primarily caused by the placement of their output in low impact journals. This is probably due to a focus on applied research which, as mentioned previously, tends to have lower rates of citations (both individual articles, and journals).

Only 30% of ARC publications fall below the field median, and it has a very strong presence in the most highly cited publication clusters.

3.30 Subfield: Zoology

Field: Biological Sciences

WoS journal sets analysed: Entomology; Ornithology; Zoology.

Table 67. Relative Citation and Journal Impact Rates, 2001–2005: Zoology

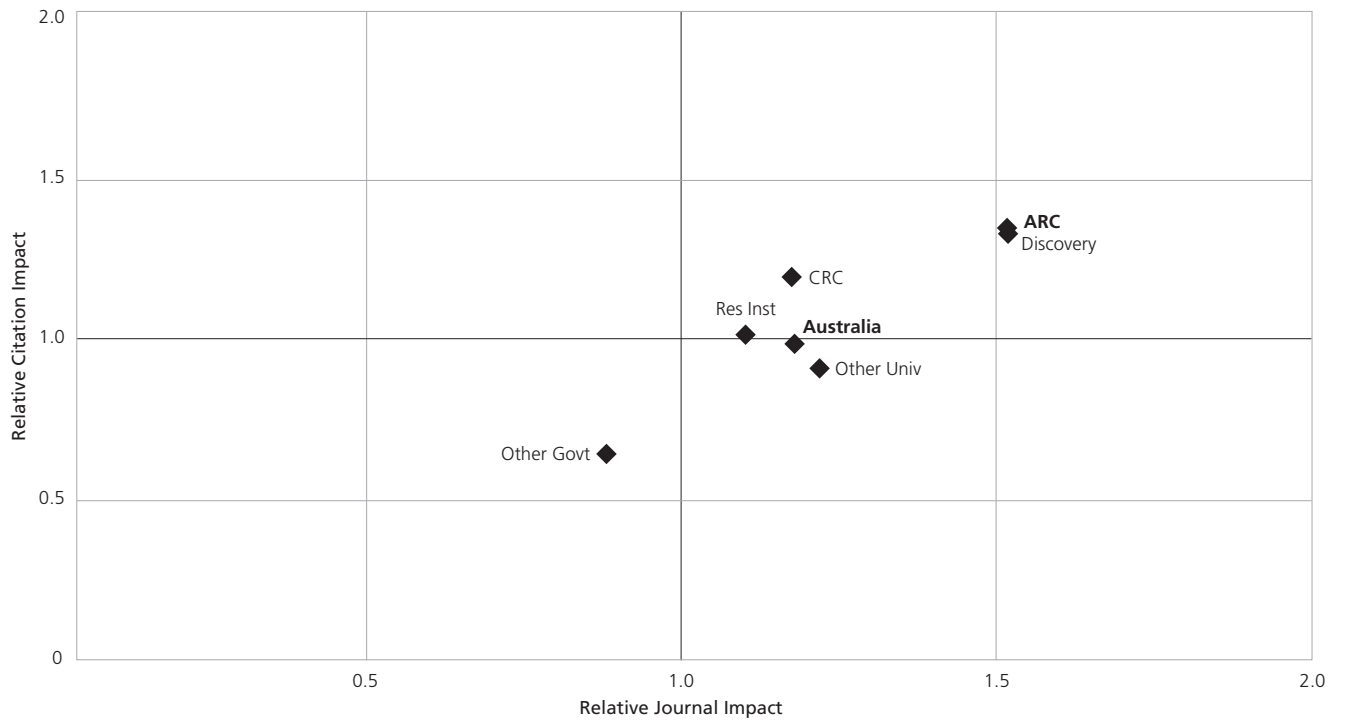
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	407	1467	1.52	1.37
ARC Total	605	2105	1.52	1.38
Cooperative Res Centres	223	711	1.20	1.20
Other Government	762	1425	0.85	0.66
Other University	1924	5401	1.24	0.94
Research Institutes	453	1371	1.11	1.02
Australia	3632	10351	1.19	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 68. Centile Distribution of Publications, 2001–2005: Zoology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.5%	38	9.3%	42	10.3%	66	16.2%	130	31.9%	129	31.7%	407
ARC Total	5	0.8%	55	9.1%	53	8.8%	90	14.9%	203	33.6%	199	32.9%	605
Cooperative Res Ctrs	3	1.3%	20	9.0%	15	6.7%	21	9.4%	73	32.7%	91	40.8%	223
Other Government	2	0.3%	25	3.3%	22	2.9%	53	7.0%	225	29.5%	435	57.1%	762
Other University	15	0.8%	84	4.4%	92	4.8%	195	10.1%	624	32.4%	914	47.5%	1924
Research Institutes	5	1.1%	28	6.2%	25	5.5%	42	9.3%	133	29.4%	220	48.6%	453
Australia	29	0.8%	197	5.4%	194	5.3%	370	10.2%	1153	31.7%	1689	46.5%	3632

Figure 35. Relative Citation and Journal Impact: Zoology



Comments

The ARC performance, primarily driven by the Discovery Projects scheme, demonstrates strong relative citation performance. Given the high impact journals in which its output appears, it would perhaps have been even stronger if it had had a higher presence in the top 1% cluster of publications for the discipline. However, it did have a stronger presence in the second 2–5% band, and less than one-third of its output below the median, therefore still registering a high relative citation impact of 1.38.

3.31 Subfield: Ecology and Evolution

Field: Biological Sciences

WoS journal set analysed: Ecology.

Table 69. Relative Citation and Journal Impact Rates, 2001–2005: Ecology and Evolution

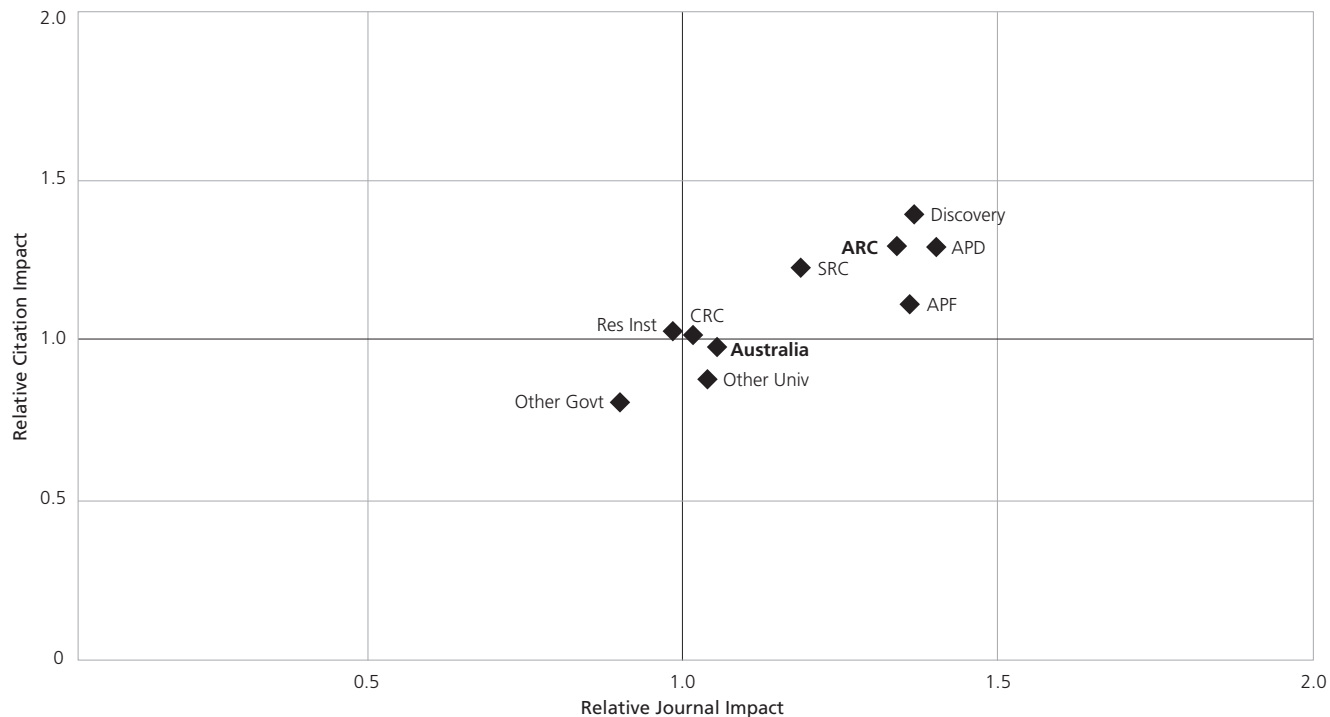
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	117	493	1.39	1.31
ARC – Australian Professorial Fellowships	122	427	1.34	1.16
ARC – Discovery Projects	593	3817	1.35	1.40
ARC – Special Res Centres	109	673	1.14	1.25
ARC Total	930	5381	1.31	1.32
Cooperative Research Centres	257	1266	1.02	1.02
Other Government	704	2821	0.86	0.80
Other University	1746	7526	1.04	0.87
Research Institutes	505	2687	0.99	1.04
Australia	3756	17977	1.07	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 70. Centile Distribution of Publications, 2001–2005: Ecology and Evolution

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	2	1.7%	11	9.4%	15	12.8%	24	20.5%	37	31.6%	28	23.9%	117
ARC – Aust Prof Fellows	3	2.5%	10	8.2%	15	12.3%	16	13.1%	43	35.2%	35	28.7%	122
ARC – Discovery Projects	11	1.9%	71	12.0%	79	13.3%	99	16.7%	192	32.4%	141	23.8%	593
ARC – Special Res Ctrs	1	0.9%	7	6.4%	6	5.5%	16	14.7%	44	40.4%	35	32.1%	109
ARC Total	19	2.0%	96	10.3%	106	11.4%	150	16.1%	316	34.0%	243	26.1%	930
Cooperative Res Ctrs	6	2.3%	14	5.4%	26	10.1%	39	15.2%	92	35.8%	80	31.1%	257
Other Government	7	1.0%	37	5.3%	48	6.8%	60	8.5%	220	31.3%	332	47.2%	704
Other University	18	1.0%	93	5.3%	139	8.0%	223	12.8%	580	33.2%	693	39.7%	1746
Research Institutes	8	1.6%	31	6.1%	52	10.3%	76	15.0%	170	33.7%	168	33.3%	505
Australia	52	1.4%	251	6.7%	334	8.9%	509	13.6%	1233	32.8%	1377	36.7%	3756

Figure 36. Relative Citation and Journal Impact: Ecology and Evolution



Comments

The ARC has a stronger presence in this subfield of biological sciences, with nearly one-quarter of Australian journal publications linked to research it supports. All ARC schemes have high citation impact and publish in high impact journals relative to the average for ecology and evolution. The ARC has a significant presence in the most highly cited clusters of publications, and only one-quarter of its output falls below the median citation level for the discipline.

3.32 Subfield: Biotechnology

Field: Biological Sciences

WoS journal sets analysed: Biotechnology and applied microbiology; Biochemical research methods.

Table 71. Relative Citation and Journal Impact Rates, 2001–2005: Biotechnology

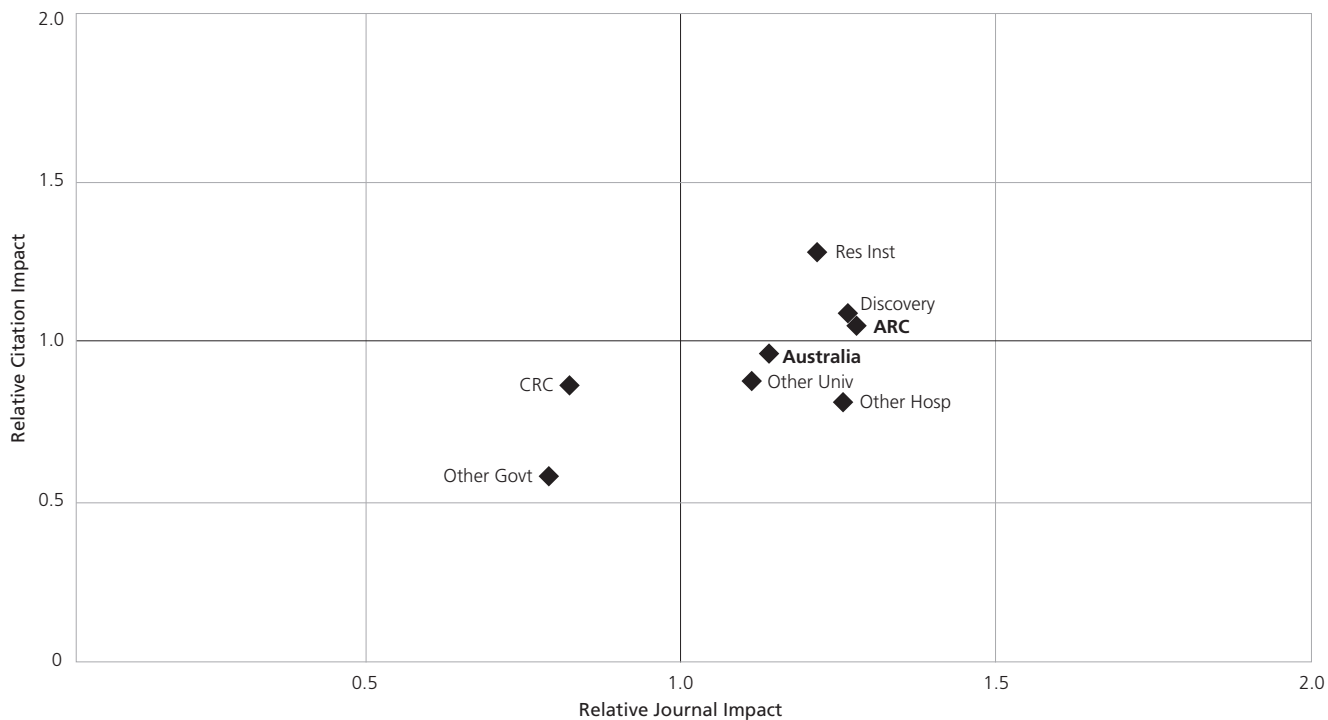
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	201	1231	1.28	1.07
ARC Total	379	2031	1.29	1.05
Cooperative Research Centres	141	849	0.83	0.88
Other Government	147	466	0.81	0.58
Other Hospital	167	844	1.27	0.82
Other University	1179	6116	1.12	0.90
Research Institutes	503	3885	1.23	1.26
Australia	2360	13449	1.15	0.98

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 72. Centile Distribution of Publications, 2001–2005: Biotechnology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	1.0%	5	2.5%	17	8.5%	27	13.4%	70	34.8%	80	39.8%	201
ARC Total	3	0.8%	14	3.7%	22	5.8%	46	12.1%	136	35.9%	158	41.7%	379
Cooperative Res Ctrs	1	0.7%	3	2.1%	3	2.1%	17	12.1%	52	36.9%	65	46.1%	141
Other Government		0.0%	2	1.4%	2	1.4%	13	8.8%	33	22.4%	97	66.0%	147
Other Hospital		0.0%	3	1.8%	3	1.8%	16	9.6%	45	26.9%	100	59.9%	167
Other University	5	0.4%	42	3.6%	50	4.2%	115	9.8%	342	29.0%	625	53.0%	1179
Research Institutes	8	1.6%	23	4.6%	25	5.0%	49	9.7%	157	31.2%	241	47.9%	503
Australia	16	0.7%	86	3.6%	106	4.5%	246	10.4%	714	30.3%	1192	50.5%	2360

Figure 37. Relative Citation and Journal Impact: Biotechnology



Comments

The ARC has a relatively modest presence in this subfield, with just 16% of the total Australian output in the subfield journal set. The highest impact sector is the Research Institutes, which primarily consists of medical research institutes. Though this sector is only responsible for 21% of Australian output, half the highest impact publications come from its constituent organisations. The ARC output is achieving only just above the world citation impact, even though its publications are appearing in relatively high impact journals.

3.33 Subfield: General Biological Sciences

Field: Biological Sciences

A number of journals, classified by WoS to its subject category, 'Biology', cannot be allocated to a specific subfield as they have a wide discipline coverage. Examples are the *Biological Reviews*, *FASEB Journal*, *Life Sciences*, and the like. This section separately analyses this set of journals.

Table 73. Relative Citation and Journal Impact Rates, 2001–2005: General Biological Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	246	2270	1.64	1.63
ARC Total	354	2853	1.64	1.57
Other Government	139	762	1.21	1.04
Other University	872	4739	1.35	0.99
Research Institutes	254	2174	1.85	1.55
Australia	1615	10459	1.47	1.19

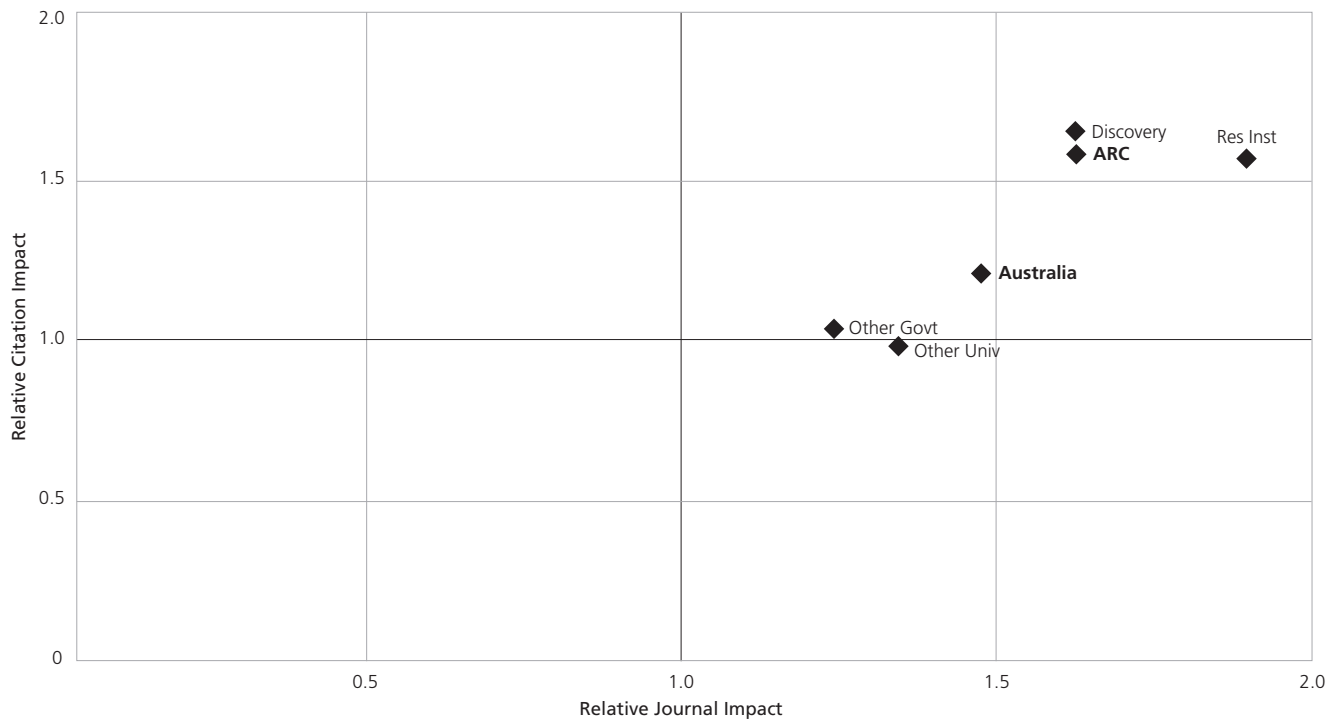
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 74. Centile Distribution of Publications, 2001–2005: General Biological Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	1.2%	8	3.3%	17	6.9%	41	16.7%	81	33.1%	95	38.8%	245
ARC Total	4	1.1%	14	4.0%	26	7.4%	58	16.5%	116	33.0%	134	38.1%	352
Other Government	1	0.7%	11	8.0%	8	5.8%	12	8.7%	35	25.4%	71	51.4%	138
Other University	5	0.6%	32	3.7%	36	4.1%	86	9.9%	297	34.2%	413	47.5%	869
Research Institutes	3	1.2%	21	8.3%	18	7.1%	30	11.9%	80	31.6%	101	39.9%	253
Australia	13	0.8%	77	4.8%	86	5.3%	189	11.7%	529	32.9%	715	44.4%	1609

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 38. Relative Citation and Journal Impact: General Biological Sciences



Comments

The ARC, primarily due to output from the Discovery Projects scheme, achieves a very high relative citation impact in these general biological journals, at a similar level to the Research Institutes sector. Their impact is well above the Australian citation impact, which in turn is above the world benchmark. The high performing sectors are also publishing in very high impact journals. While they do not have a particularly high presence in the top 1% cluster of publications, they have a relatively low proportion of their output below the median for this set of journals.

3.34 Field: Information, Computing and Communication Sciences

WoS journal sets analysed: Computer science, cybernetics; Computer science, information systems; Computer science, artificial intelligence; Computer science, software, graphics, programming; Computer science, theory and methods; Computer science, interdisciplinary applications.

Table 75. Relative Citation and Journal Impact Rates, 2001–2005: Information, Computing and Communication Sciences

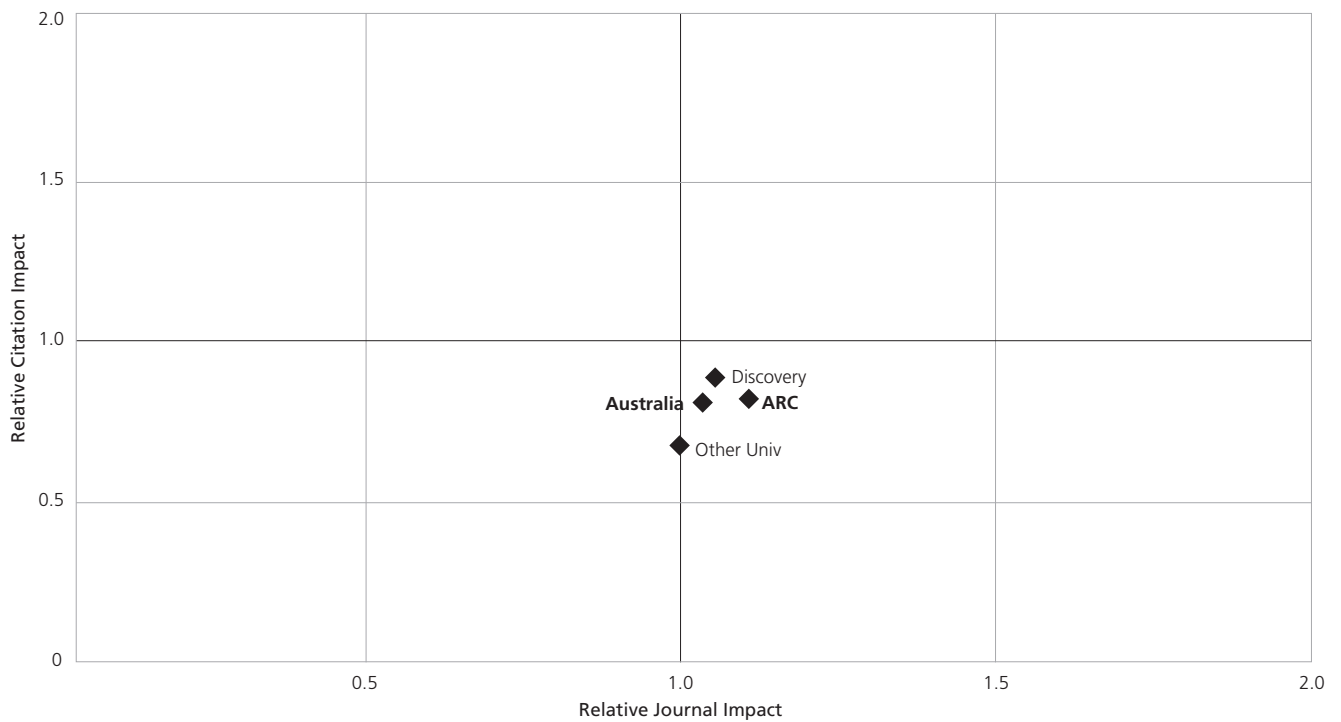
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	215	537	1.06	0.91
ARC Total	283	654	1.13	0.86
Other University	885	1810	1.00	0.70
Australia	1312	3117	1.04	0.84

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 76. Centile Distribution of Publications, 2001–2005: Information, Computing and Communication Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.9%	6	2.8%	17	7.9%	39	18.1%	69	32.1%	82	38.1%	215
ARC Total	4	1.4%	7	2.5%	22	7.8%	46	16.3%	87	30.7%	117	41.3%	283
Other University	11	1.2%	41	4.6%	48	5.4%	63	7.1%	231	26.1%	491	55.5%	885
Australia	19	1.4%	54	4.1%	80	6.1%	123	9.4%	356	27.1%	680	51.8%	1312

Figure 39. Relative Citation and Journal Impact: Information, Computing and Communication Sciences



Comments

Journal publication is not the normal mode for disseminating research results in this field, with conference presentations and publications being far more common. In addition, WoS coverage of computing journals in the standard SCI is not very comprehensive. For these reasons, the number of publications covered by the relevant journal sets is small (only 1,312 for Australia in total over the 5-year period) and caution should be used in the interpretation of any citation analysis.

Australia's aggregate performance in the field, driven largely by the largest sector, the Other University sector, falls below the world benchmark, even though it is appearing in journals of slightly above average impact. Publications linked to ARC are closest to the world benchmark, and the strongest subset – publications from the Discovery Projects scheme – performs slightly better again, but still below the field average.

3.35 Field: Engineering and Technology

In addition to journals utilised in the analyses for sections 3.36 to 3.47 below, this field analysis also includes journals from the following WoS journal sets: Food science and technology; Aerospace engineering and technology; Photographic technology; Remote sensing; Engineering, environmental; Engineering, marine; Engineering, biomedical; Materials science, biomaterials; Computer science, hardware and architecture; Engineering.

Table 77. Relative Citation and Journal Impact Rates, 2001–2005: Engineering and Technology Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
	293	530	1.34	1.23
ARC – Australian Professorial Fellowships	417	1162	1.38	1.49
ARC – Australian Research Fellowships	126	208	1.20	1.16
ARC – Centres Excellence	110	65	1.64	1.19
ARC – Discovery Projects	1772	5015	1.21	1.15
ARC – Federation Fellowships	252	505	1.68	1.87
ARC – Linkage Projects	432	1184	1.23	1.25
ARC – Australian Postdoctoral Fellowships	190	557	1.41	1.33
ARC – Special Research Centres	300	806	1.17	1.14
ARC Total	3083	8254	1.29	1.20
Cooperative Research Centres	673	2009	1.33	1.15
Other Government	767	1787	1.15	0.89
Other Hospital	187	486	1.44	1.17
Other University	6256	13633	1.13	0.88
Research Institutes	1177	3717	1.31	1.17
Australia	11989	29075	1.18	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 78. Centile Distribution of Publications, 2001–2005: Engineering and Technology Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	1	0.3%	12	4.1%	27	9.2%	37	12.6%	85	29.0%	131	44.7%	293
ARC – Aust Prof Fellows	3	0.7%	30	7.2%	36	8.6%	56	13.4%	124	29.7%	168	40.3%	417
ARC – Aust Res Fellows	2	1.6%	7	5.6%	14	11.1%	17	13.5%	26	20.6%	60	47.6%	126
ARC – Centres Excellence	4	3.6%	4	3.6%	13	11.8%	18	16.4%	22	20.0%	49	44.5%	110
ARC – Discovery Projects	16	0.9%	102	5.8%	159	9.0%	242	13.7%	560	31.6%	693	39.1%	1772
ARC – Federation Fellows	13	5.2%	14	5.6%	21	8.3%	33	13.1%	79	31.3%	92	36.5%	252
ARC – Linkage Projects	5	1.2%	22	5.1%	26	6.0%	55	12.7%	137	31.7%	187	43.3%	432
ARC – QEII Fellows	2	1.1%	14	7.4%	9	4.7%	17	8.9%	56	29.5%	92	48.4%	190
ARC – Special Res Ctrs	6	2.0%	23	7.7%	26	8.7%	24	8.0%	96	32.0%	125	41.7%	300
ARC Total	39	1.3%	184	6.0%	245	7.9%	395	12.8%	951	30.8%	1269	41.2%	3083
Cooperative Res Ctrs	6	0.9%	38	5.6%	42	6.2%	72	10.7%	239	35.5%	276	41.0%	673
Other Government	3	0.4%	29	3.8%	30	3.9%	59	7.7%	193	25.2%	453	59.1%	767
Other Hospital		0.0%	6	3.2%	5	2.7%	16	8.6%	51	27.3%	109	58.3%	187
Other University	44	0.7%	223	3.6%	314	5.0%	654	10.5%	1793	28.7%	3228	51.6%	6256
Research Institutes	10	0.8%	63	5.4%	76	6.5%	118	10.0%	351	29.8%	559	47.5%	1177
Australia	103	0.9%	532	4.4%	700	5.8%	1312	10.9%	3465	28.9%	5877	49.0%	11989

3.36 Subfield: Manufacturing Engineering

Field: Engineering and Technology

WoS journal sets analysed: Engineering, manufacturing; Robotics and automatic control; Materials science, textiles.

Table 79. Relative Citation and Journal Impact Rates, 2001–2005: Manufacturing Engineering

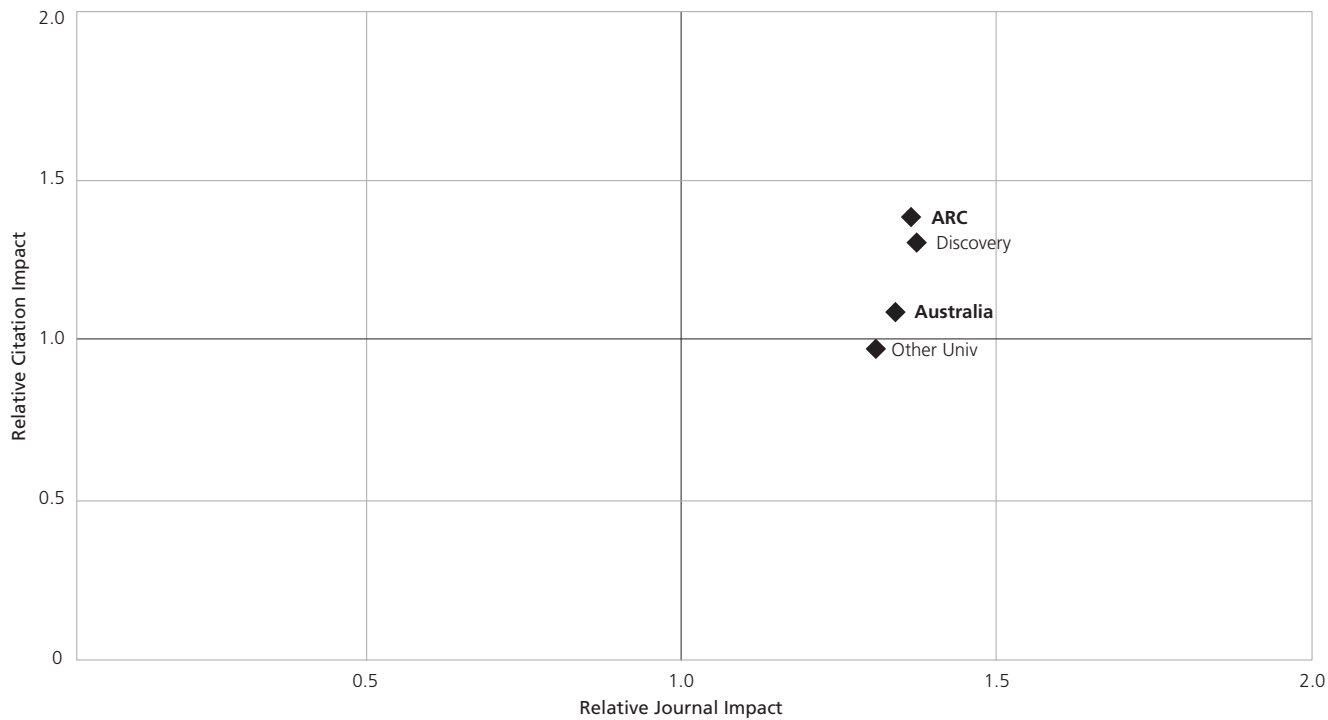
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	144	310	1.34	1.33
ARC Total	201	420	1.33	1.41
Other University	313	529	1.26	0.97
Australia	569	1043	1.29	1.10

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 80. Centile Distribution of Publications, 2001–2005: Manufacturing Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	1	0.7%	5	3.5%	13	9.0%	22	15.3%	45	31.3%	58	40.3%	144
ARC Total	2	1.0%	6	3.0%	16	8.0%	27	13.4%	63	31.3%	87	43.3%	201
Other University	1	0.3%	8	2.6%	12	3.8%	38	12.1%	100	31.9%	154	49.2%	313
Australia	3	0.5%	14	2.5%	30	5.3%	68	12.0%	182	32.0%	272	47.8%	569

Figure 41. Relative Citation and Journal Impact: Manufacturing Engineering



Comments

Australia exhibits a robust citation performance in this subfield, albeit based on a very small set of publications. The Discovery Projects scheme is the most active unit: it is publishing in high impact journals, and attracting citations well above the world benchmarks. Other university publications are appearing in journals of similar average impact, but attracting many less citations.

3.37 Subfield: Mechanical and Industrial Engineering

Field: Engineering and Technology

WoS journal sets analysed: Engineering mechanical; Engineering, industrial.

Table 81. Relative Citation and Journal Impact Rates, 2001–2005: Mechanical and Industrial Engineering

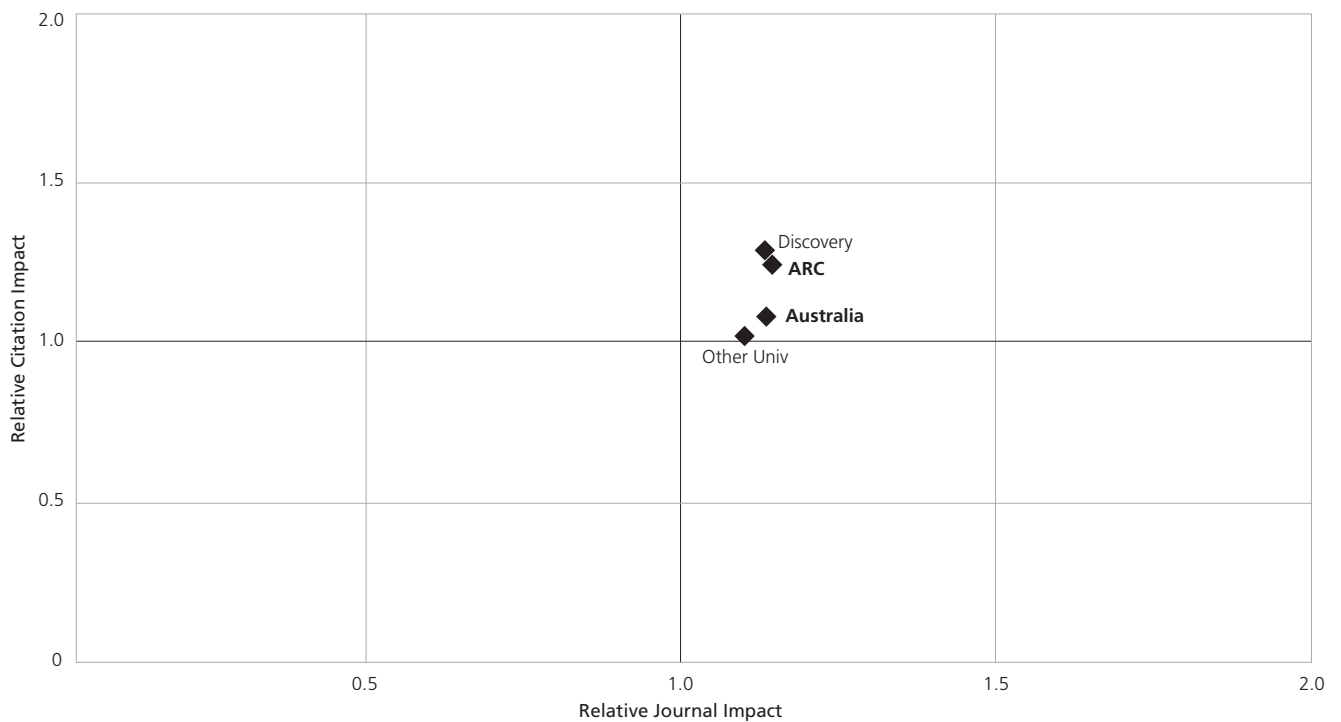
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	146	315	1.13	1.29
ARC Total	198	385	1.15	1.24
Other University	501	814	1.10	1.02
Australia	792	1379	1.13	1.09

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 82. Centile Distribution of Publications, 2001–2005: Mechanical and Industrial Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects		0.0%	4	2.7%	12	8.2%	24	16.4%	52	35.6%	54	37.0%	146
ARC Total		0.0%	4	2.0%	13	6.6%	28	14.1%	65	32.8%	88	44.4%	198
Other University	1	0.2%	15	3.0%	19	3.8%	43	8.6%	155	30.9%	268	53.5%	501
Australia	1	0.1%	21	2.7%	36	4.5%	79	10.0%	246	31.1%	409	51.6%	792

Figure 42. Relative Citation and Journal Impact: Mechanical and Industrial Engineering



Comments

The results of citation analysis obtained for this discipline mirror closely that for the previous one – Manufacturing Engineering. Australian citation performance in this subfield is robust, but is also based on a small set of publications. The Discovery Projects scheme is the most active unit. It is publishing in journals with an above average impact, and attracting citations well above the world benchmarks. Other university publications are appearing in journals of similar average impact, but attracting many less citations.

3.38 Subfield: Chemical Engineering

Field: Engineering and Technology

WoS journal sets analysed: Engineering, chemical.

Table 83. Relative Citation and Journal Impact Rates, 2001–2005: Chemical Engineering

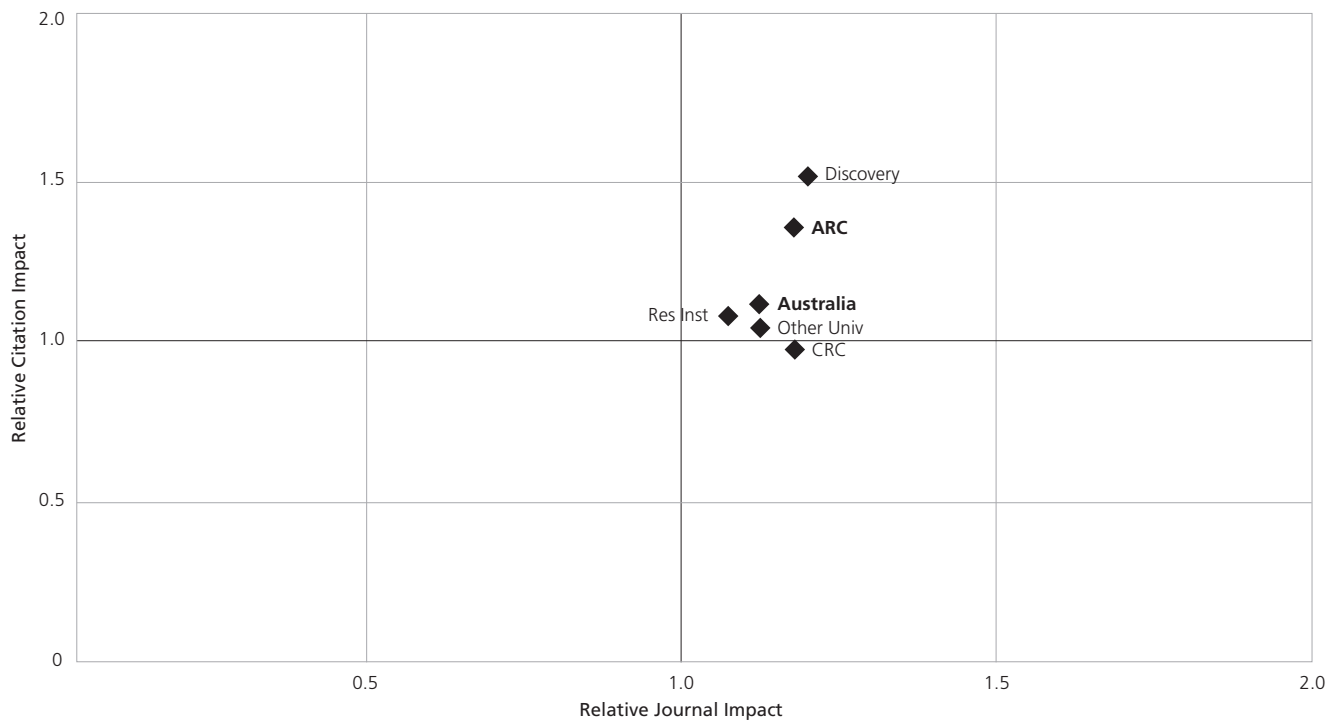
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	245	882	1.22	1.51
ARC Total	425	1309	1.18	1.36
Cooperative Research Centres	103	230	1.20	0.99
Other University	793	2019	1.13	1.05
Research Institutes	134	396	1.08	1.08
Australia	1494	4004	1.13	1.12

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 84. Centile Distribution of Publications, 2001–2005: Chemical Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.8%	24	9.8%	20	8.2%	43	17.6%	91	37.1%	65	26.5%	245
ARC Total	4	0.9%	40	9.4%	32	7.5%	59	13.9%	152	35.8%	138	32.5%	425
Cooperative Res Ctrs	1	1.0%	4	3.9%	8	7.8%	9	8.7%	35	34.0%	46	44.7%	103
Other University	9	1.1%	28	3.5%	53	6.7%	94	11.9%	262	33.0%	347	43.8%	793
Research Institutes	2	1.5%	9	6.7%	7	5.2%	17	12.7%	48	35.8%	51	38.1%	134
Australia	16	1.1%	80	5.4%	101	6.8%	181	12.1%	505	33.8%	611	40.9%	1494

Figure 43. Relative Citation and Journal Impact: Chemical Engineering



Comments

In terms of publication numbers, chemical engineering is one of the larger subfields of engineering and five sectors and schemes have sufficient publications to be analysed separately. All units publish in journals of similar average impact, but ARC linked publications achieve much higher rates of citations, principally driven by the strongly performing Discovery Projects scheme. While Discovery Projects only have the expected number of publications in the most highly cited cluster, they have double the number expected in the next group, and a low proportion below the field median.

3.39 Subfield: Resources Engineering

Field: Engineering and Technology

WoS journal sets analysed: Mining and mineral engineering; Engineering, petroleum; Energy and fuels; Engineering, geological.

Table 85. Relative Citation and Journal Impact Rates, 2001–2005: Resources Engineering

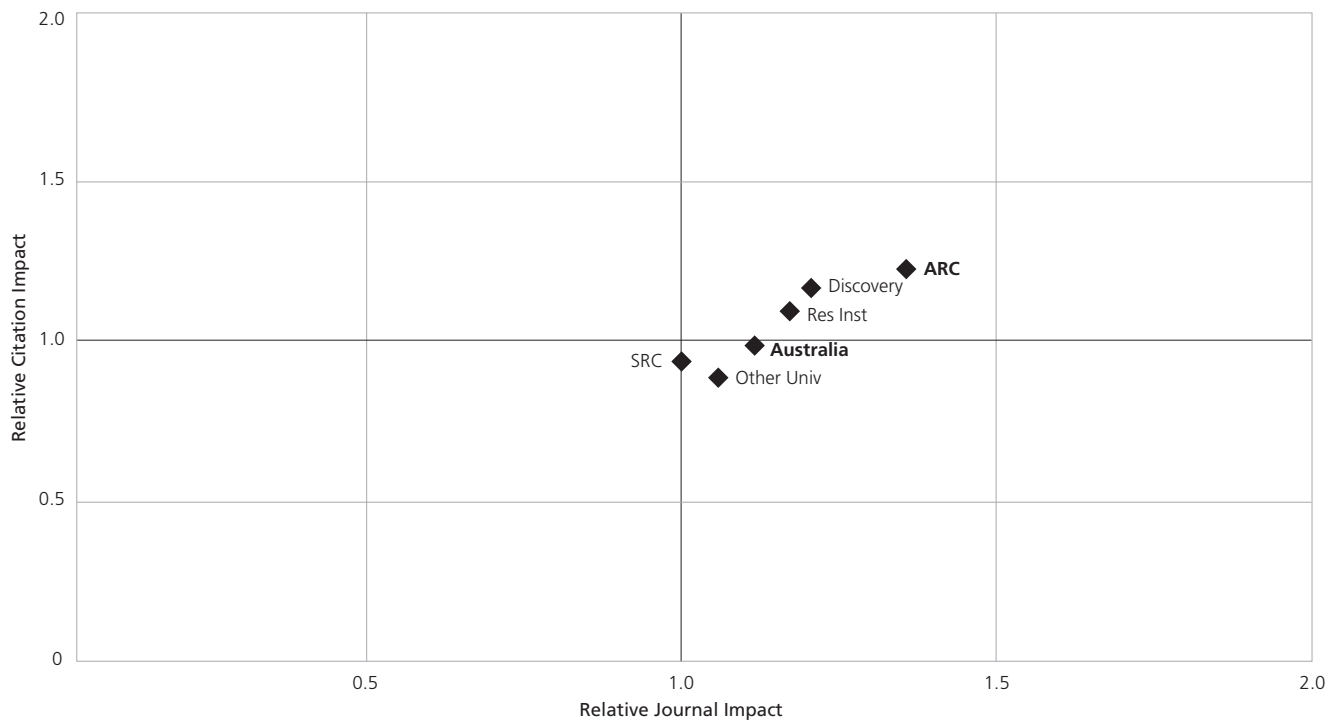
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	147	371	1.20	1.17
ARC – Special Research Centres	109	231	1.00	0.94
ARC Total	354	878	1.33	1.21
Other University	558	1085	1.06	0.89
Research Institutes	124	353	1.17	1.09
Australia	1202	2629	1.13	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 86. Centile Distribution of Publications, 2001–2005: Resources Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	1.4%	17	11.6%	10	6.8%	19	12.9%	44	29.9%	55	37.4%	147
ARC – Special Res Ctrs	1	0.9%	12	11.0%	6	5.5%	13	11.9%	27	24.8%	50	45.9%	109
ARC Total	4	1.1%	36	10.2%	28	7.9%	48	13.6%	97	27.4%	141	39.8%	354
Other University	11	2.0%	29	5.2%	31	5.6%	66	11.8%	175	31.4%	246	44.1%	558
Research Institutes	2	1.6%	14	11.3%	7	5.6%	19	15.3%	30	24.2%	52	41.9%	124
Australia	19	1.6%	84	7.0%	79	6.6%	149	12.4%	342	28.5%	529	44.0%	1202

Figure 44. Relative Citation and Journal Impact: Resources Engineering



Comments

While output linked to the ARC has increased by 69% in this subfield, there has been a significant decline in relative citation impact – by 41%. This is one of the largest falls for any subdiscipline. ARC output is still appearing in high impact journals, but the publications are not achieving the citations one might expect from these journals, and this results in a modest (compared to the ARC performance in many other disciplines) relative citation impact of 1.21.

3.40 Subfield: Civil Engineering

Field: Engineering and Technology

WoS journal sets analysed: Engineering, civil; Transportation; Water Resources; Construction and building technology.

Table 87. Relative Citation and Journal Impact Rates, 2001–2005: Civil Engineering

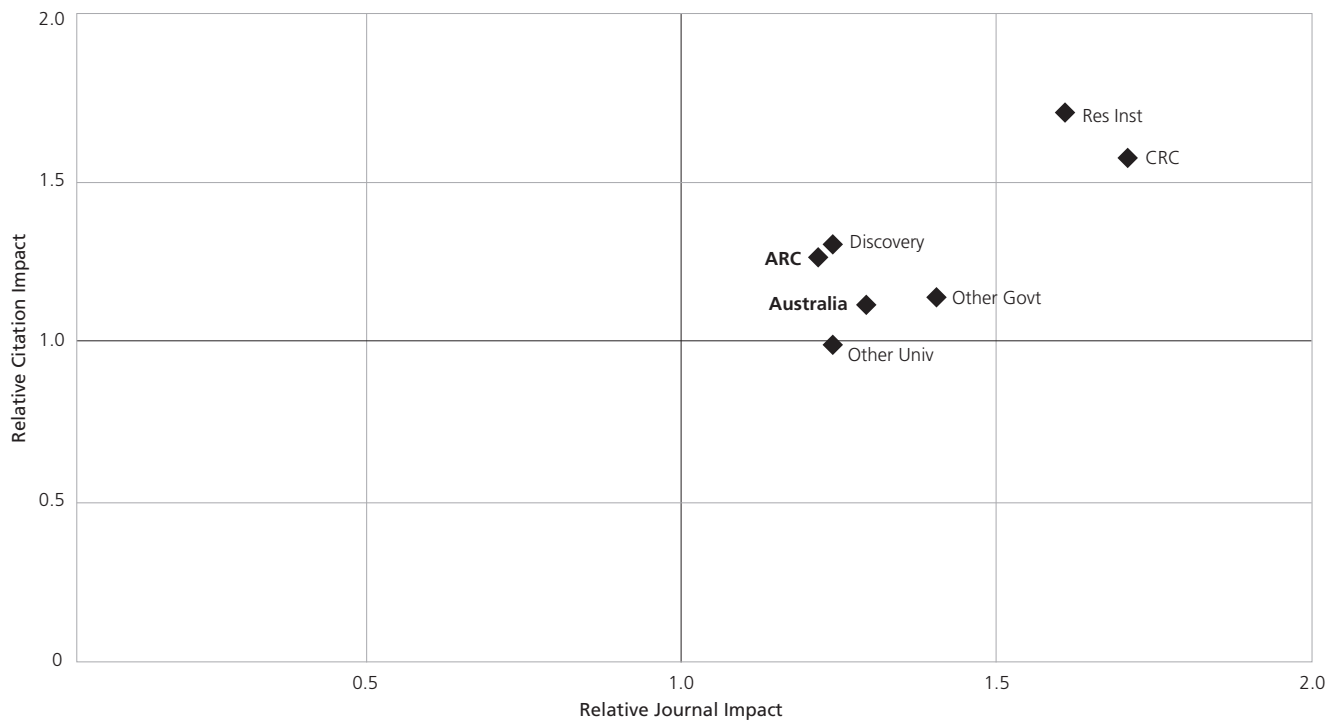
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	185	438	1.27	1.30
ARC Total	297	632	1.24	1.27
Cooperative Research Centres	154	482	1.68	1.57
Other Government	199	496	1.41	1.16
Other University	1060	2008	1.26	0.99
Research Institutes	218	735	1.58	1.67
Australia	1887	4103	1.30	1.13

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 88. Centile Distribution of Publications, 2001–2005: Civil Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	1.6%	14	7.6%	19	10.3%	23	12.4%	53	28.6%	73	39.5%	185
ARC Total	4	1.3%	19	6.4%	24	8.1%	31	10.4%	89	30.0%	130	43.8%	297
Cooperative Res Ctrs	3	1.9%	6	3.9%	9	5.8%	10	6.5%	65	42.2%	61	39.6%	154
Other Government		0.0%	5	2.5%	5	2.5%	15	7.5%	53	26.6%	121	60.8%	199
Other University	9	0.8%	46	4.3%	42	4.0%	90	8.5%	281	26.5%	592	55.8%	1060
Research Institutes	4	1.8%	13	6.0%	16	7.3%	28	12.8%	74	33.9%	83	38.1%	218
Australia	19	1.0%	88	4.7%	93	4.9%	167	8.9%	516	27.3%	1004	53.2%	1887

Figure 45. Relative Citation and Journal Impact: Civil Engineering



Comments

In journals classified to the subfield of civil engineering, it is the Research Institutes and CRC sectors that have the stand-out performances. Their relative citation impact is well above the Australian and world averages, and they are publishing in very high impact journals. ARC performance is also above world benchmarks for citation and journal impact, and above the Australian citation impact.

3.41 Subfield: Electrical and Electronic Engineering

Field: Engineering and Technology

WoS journal sets analysed: Engineering, electrical and electronic.

Table 89. Relative Citation and Journal Impact Rates, 2001–2005: Electrical and Electronic Engineering

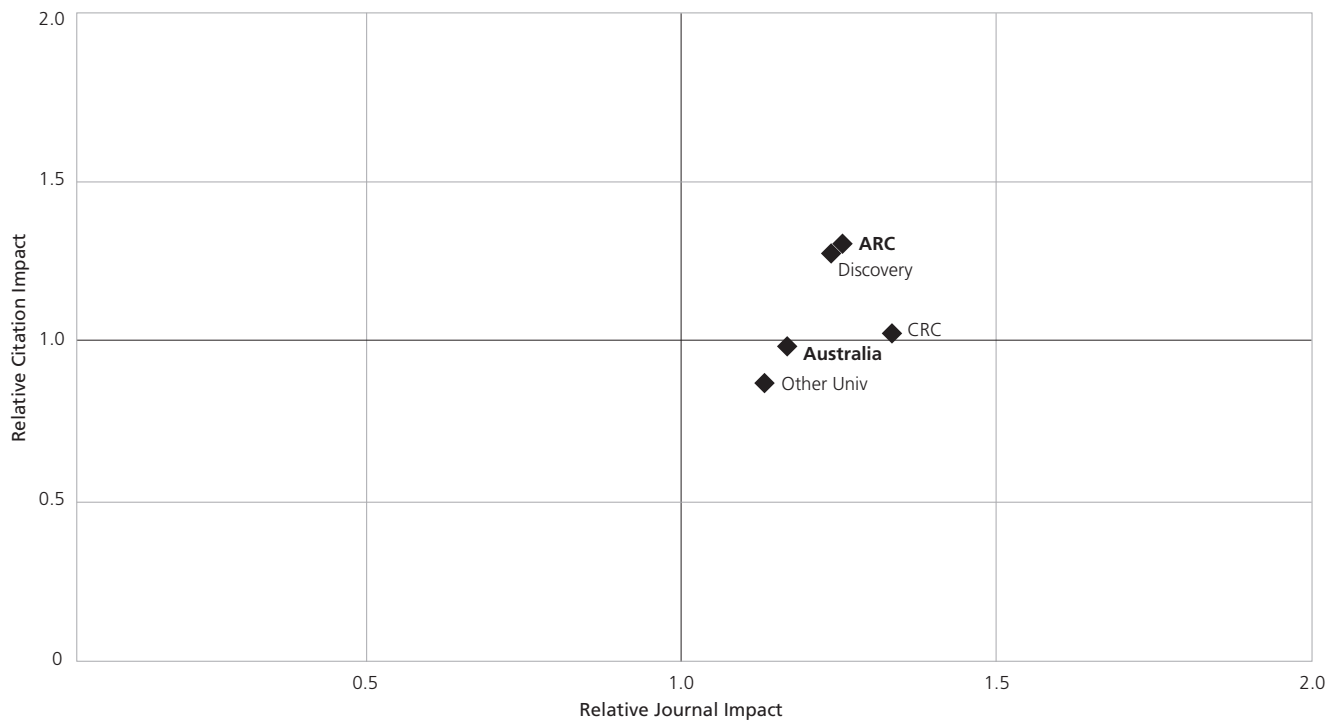
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	390	1066	1.24	1.21
ARC Total	621	1529	1.25	1.24
Cooperative Research Centres	109	305	1.32	1.01
Other University	970	1891	1.13	0.86
Australia	1901	4167	1.17	1.00

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 90. Centile Distribution of Publications, 2001–2005: Electrical and Electronic Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	6	1.5%	18	4.6%	44	11.3%	62	15.9%	112	28.7%	148	37.9%	390
ARC Total	13	2.1%	31	5.0%	63	10.1%	93	15.0%	177	28.5%	244	39.3%	621
Cooperative Res Ctrs		0.0%	3	2.8%	6	5.5%	20	18.3%	33	30.3%	47	43.1%	109
Other University	7	0.7%	40	4.1%	48	4.9%	105	10.8%	267	27.5%	503	51.9%	970
Australia	22	1.2%	83	4.4%	129	6.8%	238	12.5%	532	28.0%	897	47.2%	1901

Figure 46. Relative Citation and Journal Impact: Electrical and Electronic Engineering



Comments

ARC-funded research is a very important source of high impact publications in electrical and electronic engineering. While only 33% of Australian output is linked to the ARC, 13 of the 22 (60%) highest impact publications are associated with one of the ARC schemes. This importance is reflected in the strong citation impact of the ARC, above the Australian level (which is in line with the discipline benchmark). The CRC sector publishes in higher impact journals, but does not attract citations at the rate that would normally be associated with these journals.

3.42 Subfield: Metallurgy

Field: Engineering and Technology

WoS journal sets analysed: Metallurgy and metallurgical engineering.

Table 91. Relative Citation and Journal Impact Rates, 2001–2005: Metallurgy

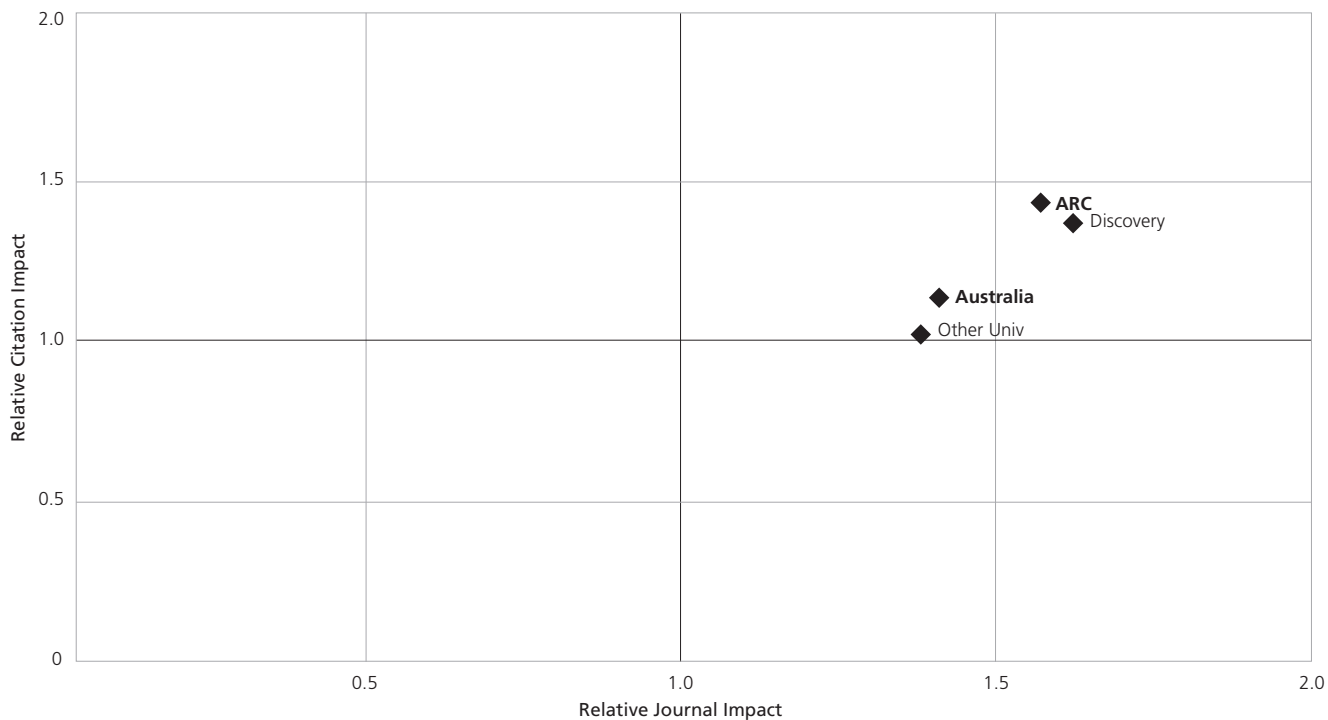
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	143	415	1.63	1.43
ARC Total	279	783	1.56	1.45
Other University	393	850	1.36	1.02
Australia	874	2062	1.39	1.14

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 92. Centile Distribution of Publications, 2001–2005: Metallurgy

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	2.1%	9	6.3%	17	11.9%	28	19.6%	48	33.6%	38	26.6%	143
ARC Total	3	1.1%	16	5.7%	21	7.5%	52	18.6%	102	36.6%	85	30.5%	279
Other University	2	0.5%	19	4.8%	24	6.1%	59	15.0%	125	31.8%	164	41.7%	393
Australia	6	0.7%	51	5.8%	62	7.1%	140	16.0%	289	33.1%	326	37.3%	874

Figure 47. Relative Citation and Journal Impact: Metallurgy



Comments

Australia’s performance in the small set of metallurgy journals is strong. Both the ARC in aggregate and the major contributing scheme (Discovery Projects) have a relative citation and journal impact well above world benchmarks, and also significantly higher than the Australian average.

3.43 Subfield: Materials Engineering

Field: Engineering and Technology

WoS journal sets analysed: Materials science; Materials science, ceramics; Materials science, characterisation and testing; Materials sciences, coatings and films; Materials science, composites; Materials science, paper and wood.

Table 93. Relative Citation and Journal Impact Rates, 2001–2005: Materials Engineering

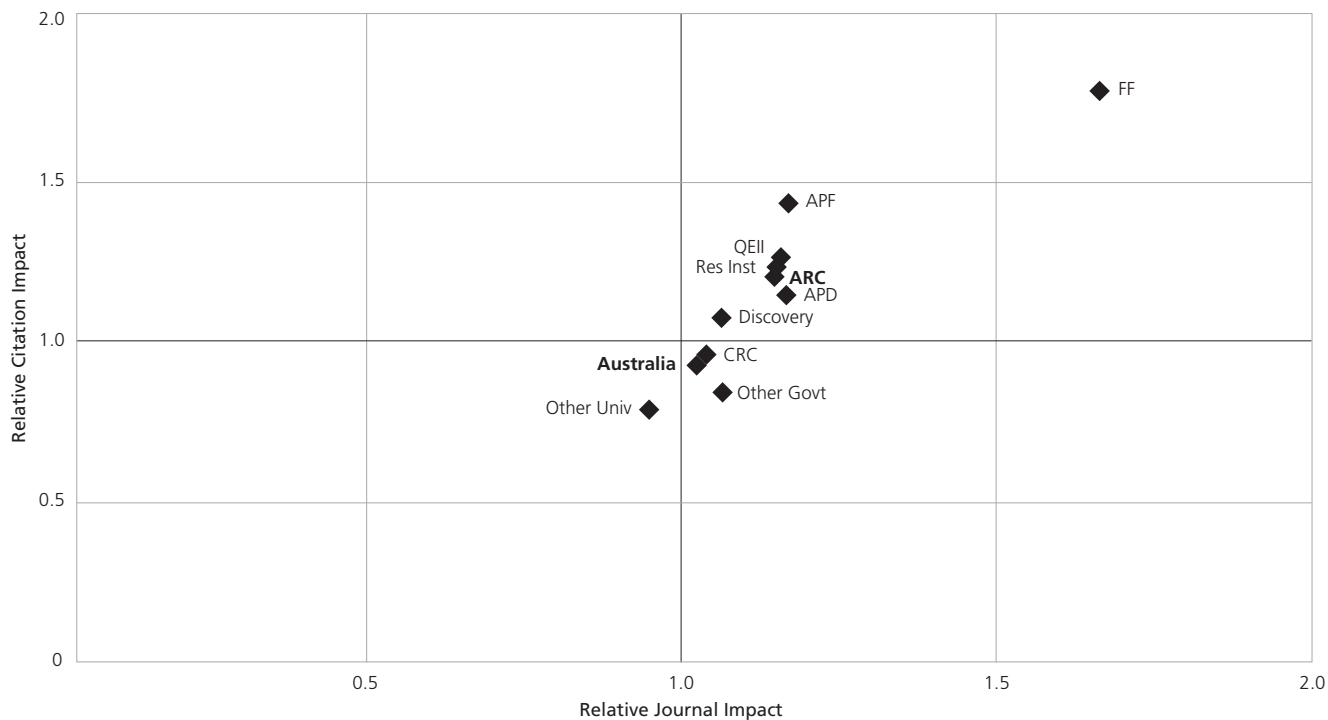
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	110	196	1.19	1.13
ARC – Australian Professorial Fellowships	182	565	1.15	1.43
ARC – Discovery Projects	539	1653	1.06	1.07
ARC – Federation Fellowships	121	297	1.66	1.76
ARC – QEII Fellowships	117	408	1.16	1.20
ARC Total	1022	3021	1.16	1.16
Cooperative Research Centres	150	400	1.03	0.94
Other Government	183	484	1.06	0.89
Other University	1444	3324	0.95	0.80
Research Institutes	252	992	1.16	1.18
Australia	2987	8083	1.03	0.96

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 94. Centile Distribution of Publications, 2001–2005: Materials Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows		0.0%	6	5.5%	11	10.0%	10	9.1%	36	32.7%	47	42.7%	110
ARC – Aust Prof Fellows		0.0%	21	11.5%	17	9.3%	24	13.2%	51	28.0%	69	37.9%	182
ARC – Discovery Projects	4	0.7%	25	4.6%	44	8.2%	56	10.4%	178	33.0%	232	43.0%	539
ARC – Federation Fellows	7	5.8%	10	8.3%	10	8.3%	10	8.3%	46	38.0%	38	31.4%	121
ARC – QEII Fellows	1	0.9%	5	4.3%	5	4.3%	9	7.7%	38	32.5%	59	50.4%	117
ARC Total	13	1.3%	61	6.0%	74	7.2%	113	11.1%	318	31.1%	443	43.3%	1022
Cooperative Res Ctrs	1	0.7%	11	7.3%	9	6.0%	21	14.0%	46	30.7%	62	41.3%	150
Other Government	2	1.1%	9	4.9%	10	5.5%	12	6.6%	55	30.1%	95	51.9%	183
Other University	6	0.4%	40	2.8%	62	4.3%	145	10.0%	450	31.2%	741	51.3%	1444
Research Institutes	2	0.8%	13	5.2%	16	6.3%	29	11.5%	73	29.0%	119	47.2%	252
Australia	24	0.8%	132	4.4%	169	5.7%	316	10.6%	915	30.6%	1431	47.9%	2987

Figure 48. Relative Citation and Journal Impact: Materials Engineering



Comments

Materials engineering is the largest of the subfields of engineering, making it possible to separately analyse the citation performance of nine sectors and schemes. Those with the highest citation impact are the Federation Fellowships and Australian Professorial Fellowships. All ARC schemes, with the exception of the Federation Fellowships, are publishing in journals with similar relative impact, though the Australian Professorial Fellowships achieve a higher level of citations for their articles. The Federation Fellows stand out, with very high relative citation and journal impacts. This scheme alone, though based on a small set of publications, accounts for 7 of the 24 most highly cited publications. In aggregate, the ARC is linked to over half these publications, and its importance to Australia as a source of high impact research in materials engineering is clear.

3.44 Subfield: Communications Technologies

Field: Engineering and Technology

WoS journal set analysed: Telecommunications.

Table 95. Relative Citation and Journal Impact Rates, 2001–2005: Communications Technologies

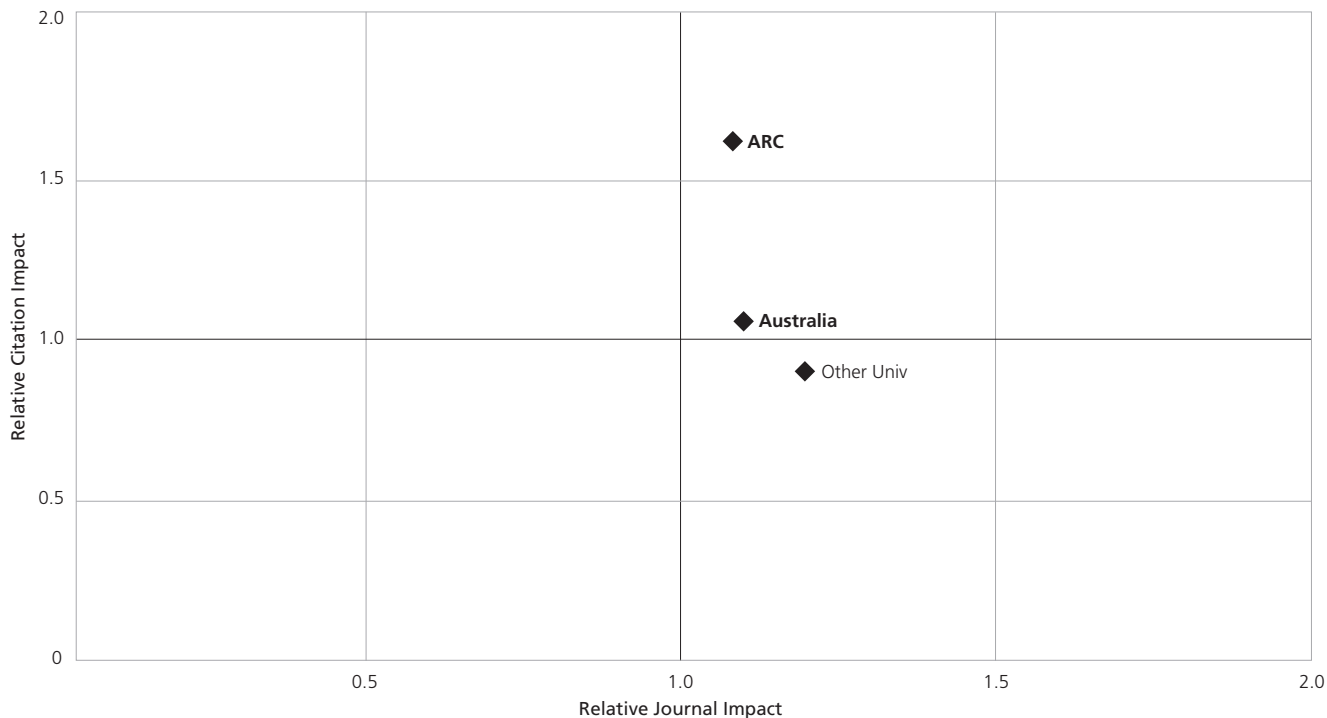
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	106	310	1.08	1.62
Other University	196	284	1.19	0.90
Australia	391	729	1.10	1.06

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 96. Centile Distribution of Publications, 2001–2005: Communications Technologies

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	3	2.8%	8	7.5%	10	9.4%	10	9.4%	32	30.2%	43	40.6%	106
Other University		0.0%	7	3.6%	9	4.6%	16	8.2%	58	29.6%	106	54.1%	196
Australia	3	0.8%	19	4.9%	21	5.4%	36	9.2%	111	28.4%	201	51.4%	391

Figure 49. Relative Citation and Journal Impact: Communications Technologies



Comments

The publications output in Communications Technologies increased sufficiently since the last study to be included for analysis, though this can only be done at the aggregate level. ARC publications are not appearing in high impact journals, but they are achieving rates of citation well above the world average for the discipline. The ARC is also linked to all three publications that fall within the top 1% most highly cited cluster of publications for this discipline.

3.45 Subfield: Interdisciplinary Engineering

Field: Engineering and Technology

WoS journal sets analysed: Mechanics; Thermodynamics.

Table 97. Relative Citation and Journal Impact Rates, 2001–2005: Interdisciplinary Engineering

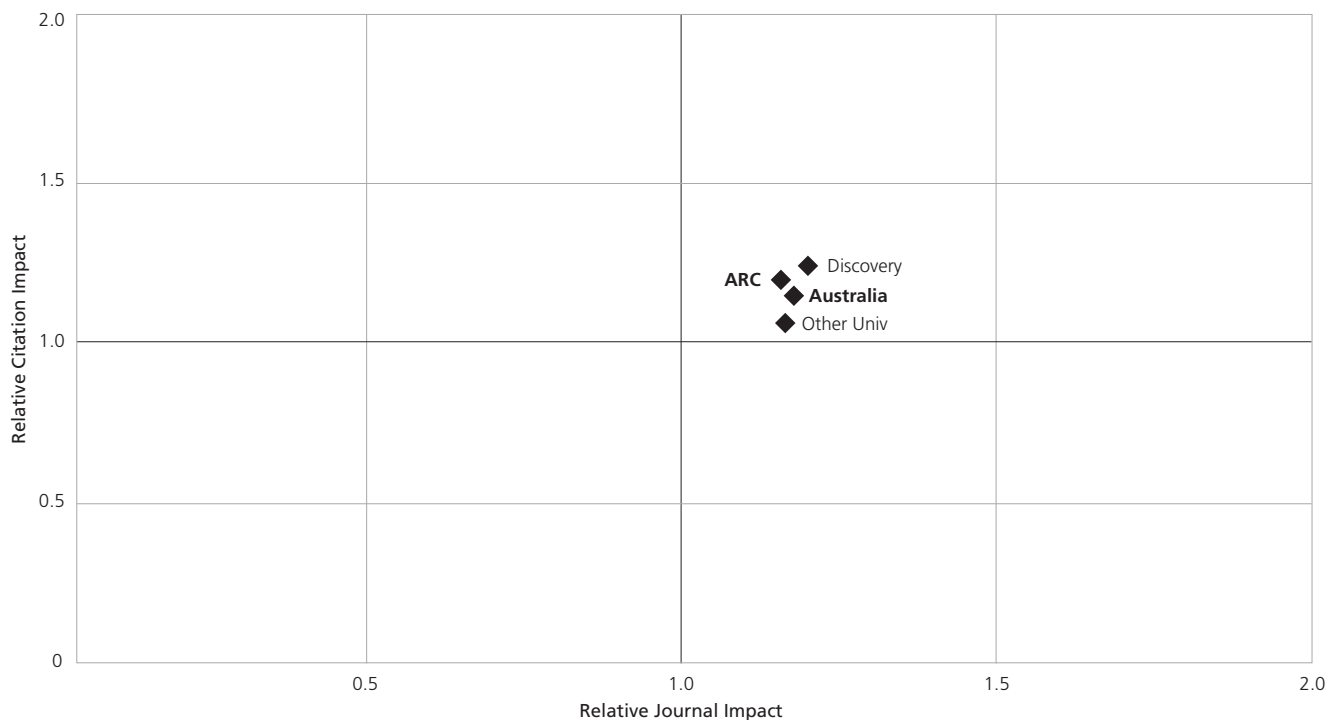
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	266	661	1.18	1.23
ARC Total	340	811	1.14	1.20
Other University	657	1511	1.13	1.05
Australia	1142	2757	1.15	1.13

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 98. Centile Distribution of Publications, 2001–2005: Interdisciplinary Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.8%	10	3.8%	25	9.4%	40	15.0%	95	35.7%	94	35.3%	266
ARC Total	4	1.2%	12	3.5%	26	7.6%	50	14.7%	117	34.4%	131	38.5%	340
Other University	9	1.4%	39	5.9%	37	5.6%	70	10.7%	185	28.2%	317	48.2%	657
Australia	14	1.2%	61	5.3%	72	6.3%	140	12.3%	343	30.0%	512	44.8%	1142

Figure 50. Relative Citation and Journal Impact: Interdisciplinary Engineering



Comments

Australia’s performance in this small interdisciplinary engineering journal set is robust, with a relative citation impact above the world average, and both the sector and scheme active in the subfield are also above that benchmark. All output is appearing in journals of similar impact, slightly above the average for the discipline, with the Discovery Projects scheme attracting citations for its articles at the highest rate.

3.46 Subfield: Nanoscience and Technology

Field: Engineering and Technology

WoS journal set analysed: Nanoscience and nanotechnology.

Table 99. Relative Citation and Journal Impact Rates, 2001–2005: Nanoscience and Technology

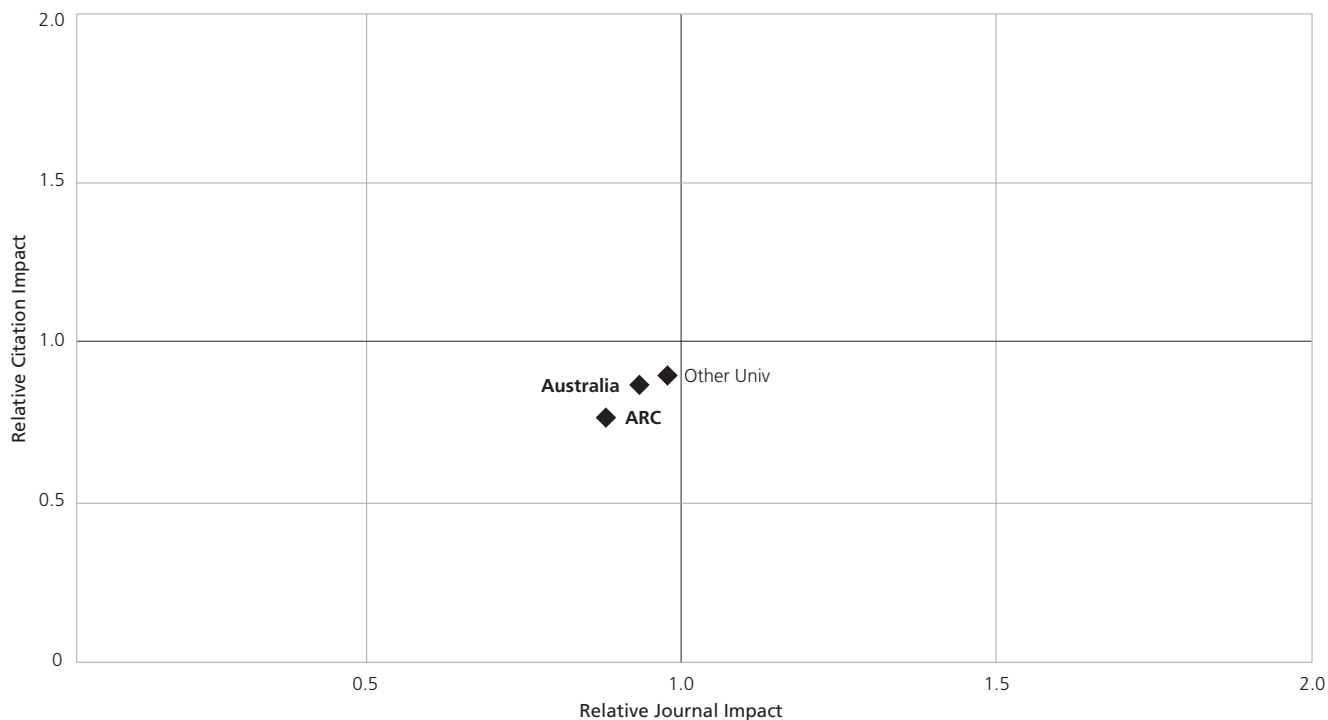
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	132	310	0.85	0.75
Other University	150	488	0.97	0.90
Australia	331	941	0.93	0.86

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 100. Centile Distribution of Publications, 2001–2005: Nanoscience and Technology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	1	0.8%	2	1.5%	10	7.6%	16	12.1%	49	37.1%	54	40.9%	132
Other University		0.0%	9	6.0%	7	4.7%	22	14.7%	56	37.3%	56	37.3%	150
Australia	2	0.6%	15	4.5%	20	6.0%	49	14.8%	119	36.0%	126	38.1%	331

Figure 51. Relative Citation and Journal Impact: Nanoscience and Technology



Comments

Nanoscience and Technology is based on a new WoS journal set and enters this analysis for the first time. It is a small journal set, with a relatively modest Australian presence of just 331 publications, though close to half of these are linked to ARC support. Australia’s performance, and particularly that of ARC-linked publications, is not strong, with relative citation and journal impacts below the world benchmarks.

3.47 Subfield: General Engineering

Field: Engineering and Technology

WoS journal set analysed: Engineering, multidisciplinary.

Table 101. Relative Citation and Journal Impact Rates, 2001–2005: General Engineering

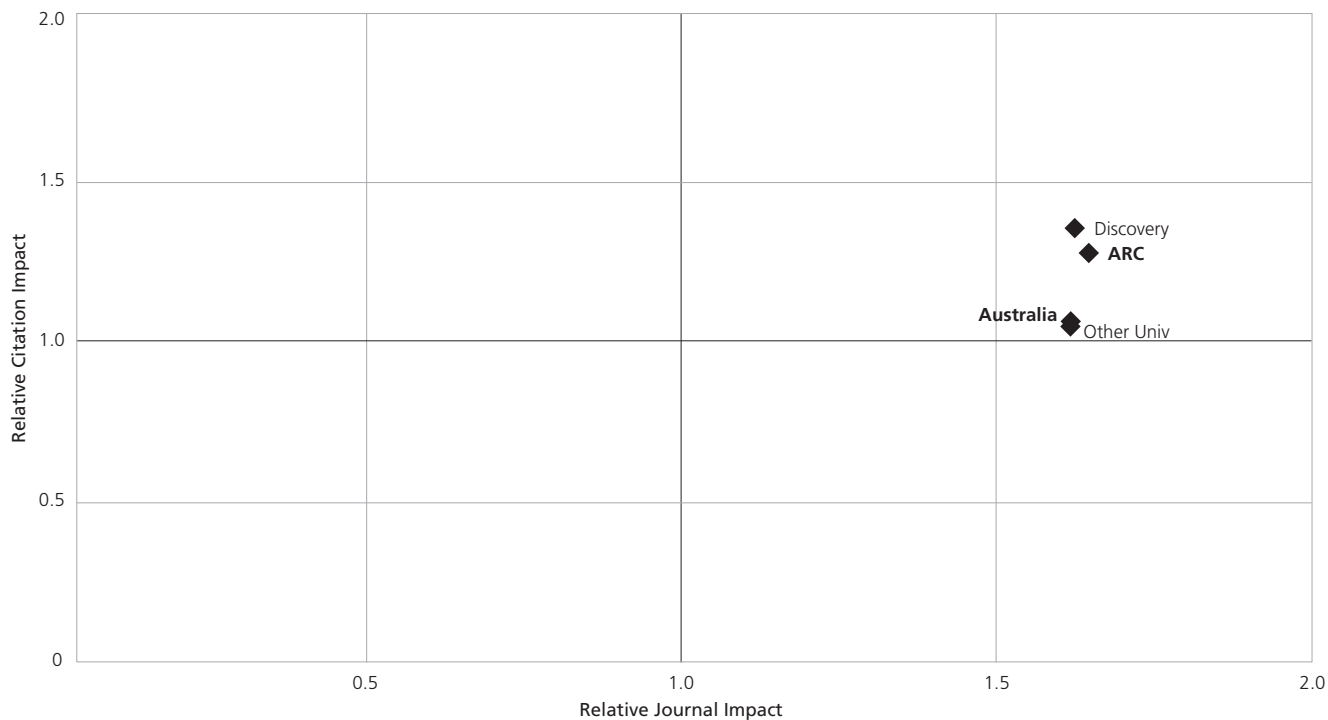
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	113	260	1.63	1.34
ARC Total	178	361	1.65	1.26
Other University	334	732	1.60	1.05
Australia	581	1207	1.60	1.06

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 102. Centile Distribution of Publications, 2001–2005: General Engineering

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage	
ARC – Discovery Projects		0.0%	5	4.4%	11	9.7%	18	15.9%	38	33.6%	41	36.3%	113
ARC Total	2	1.1%	6	3.4%	15	8.4%	23	12.9%	62	34.8%	70	39.3%	178
Other University	3	0.9%	17	5.1%	18	5.4%	35	10.5%	108	32.3%	153	45.8%	334
Australia	5	0.9%	24	4.1%	35	6.0%	62	10.7%	190	32.7%	265	45.6%	581

Figure 52. Relative Citation and Journal Impact: General Engineering



Comments

This interdisciplinary engineering journal set is another category for which the ARC now has sufficient publications for analysis, unlike the previous study. In aggregate, Australia is publishing in a very high impact subset of these journals, but does not achieve the citation levels that one would expect from these high impact outlets. In contrast, ARC (and in particular Discovery Project) publications are attracting much higher citation levels.

3.48 Field: Agricultural, Veterinary and Environmental Sciences

In addition to journals from the WoS subject category sets used for the subfield analyses in sections 3.49 and 3.51 below, the set for this field as a whole also includes journals from the following journal sets: Agriculture, soil science; Agriculture; Horticulture; Agriculture, Dairy and animal science; Forestry; Fisheries; Limnology.

Table 103. Relative Citation and Journal Impact Rates, 2001–2005: Agricultural, Veterinary and Environmental Sciences

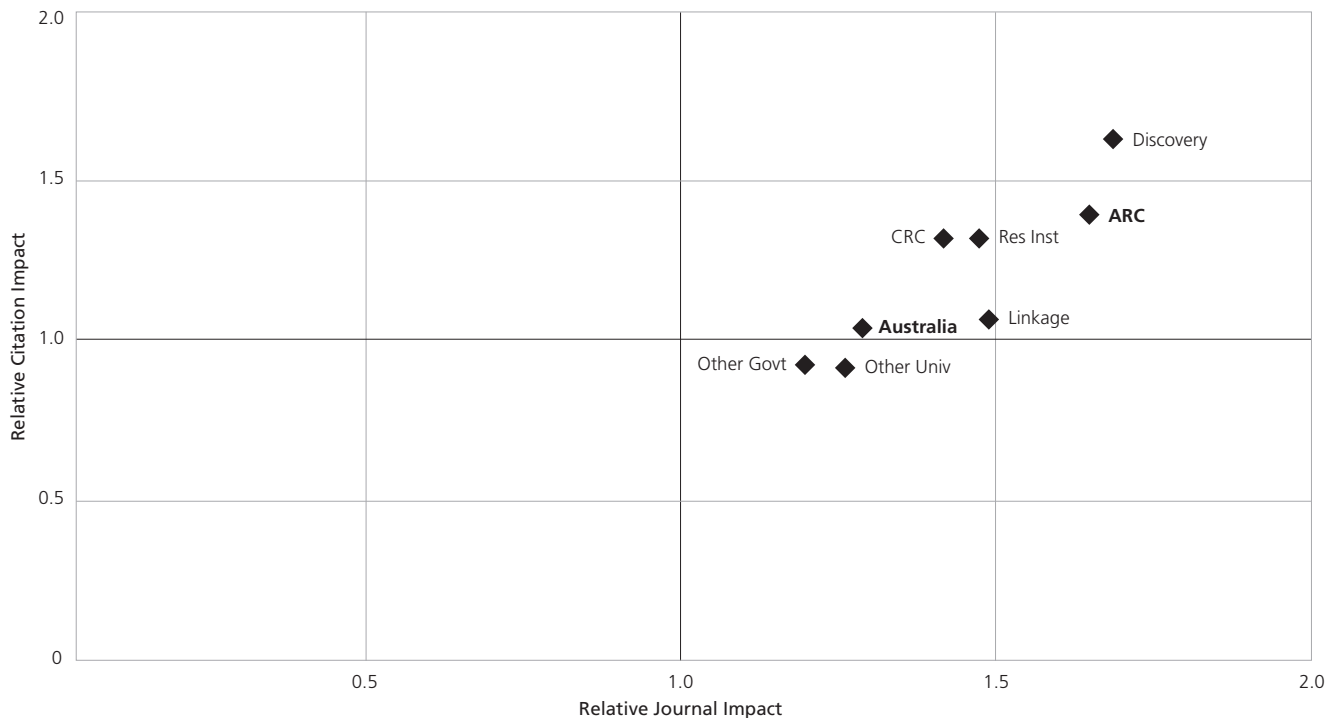
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	339	1407	1.66	1.63
ARC – Linkage Projects	299	726	1.49	1.08
ARC Total	784	2569	1.61	1.39
Cooperative Research Centres	1027	3867	1.41	1.32
Other Government	2279	6177	1.20	0.93
Other University	4929	12787	1.28	0.92
Research Institutes	2234	8860	1.46	1.32
Australia	10255	30475	1.32	1.05

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 104. Centile Distribution of Publications, 2001–2005: Agricultural, Veterinary and Environmental Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	7	2.1%	18	5.3%	32	9.4%	41	12.1%	93	27.4%	148	43.7%	339
ARC – Linkage Projects	3	1.0%	11	3.7%	15	5.0%	38	12.7%	104	34.8%	128	42.8%	299
ARC Total	11	1.4%	36	4.6%	55	7.0%	99	12.6%	247	31.5%	336	42.9%	784
Cooperative Res Ctrs	19	1.9%	69	6.7%	58	5.6%	137	13.3%	339	33.0%	405	39.4%	1027
Other Government	20	0.9%	84	3.7%	93	4.1%	208	9.1%	631	27.7%	1243	54.5%	2279
Other University	33	0.7%	159	3.2%	216	4.4%	472	9.6%	1345	27.3%	2704	54.9%	4929
Research Institutes	29	1.3%	145	6.5%	152	6.8%	292	13.1%	695	31.1%	921	41.2%	2234
Australia	96	0.9%	439	4.3%	523	5.1%	1094	10.7%	2921	28.5%	5182	50.5%	10255

Figure 53. Relative Citation and Journal Impact: Agricultural, Veterinary and Environmental Sciences



Comments

ARC-supported research accounts for only 7.6% of Australian publications in the field, with three sectors – Other Government, Other University and Research Institutes (principally CSIRO) – being the prime sites of research. The field has relatively homogenous citation practices between its constituent subfields, so it is unlikely that a focus on any particular discipline is likely to affect a sector or scheme’s performance at the aggregate field level.

Publications linked to ARC funding perform strongly in the field, particularly on the measure of relative journal impact. Within the ARC, Discovery Project output achieves a higher citation rate for its articles. It also has a strong presence in the most highly cited cluster of publications. The output from Linkage Projects, while also appearing in high impact journals, is not achieving the citation rates that would be expected for these outlets, though its citation impact is above the world benchmark for the field.

3.49 Subfield: Veterinary Sciences

Field: Agricultural, Veterinary and Environmental Science

WoS journal sets analysed: Veterinary sciences; Parasitology.

Table 105. Relative Citation and Journal Impact Rates, 2001–2005: Veterinary Sciences

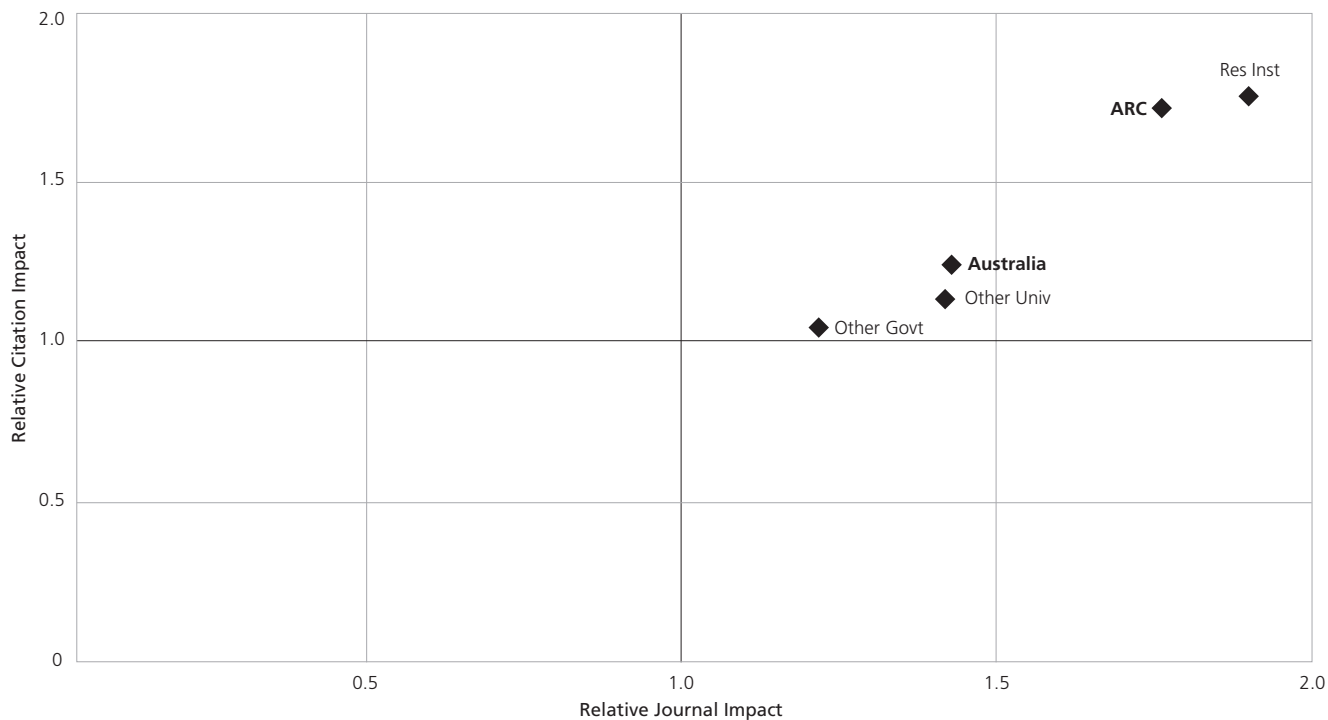
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	114	445	1.74	1.72
Other Government	375	993	1.19	1.03
Other University	1165	3230	1.41	1.10
Research Institutes	389	1758	1.91	1.76
Australia	2089	6449	1.43	1.23

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 106. Centile Distribution of Publications, 2001–2005: Veterinary Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	1	0.9%	7	6.1%	5	4.4%	13	11.4%	38	33.3%	50	43.9%	114
Other Government	4	1.1%	10	2.7%	13	3.5%	34	9.1%	102	27.2%	212	56.5%	375
Other University	11	0.9%	34	2.9%	56	4.8%	111	9.5%	330	28.3%	623	53.5%	1165
Research Institutes	3	0.8%	34	8.7%	30	7.7%	54	13.9%	129	33.2%	139	35.7%	389
Australia	18	0.9%	93	4.5%	107	5.1%	218	10.4%	606	29.0%	1047	50.1%	2089

Figure 54. Relative Citation and Journal Impact: Veterinary Sciences



Comments

The ARC is only a small player in Australia’s research in veterinary sciences, with most being concentrated in the Other Government, Research Institutes and Other University sectors. Nevertheless, the small group of publications linked to ARC funding has a very high citation impact and are appearing in very high impact journals. The same is also true of research emanating from the Research Institutes.

3.50 Subfield: Fisheries

Field: Agricultural, Veterinary and Environmental Science

WoS journal sets analysed: Fisheries, Limnology.

Table 107. Relative Citation and Journal Impact Rates, 2001–2005: Fisheries Sciences

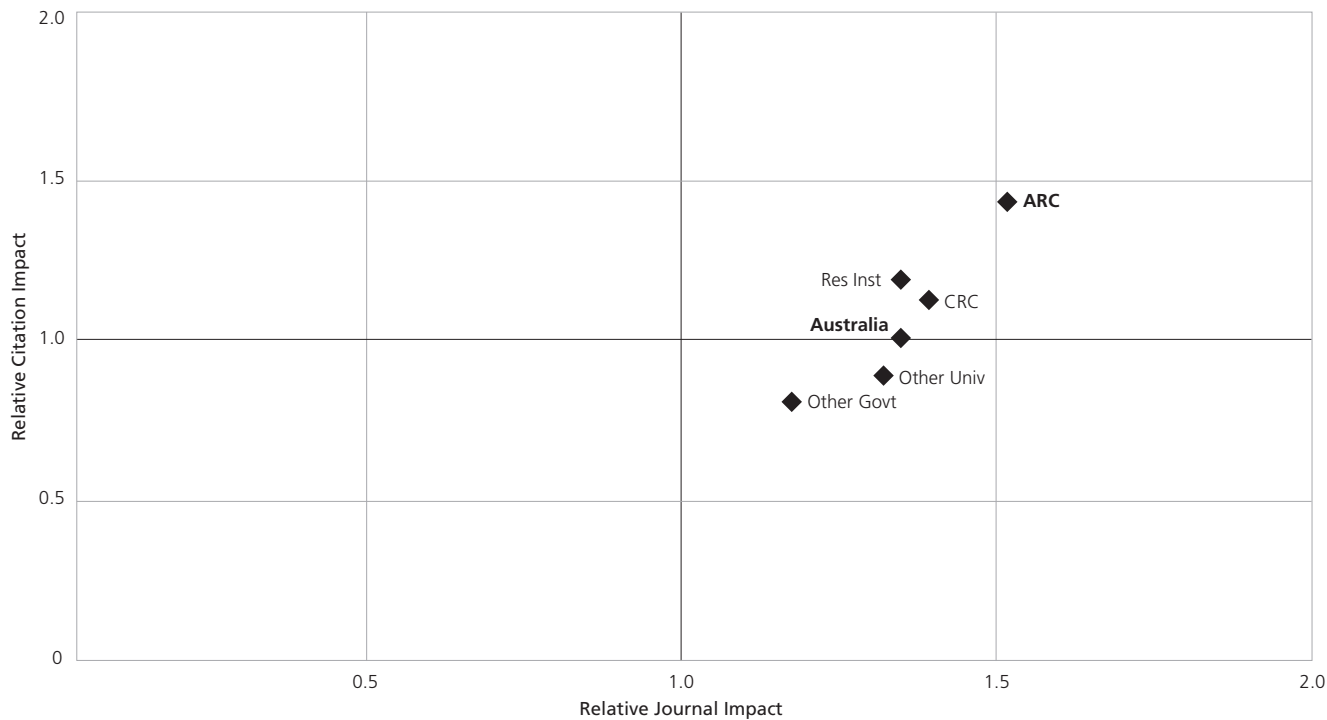
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	138	468	1.51	1.44
Cooperative Research Centres	163	550	1.38	1.13
Other Government	338	904	1.17	0.81
Other University	593	1666	1.30	0.88
Research Institutes	255	1026	1.33	1.20
Australia	1320	4130	1.32	1.00

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 108. Centile Distribution of Publications, 2001–2005: Fisheries Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	2	1.4%	10	7.2%	12	8.7%	17	12.3%	36	26.1%	61	44.2%	138
Cooperative Res Ctrs	2	1.2%	12	7.4%	6	3.7%	25	15.3%	48	29.4%	70	42.9%	163
Other Government	1	0.3%	6	1.8%	10	3.0%	29	8.6%	94	27.8%	198	58.6%	338
Other University	2	0.3%	17	2.9%	26	4.4%	59	9.9%	166	28.0%	323	54.5%	593
Research Institutes	1	0.4%	16	6.3%	17	6.7%	28	11.0%	91	35.7%	102	40.0%	255
Australia	6	0.5%	59	4.5%	68	5.2%	147	11.1%	380	28.8%	660	50.0%	1320

Figure 55. Relative Citation and Journal Impact: Fisheries Sciences



Comments

Due to increased output linked to ARC funding, fisheries science can now be included in this analysis. The ARC has a higher presence in this discipline than other subfields of agricultural, veterinary and environmental science; but still remains at a relatively low level. It is clear that ARC-linked publications are appearing in high impact journals and achieving a very strong relative citation impact.

3.51 Subfield: Environmental Sciences

Field: Agricultural, Veterinary and Environmental Science

WoS journal set analysed: Environmental sciences.

Table 109. Relative Citation and Journal Impact Rates, 2001–2005: Environmental Sciences

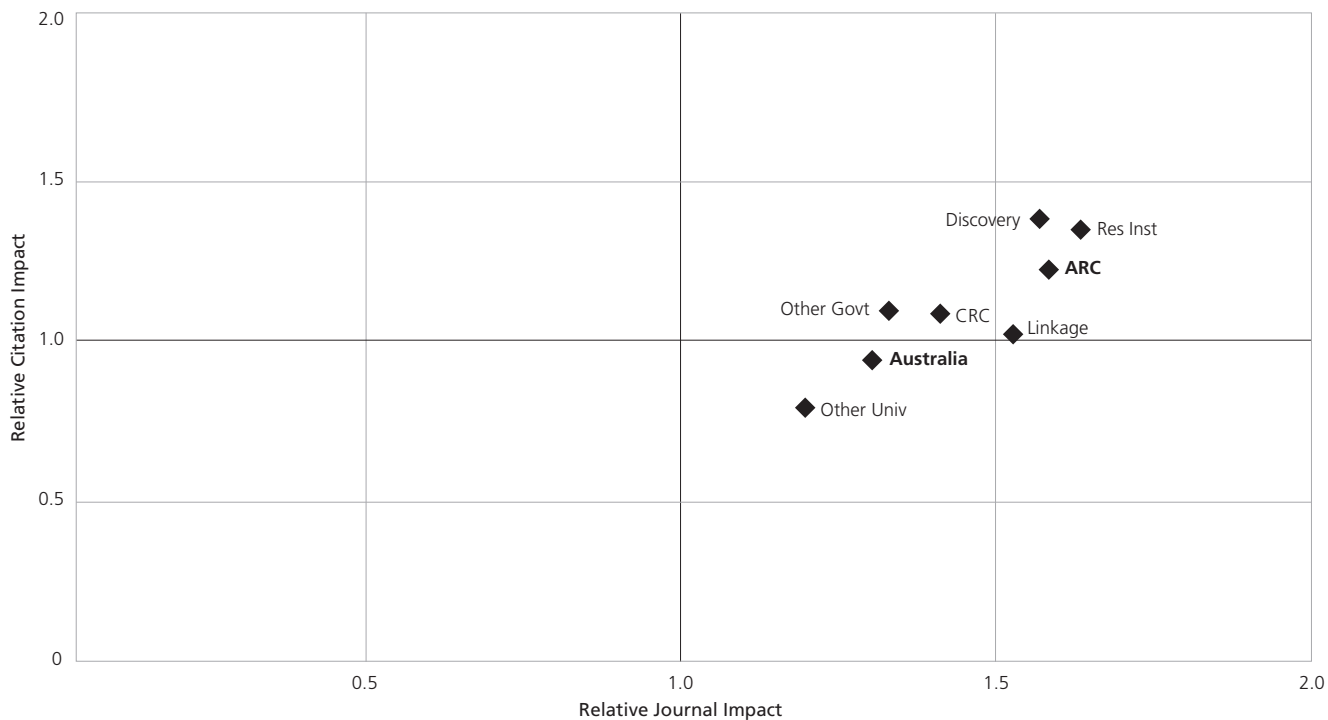
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	178	725	1.56	1.37
ARC – Linkage Projects	116	310	1.54	1.02
ARC Total	373	1222	1.57	1.21
Cooperative Research Centres	228	851	1.42	1.08
Other Government	491	1807	1.34	1.08
Other University	1686	4231	1.19	0.76
Research Institutes	472	2203	1.63	1.35
Australia	3056	9400	1.30	0.93

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 110. Centile Distribution of Publications, 2001–2005: Environmental Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	4	2.2%	10	5.6%	21	11.8%	21	11.8%	51	28.7%	71	39.9%	178
ARC – Linkage Projects	1	0.9%	5	4.3%	11	9.5%	16	13.8%	36	31.0%	47	40.5%	116
ARC Total	7	1.9%	18	4.8%	35	9.4%	47	12.6%	119	31.9%	147	39.4%	373
Cooperative Res Ctrs	4	1.8%	7	3.1%	14	6.1%	25	11.0%	88	38.6%	90	39.5%	228
Other Government	5	1.0%	16	3.3%	23	4.7%	42	8.6%	135	27.5%	270	55.0%	491
Other University	6	0.4%	59	3.5%	70	4.2%	151	9.0%	470	27.9%	930	55.2%	1686
Research Institutes	6	1.3%	34	7.2%	36	7.6%	66	14.0%	160	33.9%	170	36.0%	472
Australia	24	0.8%	125	4.1%	170	5.6%	306	10.0%	890	29.1%	1541	50.4%	3056

Figure 56. Relative Citation and Journal Impact: Environmental Sciences



Comments

The number of publications linked to ARC funding has more than doubled since the last study, and it is now possible to analyse ARC schemes individually. Both the Linkage and Discovery Projects schemes publish in journals of similar impact, though the Discovery Projects publications achieve significantly higher citation rates. This scheme also has a strong presence in the highly cited cluster of publications.

3.52 Field: Medical and Health Sciences

In addition to journals from the WoS subject category sets used for the subfield analyses in sections 3.53 to 3.58 below, the set for medical and health sciences as a whole also includes journals from the following journal sets: Chemistry, medicinal; Dentistry, oral surgery and medicine; Nursing; Ergonomics; Health care sciences and services; Health policy and services; Medical informatics; Nutrition and dietetics; Public, environmental and occupational health; Substance abuse; Sports sciences; Medical laboratory technology; Medicine, research and experimental; Medicine, miscellaneous.

Table 111. Relative Citation and Journal Impact Rates, 2001–2005: Medical and Health Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Australian Postdoctoral Fellowships	108	805	1.49	2.52
ARC – Australian Professorial Fellowships	145	1067	1.64	1.25
ARC – Australian Research Fellowships	75	524	1.39	1.17
ARC – Discovery Projects	829	4413	1.27	0.90
ARC – Linkage Projects	173	547	1.10	0.72
ARC – Special Research Centres	116	841	1.49	1.45
ARC Total	1472	8156	1.41	1.05
Cooperative Research Centres	513	3637	1.51	1.13
Other Government	2073	9713	0.99	0.79
Other Hospital	10889	65743	1.16	1.01
Other University	21287	123376	1.25	0.99
Research Institutes	6506	59726	1.93	1.61
Australia	36142	231772	1.34	1.09

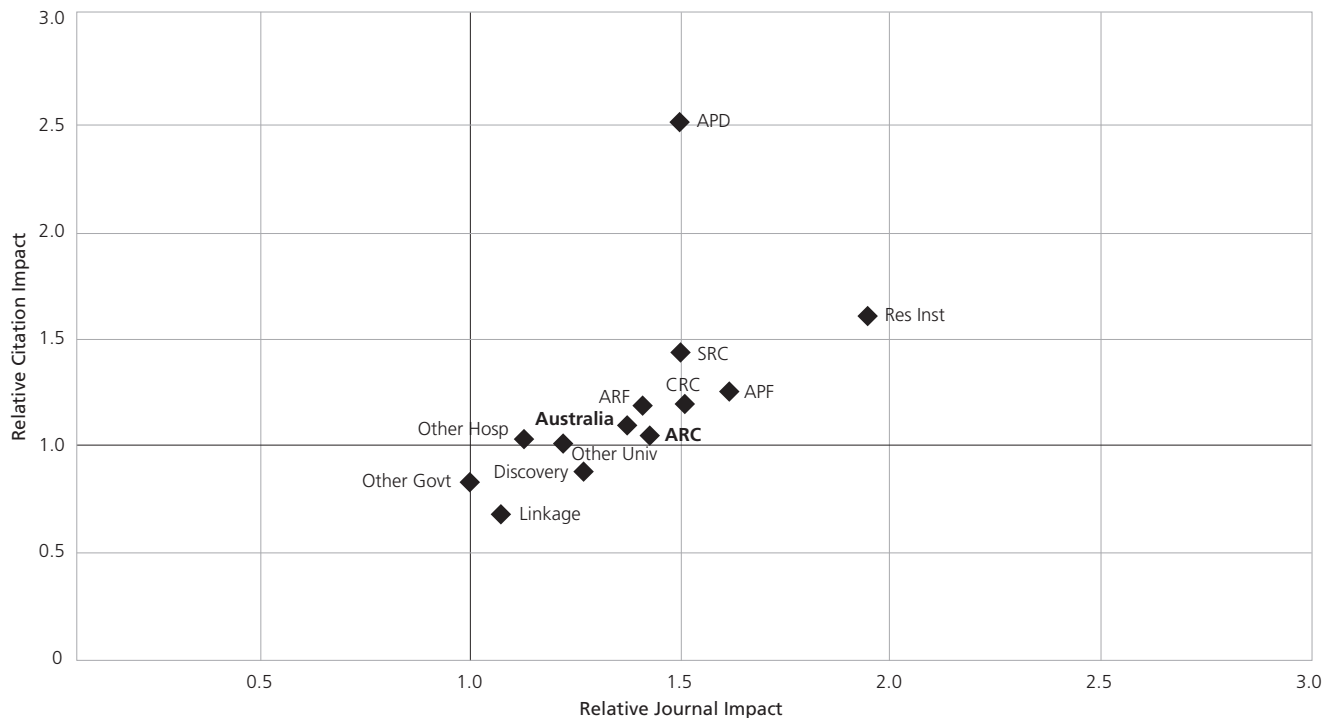
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 112. Centile Distribution of Publications, 2001–2005: Medical and Health Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Aust Postdoc Fellows	3	2.8%	6	5.6%	7	6.5%	10	9.3%	32	29.6%	50	46.3%	108
ARC – Aust Prof Fellows	1	0.7%	5	3.4%	13	9.0%	20	13.8%	50	34.5%	56	38.6%	145
ARC – Discovery Projects	6	0.7%	27	3.3%	46	5.5%	79	9.5%	270	32.6%	401	48.4%	829
ARC – Linkage Projects	1	0.6%	10	5.8%	10	5.8%	20	11.6%	45	26.0%	87	50.3%	173
ARC – Special Res Ctrs	1	0.9%	5	4.3%	8	6.9%	11	9.5%	35	30.2%	56	48.3%	116
ARC Total	14	1.0%	64	4.3%	99	6.7%	161	10.9%	448	30.4%	686	46.6%	1472
Cooperative Res Ctrs	5	1.0%	28	5.5%	39	7.6%	57	11.1%	147	28.7%	237	46.2%	513
Other Government	32	1.5%	75	3.6%	105	5.1%	223	10.8%	629	30.3%	1009	48.7%	2073
Other Hospital	173	1.6%	461	4.2%	578	5.3%	1136	10.4%	3137	28.8%	5404	49.6%	10889
Other University	255	1.2%	955	4.5%	1247	5.9%	2387	11.2%	6570	30.9%	9870	46.4%	21284
Research Institutes	110	1.7%	444	6.8%	572	8.8%	897	13.8%	2029	31.2%	2454	37.7%	6506
Australia	520	1.4%	1736	4.8%	2243	6.2%	4068	11.3%	10858	30.0%	16714	46.2%	36139

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 57. Relative Citation and Journal Impact: Medical and Health Sciences



Comments

Research in the medical and health sciences is primarily the domain of the hospitals, the universities and the medical research institutes, often with funding support from the NHMRC. ARC-supported research in this field results in just 4% of the Australian publications found in WoS citation indexes.

In contrast to the previous study, there are now a number of ARC schemes with sufficient publications to have their output in this field analysed independently. Of these, the strength of the citation performance of the small APD publication set is obvious from Figure 57. It is also apparent from the proportion of their output that appears in the most highly cited bands of publications.

Of the more active sectors in this field, the Research Institutes are the other very strong performers.

A more detailed analysis of output in the medical and health sciences can be obtained from a parallel study undertaken by REPP for the NHMRC (Butler and Henadeera, forthcoming)

3.53 Subfield: Immunology

Field: Medical and Health Sciences

WoS journal sets analysed: Immunology; Allergy.

Table 113. Relative Citation and Journal Impact Rates, 2001–2005: Immunology

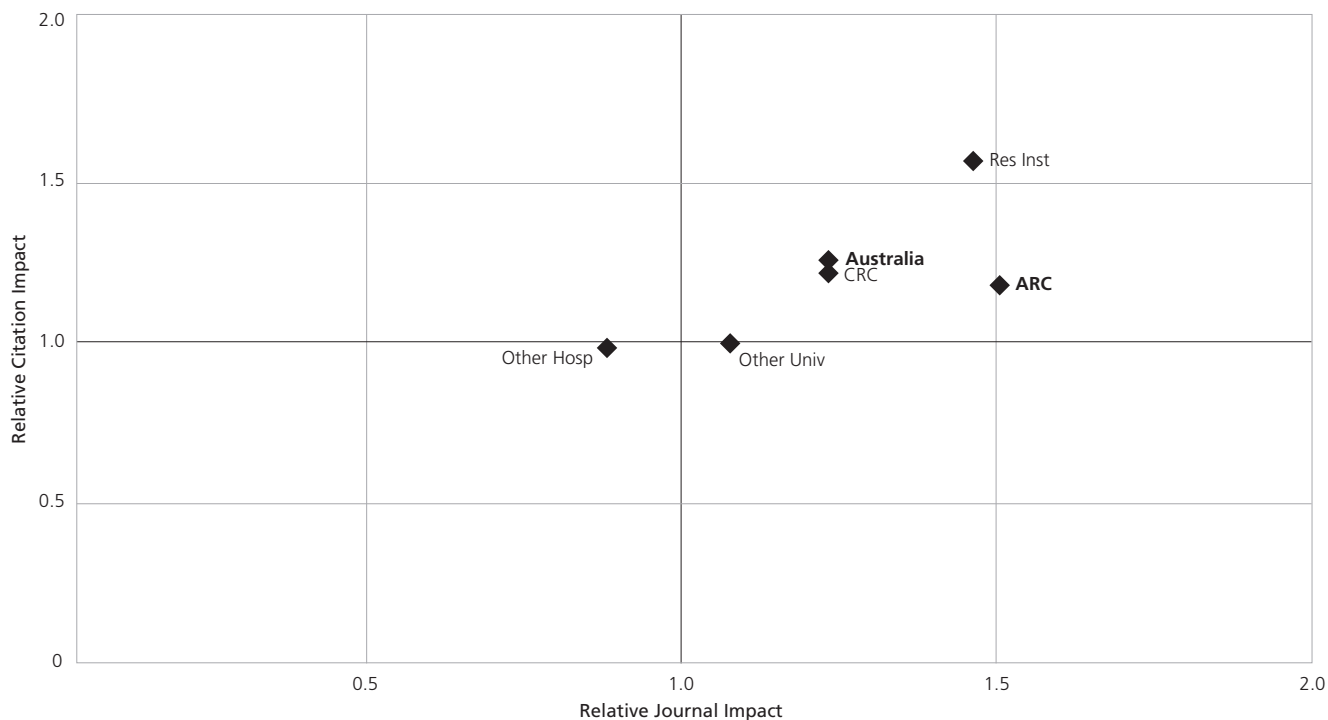
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	106	900	1.51	1.17
Cooperative Research Centres	205	1960	1.21	1.19
Other Hospital	599	5042	0.86	0.99
Other University	1312	10644	1.07	1.00
Research Institutes	1043	12572	1.47	1.57
Australia	2851	27360	1.21	1.21

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 114. Centile Distribution of Publications, 2001–2005: Immunology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	2	1.9%	9	8.5%	5	4.7%	17	16.0%	25	23.6%	48	45.3%	106
Cooperative Res Ctrs	3	1.5%	17	8.3%	17	8.3%	22	10.7%	63	30.7%	83	40.5%	205
Other Hospital	18	3.0%	29	4.8%	35	5.8%	52	8.7%	165	27.5%	300	50.1%	599
Other University	21	1.6%	52	4.0%	86	6.6%	123	9.4%	373	28.4%	657	50.1%	1312
Research Institutes	13	1.2%	82	7.9%	94	9.0%	134	12.8%	285	27.3%	435	41.7%	1043
Australia	46	1.6%	160	5.6%	206	7.2%	312	10.9%	788	27.6%	1339	47.0%	2851

Figure 58. Relative Citation and Journal Impact: Immunology



Comments

Publications linked to ARC funding are appearing in very high impact journals, but are not achieving the citations that are generally attached to articles in these journals. In contrast, the Research Institutes sector, which publishes in similarly high impact journals, has a much higher relative citation impact. The Other Hospital sector has a significant number of highly cited publications, but also has a higher proportion of publications falling below the field median, in contrast to the sector and scheme which have relative citation impacts above field parity.

3.54 Subfield: Pharmacology and Pharmaceutical Science

Field: Medical and Health Sciences

WoS journal sets analysed: Pharmacology and pharmacy; Toxicology.

Table 115. Relative Citation and Journal Impact Rates, 2001–2005: Pharmacology and Pharmaceutical Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	106	656	1.10	1.07
ARC Total	194	1095	1.15	1.08
Other Government	195	925	0.93	0.93
Other Hospital	492	2598	1.14	1.00
Other University	1972	9658	1.12	0.96
Research Institutes	441	3163	1.36	1.48
Australia	2929	15500	1.16	1.05

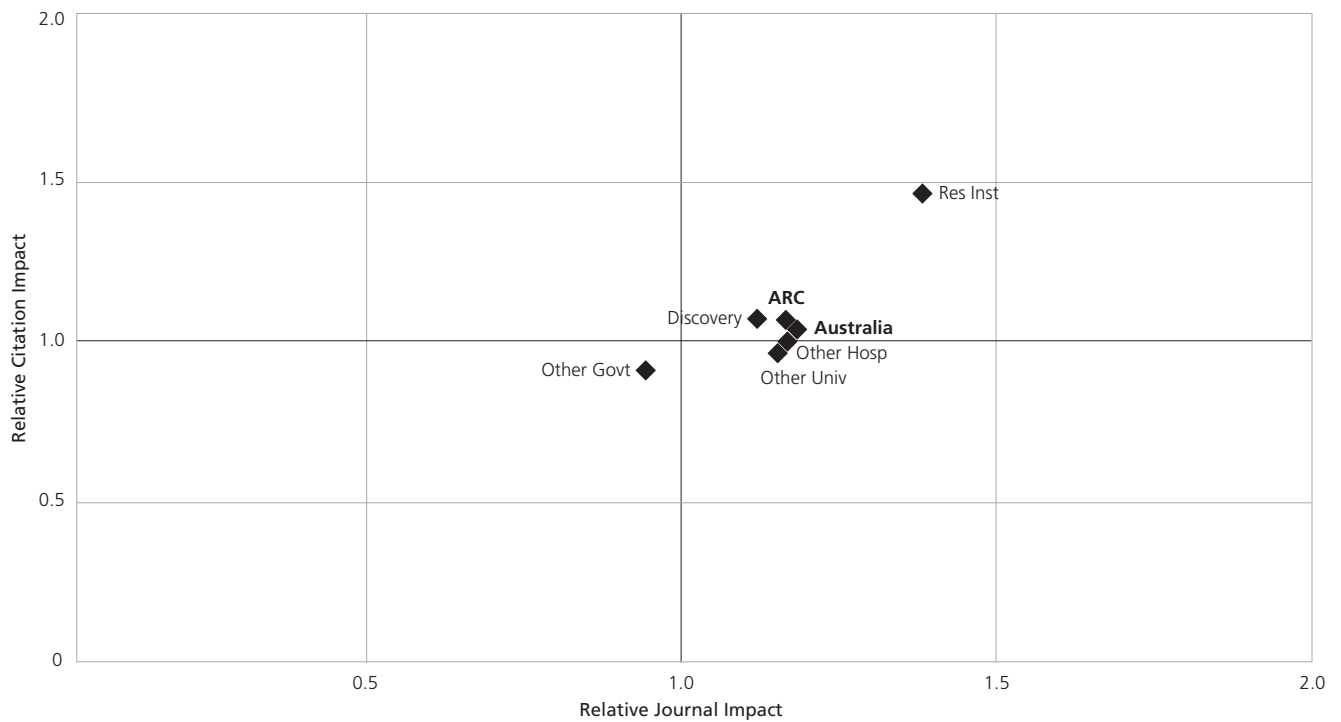
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 116. Centile Distribution of Publications, 2001–2005: Pharmacology and Pharmaceutical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	1	0.9%	2	1.9%	6	5.7%	8	7.5%	37	34.9%	52	49.1%	106
ARC Total	1	0.5%	6	3.1%	11	5.7%	16	8.2%	68	35.1%	92	47.4%	194
Other Government	3	1.5%	5	2.6%	10	5.1%	19	9.7%	67	34.4%	91	46.7%	195
Other Hospital	5	1.0%	21	4.3%	16	3.3%	50	10.2%	150	30.5%	250	50.8%	492
Other University	11	0.6%	75	3.8%	74	3.8%	193	9.8%	608	30.8%	1010	51.2%	1971
Research Institutes	7	1.6%	18	4.1%	35	7.9%	55	12.5%	137	31.1%	189	42.9%	441
Australia	21	0.7%	112	3.8%	137	4.7%	296	10.1%	918	31.4%	1444	49.3%	2928

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 59. Relative Citation and Journal Impact: Pharmacology and Pharmaceutical Sciences



Comments

The ARC set of publications in this subfield is small, at just under 200 publications. The Discovery Projects scheme just passes the 100 publication threshold needed for analysis. Their citation impact hovers just above the world benchmark and their publications are appearing in journals of above average impact for this set.

Highly cited publications in the field are primarily distributed across the larger sectors in line with the size of their total output, with little presence on the part of the three smaller sectors.

3.55 Subfield: Medical Physiology

Field: Medical and Health Sciences

WoS journal sets analysed: Anatomy and morphology; Physiology.

Table 117. Relative Citation and Journal Impact Rates, 2001–2005: Medical Physiology

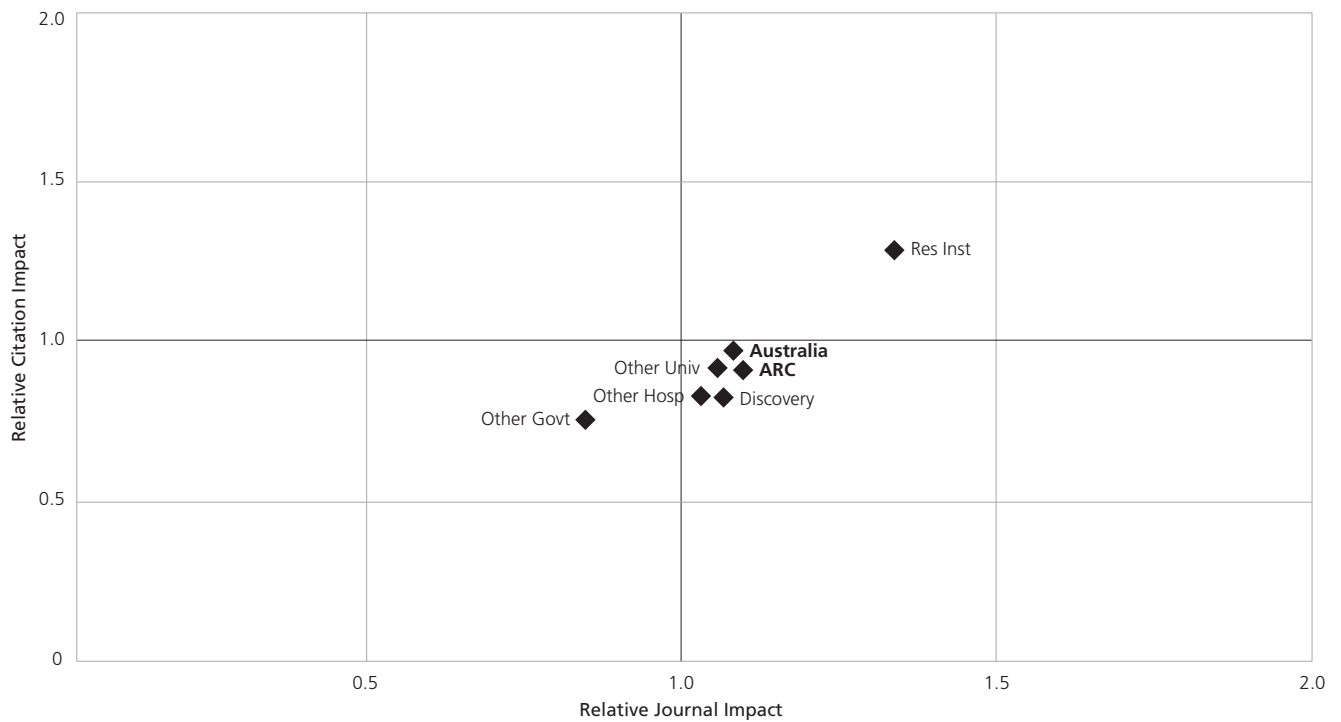
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	194	1084	1.08	0.82
ARC Total	267	1520	1.11	0.91
Other Government	101	465	0.86	0.72
Other Hospital	252	1256	1.04	0.82
Other University	1606	9442	1.06	0.92
Research Institutes	368	2834	1.33	1.28
Australia	2352	14309	1.10	0.96

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 118. Centile Distribution of Publications, 2001–2005: Medical Physiology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	1	0.5%	6	3.1%	11	5.7%	20	10.3%	68	35.1%	88	45.4%	194
ARC Total	1	0.4%	8	3.0%	21	7.9%	29	10.9%	92	34.5%	116	43.4%	267
Other Government		0.0%	6	5.9%	2	2.0%	11	10.9%	37	36.6%	45	44.6%	101
Other Hospital	2	0.8%	7	2.8%	8	3.2%	17	6.7%	69	27.4%	149	59.1%	252
Other University	13	0.8%	59	3.7%	80	5.0%	167	10.4%	515	32.1%	772	48.1%	1606
Research Institutes	4	1.1%	20	5.4%	22	6.0%	43	11.7%	125	34.0%	154	41.8%	368
Australia	18	0.8%	92	3.9%	130	5.5%	247	10.5%	758	32.2%	1107	47.1%	2352

Figure 60. Relative Citation and Journal Impact: Medical Physiology



Comments

The ARC contribution to medical physiology is the largest of any of the subfields of medical and health sciences, but is still only 11% of Australia's total output. Its publications have a relative citation impact below the world and Australian benchmarks.

The only group to perform strongly in aggregate in this discipline is the Research Institutes sector.

3.56 Subfield: Neurosciences

Field: Medical and Health Sciences

WoS journal set analysed: Neurosciences.

Table 119. Relative Citation and Journal Impact Rates, 2001–2005: Neurosciences

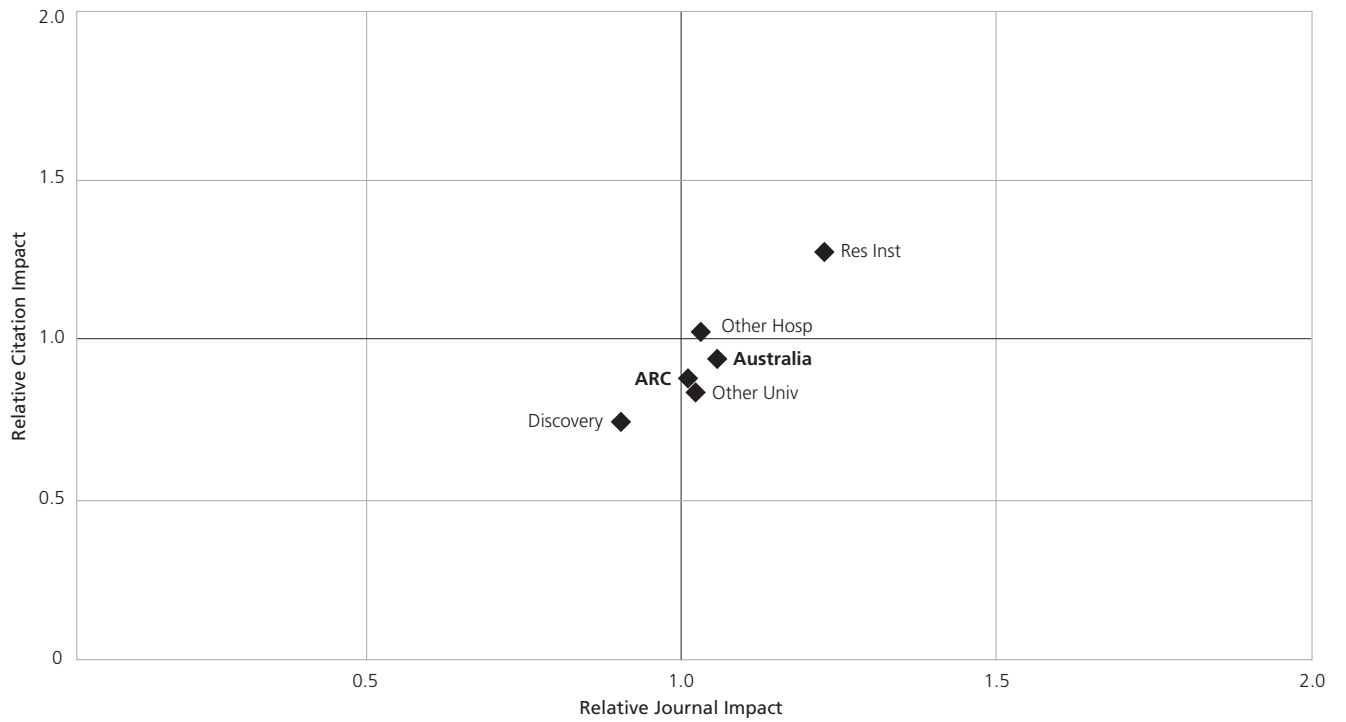
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	233	1278	0.90	0.78
ARC Total	349	2019	1.01	0.90
Other Hospital	714	5130	1.03	1.03
Other University	2454	15016	1.02	0.86
Research Institutes	699	5845	1.22	1.27
Australia	3749	24507	1.06	0.94

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 120. Centile Distribution of Publications, 2001–2005: Neurosciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	2	0.9%	8	3.4%	9	3.9%	23	9.9%	76	32.6%	115	49.4%	233
ARC Total	4	1.1%	17	4.9%	18	5.2%	31	8.9%	105	30.1%	174	49.9%	349
Other Hospital	11	1.5%	37	5.2%	37	5.2%	89	12.5%	230	32.2%	310	43.4%	714
Other University	23	0.9%	81	3.3%	112	4.6%	264	10.8%	778	31.7%	1196	48.7%	2454
Research Institutes	13	1.9%	43	6.2%	45	6.4%	103	14.7%	216	30.9%	279	39.9%	699
Australia	45	1.2%	151	4.0%	192	5.1%	426	11.4%	1168	31.2%	1767	47.1%	3749

Figure 61. Relative Citation and Journal Impact: Neurosciences



Comments

In aggregate, Australia’s citation performance in neuroscience journals falls below the world average, and the same is true for ARC performance in aggregate. The Research Institutes have a much stronger citation impact, and the Other Hospital sector also perform marginally above the world benchmark. Their performance relative to the ARC and Other University sector is also reinforced by their more visible presence in the more highly cited clusters of publications.

3.57 Subfield: Clinical Sciences

Field: Medical and Health Sciences

WoS journal sets analysed: Andrology; Anesthesiology; Cardiac and cardiovascular systems; Clinical neurology; Dermatology and venereal diseases; Emergency medicine and critical care; Endocrinology and metabolism; Gastroenterology and hepatology; Geriatrics and gerontology; Hematology; Infectious diseases; Medicine, general and internal; Obstetrics and gynecology; Oncology; Ophthalmology; Orthopedics; Otorhinolaryngology; Pathology; Pediatrics; Peripheral vascular disease; Psychiatry; Psychology; Radiology, nuclear medicine and medical imaging; Rehabilitation; Rheumatology; Respiratory system; Transplantation; Surgery; Urology and nephrology; Tropical medicine.

Table 121. Relative Citation and Journal Impact Rates, 2001–2005: Clinical Sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	388	2045	1.37	0.89
ARC Total	672	3636	1.46	1.06
Cooperative Research Centres	263	1876	1.40	1.18
Other Government	1296	6548	1.16	0.87
Other Hospital	9217	57204	1.25	1.05
Other University	13245	83190	1.41	1.11
Research Institutes	4320	37651	2.00	1.57
Australia	23989	160095	1.46	1.16

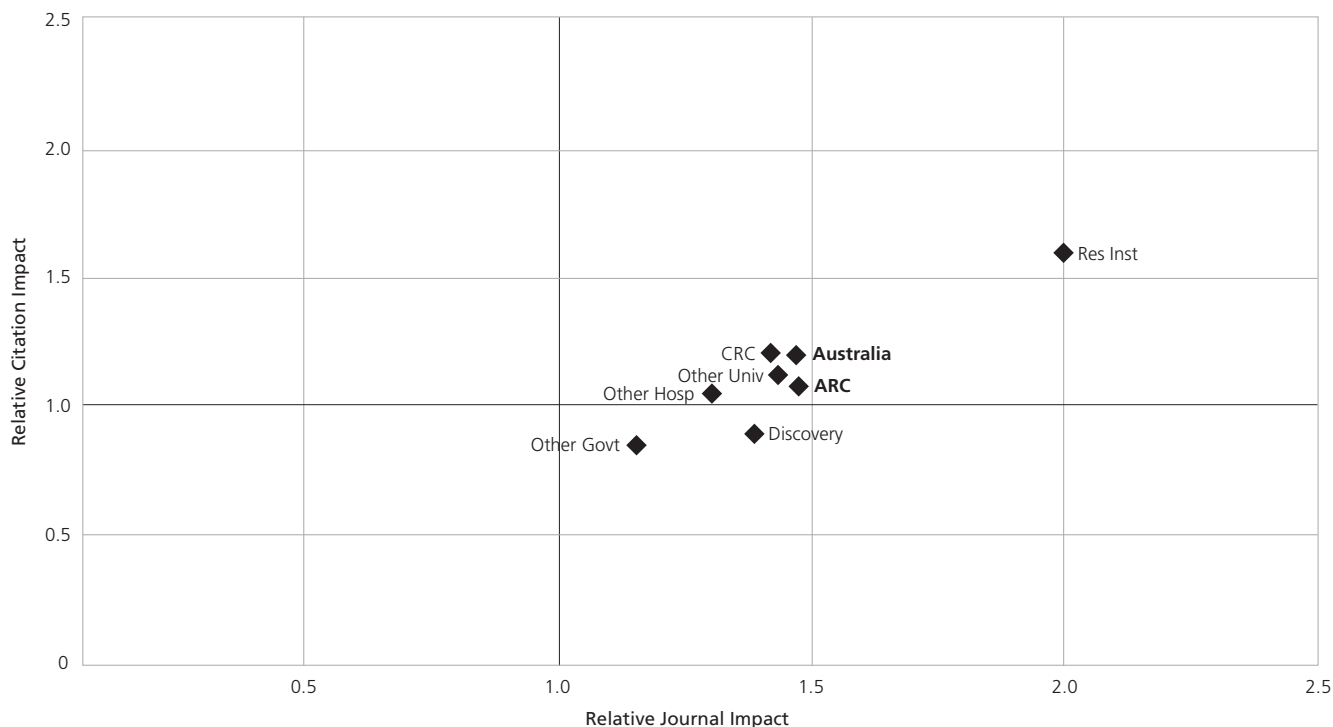
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 122. Centile Distribution of Publications, 2001–2005: Clinical Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	3	0.8%	12	3.1%	22	5.7%	39	10.1%	127	32.7%	185	47.7%	388
ARC Total	6	0.9%	31	4.6%	44	6.5%	78	11.6%	206	30.7%	307	45.7%	672
Cooperative Res Ctrs	3	1.1%	12	4.6%	17	6.5%	30	11.4%	74	28.1%	127	48.3%	263
Other Government	18	1.4%	39	3.0%	59	4.6%	150	11.6%	406	31.3%	624	48.1%	1296
Other Hospital	155	1.7%	407	4.4%	511	5.5%	998	10.8%	2655	28.8%	4491	48.7%	9217
Other University	182	1.4%	641	4.8%	842	6.4%	1607	12.1%	4230	31.9%	5740	43.3%	13242
Research Institutes	76	1.8%	292	6.8%	398	9.2%	594	13.8%	1417	32.8%	1543	35.7%	4320
Australia	394	1.6%	1200	5.0%	1548	6.5%	2812	11.7%	7362	30.7%	10670	44.5%	23986

NOTE: There were a very small number of publications for which centile data was not provided by Thomson Reuters hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 62. Relative Citation and Journal Impact: Clinical Sciences



Comments

ARC-supported research accounts for only 2% of Australian output in clinical sciences. The bulk of publications come from the Other University and Other Hospital sectors, with the Research Institutes the next largest sector. Of these, it is the Research Institutes that have a strong relative impact in both citations and, particularly, journals.

Over half the ARC publications in this subfield are from the Discovery Projects scheme, with 284 resulting from other funding schemes. It is the performance of this latter set of publications that drives the ARC’s overall citation performance, as those from the Discovery Projects scheme fall below the world benchmark for the discipline, despite appearing in relatively high impact journals.

3.58 Subfield: Public Health and Health Services

Field: Medical and Health Sciences

WoS journal sets analysed: Ergonomics; Health care sciences & services; Health policy & services; Medical informatics; Nutrition & dietetics; Medical informatics; Public, environmental & occupational health; Substance abuse.

Table 123. Relative Citation and Journal Impact Rates, 2001–2005: Public Health and Health Services

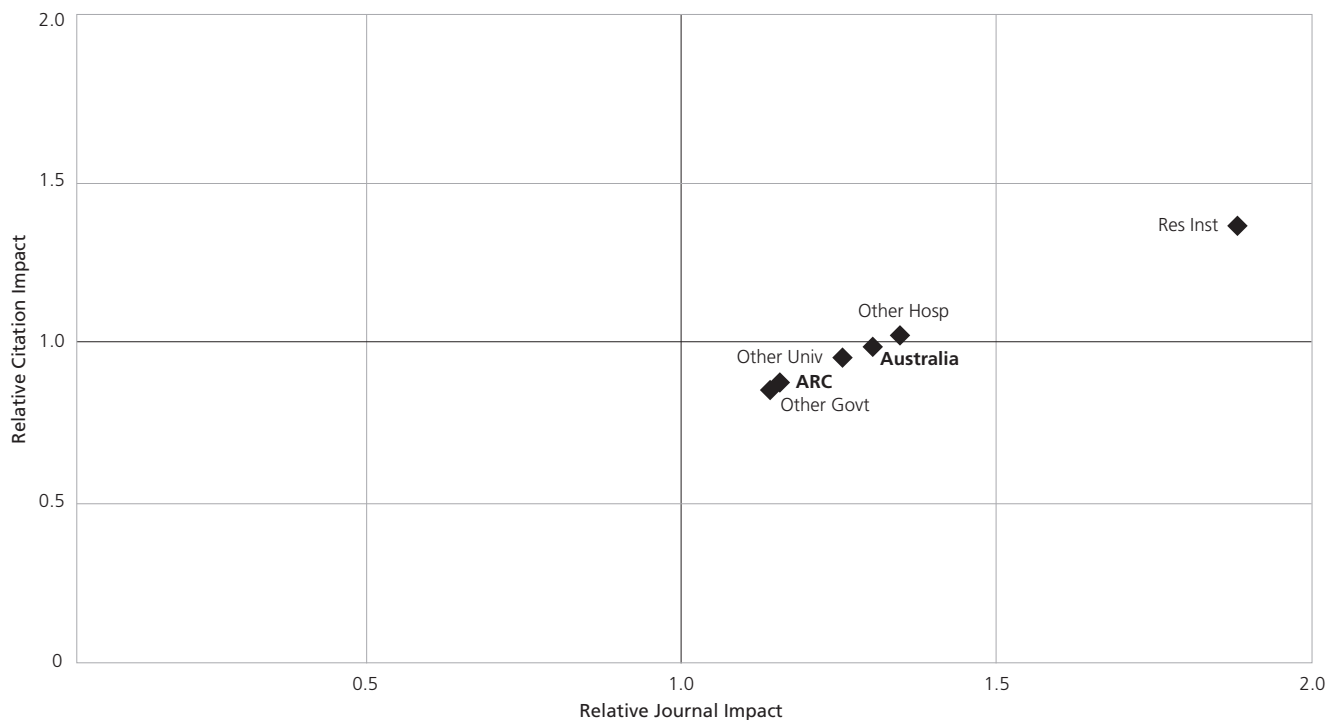
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	150	399	1.15	0.87
Other Government	530	2048	1.13	0.85
Other Hospital	759	3234	1.36	1.01
Other University	3219	12532	1.26	0.95
Research Institutes	590	3269	1.87	1.39
Australia	4535	18316	1.31	0.99

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 124. Centile Distribution of Publications, 2001–2005: Public Health and Health Services

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	1	0.7%	6	4.0%	14	9.3%	16	10.7%	36	24.0%	77	51.3%	150
Other Government	14	2.6%	26	4.9%	27	5.1%	44	8.3%	133	25.1%	286	54.0%	530
Other Hospital	7	0.9%	24	3.2%	36	4.7%	72	9.5%	215	28.3%	405	53.4%	759
Other University	36	1.1%	165	5.1%	206	6.4%	342	10.6%	877	27.2%	1593	49.5%	3219
Research Institutes	7	1.2%	37	6.3%	40	6.8%	83	14.1%	190	32.2%	233	39.5%	590
Australia	51	1.1%	224	4.9%	282	6.2%	498	11.0%	1247	27.5%	2233	49.2%	4535

Figure 63. Relative Citation and Journal Impact: Public Health and Health Services



Comments

For this study there are now sufficient publications in public health and health services to undertake an analysis of the discipline; however like all medical and health sciences research, ARC-funded output has only a minor role to play. The ARC-funded research has few highly cited publications, and though its journals have an impact above the world average, the actual citations that its publications achieve is below the average for the discipline.

3.59 Subfield: Interdisciplinary Life Sciences

Field: Science – General

A number of WoS subject categories span many disciplines and cannot be legitimately allocated to a specific field, though all focus primarily on the life sciences. The subject categories concerned are: Marine and freshwater biology; Development biology; Virology; Mycology; and Reproductive biology. This section separately analyses this set of journals.

Table 125. Relative Citation and Journal Impact Rates, 2001–2005: Interdisciplinary Life Sciences

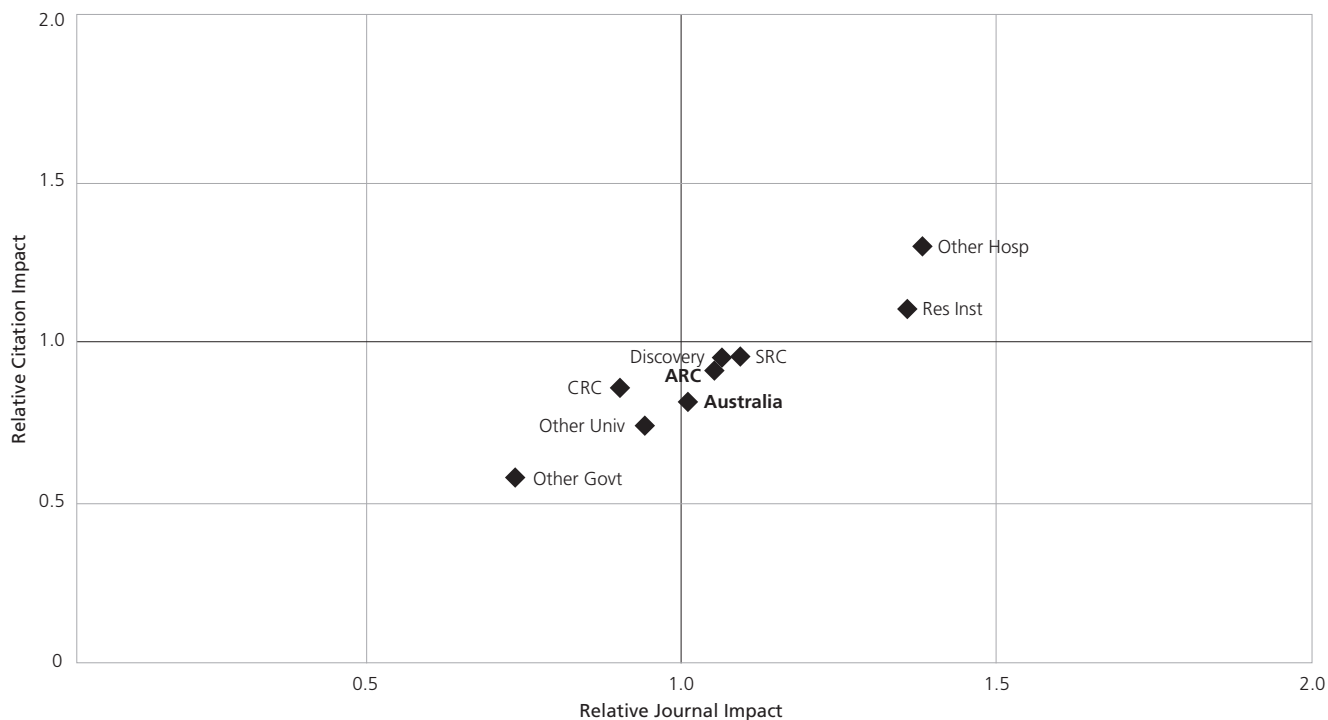
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	316	1695	1.06	0.95
ARC – Special Research Centres	143	853	1.09	0.96
ARC Total	648	3188	1.05	0.92
Cooperative Research Centres	340	1658	0.89	0.87
Other Government	894	3068	0.73	0.58
Other Hospital	315	2596	1.36	1.32
Other University	2599	11446	0.94	0.75
Research Institutes	895	5989	1.33	1.10
Australia	5057	24502	1.00	0.83

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 126. Centile Distribution of Publications, 2001–2005: Interdisciplinary Life Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	6	1.9%	21	6.6%	24	7.6%	55	17.4%	79	25.0%	131	41.5%	316
ARC – Special Res Ctrs	1	0.7%	7	4.9%	5	3.5%	11	7.7%	46	32.2%	73	51.0%	143
ARC Total	9	1.4%	41	6.3%	40	6.2%	94	14.5%	180	27.8%	284	43.5%	648
Cooperative Res Ctrs	9	2.6%	26	7.6%	16	4.7%	48	14.1%	93	27.4%	148	43.5%	340
Other Government	7	0.8%	27	3.0%	34	3.8%	85	9.5%	248	27.7%	493	55.1%	894
Other Hospital	9	2.9%	22	7.0%	18	5.7%	38	12.1%	103	32.7%	125	39.7%	315
Other University	20	0.8%	102	3.9%	124	4.8%	284	10.9%	749	28.8%	1320	50.8%	2599
Research Institutes	7	0.8%	45	5.0%	42	4.7%	107	12.0%	287	32.1%	407	45.5%	895
Australia	52	1.0%	233	4.6%	257	5.1%	586	11.6%	1461	28.9%	2468	48.8%	5057

Figure 64. Relative Citation and Journal Impact: Interdisciplinary Life Sciences



Comments

This diverse set of journals covers output from many disciplines, with widely varying citation practices. It is safe to say that research focussing on human issues will be more heavily cited than those focussing on plants and animals. It would therefore be expected that publications from the Other Research Institutes and Other Hospitals, with their strong focus on human research, would have the highest rates of citation per publication. Figure 64 shows that this expectation is met.

To accurately interpret the performance of sectors, it is necessary to delve more deeply into the data to determine in which aspects of the life sciences each is most active. However, some indication of the likely outcome of such an analysis can be gleaned from Table 4, which distributes all publications from sectors across fields and subfields of research. This shows the output of CRCs and the Other Government sectors more heavily concentrate in plant and animal sciences than most other sectors. Their position in the bottom left-hand quadrant of Figure 64 is therefore not surprising.

In aggregate, Australia's citation performance falls below the world average. This is due in part, but not entirely, to Australia's greater concentration of research in animal and plant sciences than is the case for most other nations. The ARC average is higher than the Australian figure, but still marginally below the world benchmark. The average impact of the journals in which its output appears is only slightly above the discipline average, but this is also likely to be due to the focus of its research.

3.60 Subfield: Multidisciplinary Sciences

Field: Science – General

Some journals indexed by WoS cover a wide variety of disciplines and cannot be classified to a particular field, or even subfield. WoS groups them together in a ‘Multidisciplinary Sciences’ subject category, and it covers journals such as *Nature*, *Science*, *Proceedings of the National Academy of Sciences*, etc.

Table 127. Relative Citation and Journal Impact Rates, 2001–2005: Multidisciplinary sciences

SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	248	4294	5.80	1.35
ARC Total	381	6458	5.87	1.43
Other Government	108	1323	4.78	0.97
Other University	728	8326	3.94	0.87
Research Institutes	269	6743	5.86	2.15
Australia	1555	27130	4.59	1.37

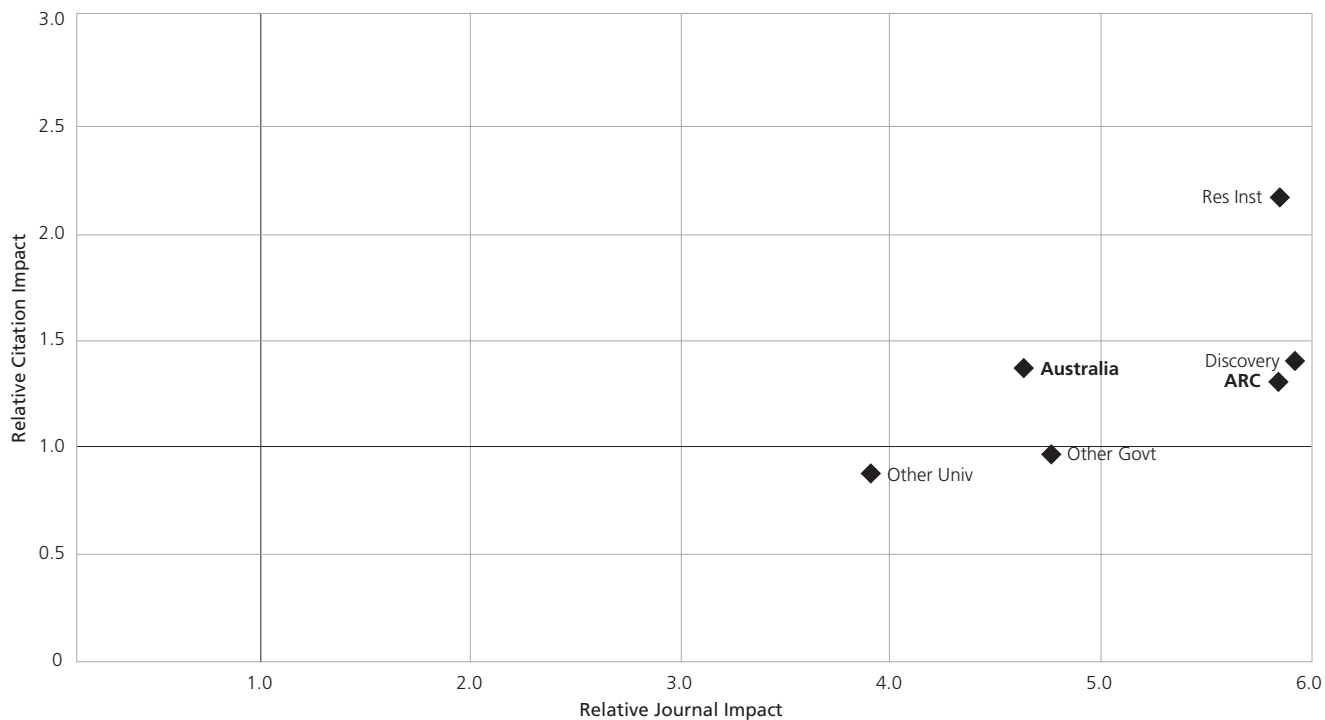
NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 128. Centile Distribution of Publications, 2001–2005: Multidisciplinary sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	28	11.3%	32	13.0%	28	11.3%	35	14.2%	61	24.7%	63	25.5%	247
ARC Total	49	12.9%	45	11.8%	43	11.3%	45	11.8%	88	23.2%	110	28.9%	380
Other Government	14	13.0%	9	8.3%	9	8.3%	9	8.3%	26	24.1%	41	38.0%	108
Other University	48	6.6%	65	8.9%	48	6.6%	79	10.9%	172	23.6%	316	43.4%	728
Research Institutes	23	8.6%	56	20.8%	28	10.4%	47	17.5%	61	22.7%	54	20.1%	269
Australia	135	8.7%	185	11.9%	130	8.4%	192	12.4%	365	23.5%	547	35.2%	1554

Note: There were a very small number of publications for which centile data was not provided by Thomson Reuters, hence the slight discrepancy in total publications compared to the RCI/RJI table.

Figure 65. Relative Citation and Journal Impact: Multidisciplinary sciences



Comments

Studies have shown that the high impact of these journals is driven by the biomedical articles they contain, and that articles relating to other fields of research, while more highly cited than they might be if they appeared in a field-specific journal, receive significantly less citations than the biomedical ones. It is therefore not surprising that the relative citation impact for the Research Institutes sector is significantly above the ARC level, even though the output for both is in the very high impact journals of this set.

3.61 Field: Economics

WoS journal sets analysed: Economics; Agricultural economics and policy; Social sciences, mathematical methods.

Table 129. Relative Citation and Journal Impact Rates, 2001–2005: Economics

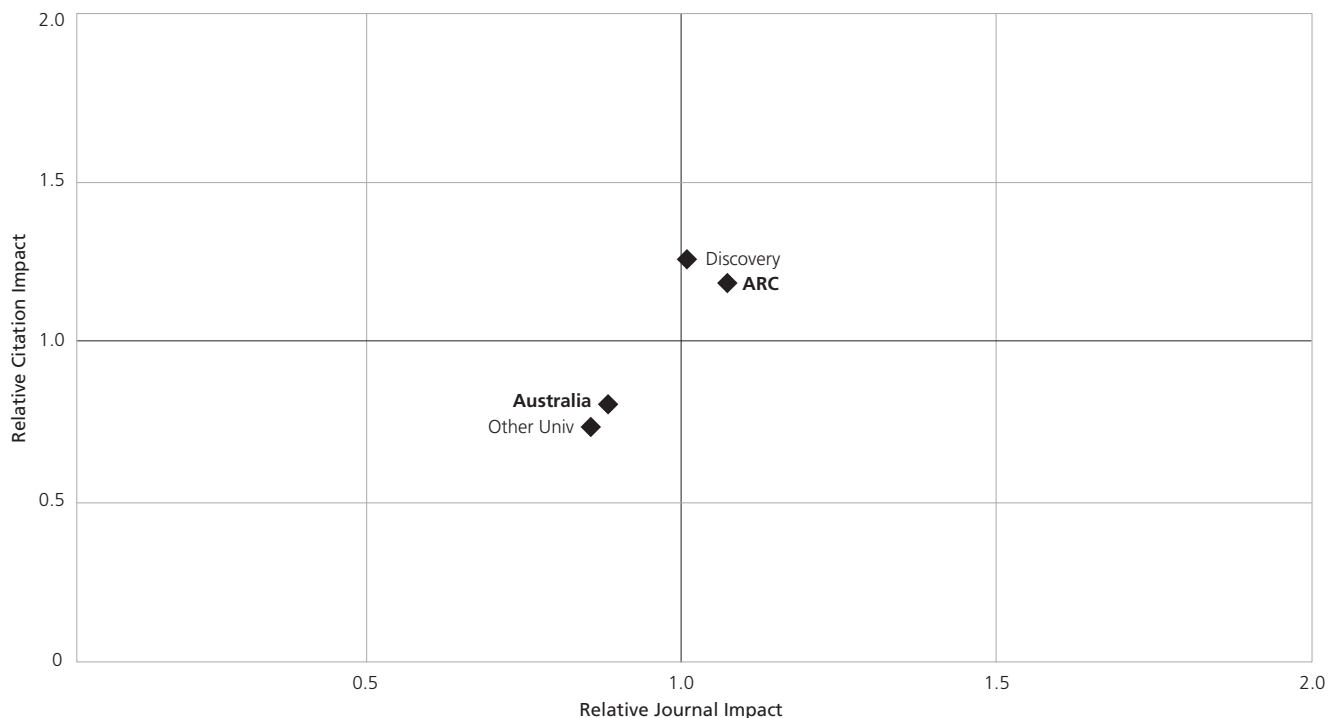
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	136	236	1.01	1.23
ARC Total	202	320	1.08	1.18
Other University	1311	1569	0.88	0.70
Australia	1612	2044	0.91	0.77

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 130. Centile Distribution of Publications, 2001–2005 – Economics

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	1	0.7%	6	4.4%	10	7.4%	11	8.1%	44	32.4%	64	47.1%	136
ARC Total	3	1.5%	7	3.5%	14	6.9%	16	7.9%	62	30.7%	100	49.5%	202
Other University	4	0.3%	33	2.5%	37	2.8%	106	8.1%	293	22.3%	838	63.9%	1311
Australia	8	0.5%	44	2.7%	59	3.7%	130	8.1%	380	23.6%	991	61.5%	1612

Figure 66. Relative Citation and Journal Impact: Economics



Comments

With just over 200 publications, the ARC (primarily through the Discovery Projects scheme) has only a small influence on Australia’s aggregate performance. The bulk of journal output in this field is from the Other University sector. However, the group of publications that is identified with ARC support has a much higher relative citation impact than other Australian output, and lies above the world average. This performance is also reflected in the data on Australia’s most highly cited economics publications.

It must be remembered that only a small proportion of publications in economics are in the indexed journal literature, and this analysis may not be representative of the discipline as a whole.

3.62 Field: Commerce, Management, Tourism and Services

WoS journal sets analysed: Business; Business, finance; Industrial relations and labour; Management; Transportation.

Table 131. Relative Citation and Journal Impact Rates, 2001–2005: Commerce, Management, Tourism and Services

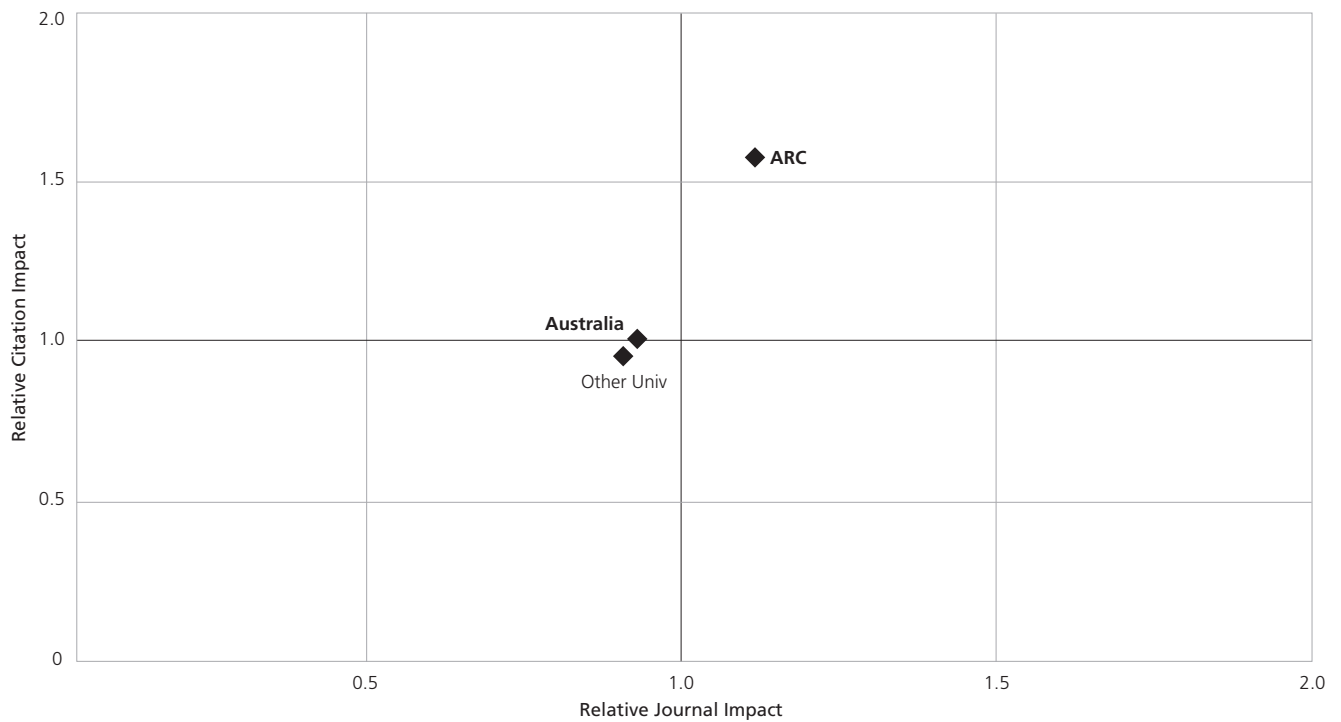
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	113	232	1.12	1.56
Other University	1291	1943	0.91	0.95
Australia	1479	2306	0.92	1.00

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 132. Centile Distribution of Publications, 2001–2005: Commerce, Management, Tourism and Services

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total	2	1.8%	5	4.4%	10	8.8%	12	10.6%	29	25.7%	55	48.7%	113
Other University	5	0.4%	42	3.3%	64	5.0%	103	8.0%	334	25.9%	743	57.6%	1291
Australia	7	0.5%	50	3.4%	78	5.3%	123	8.3%	384	26.0%	837	56.6%	1479

Figure 67. Relative Citation and Journal Impact: Commerce, Management, Tourism and Services



Comments

For this study there are now sufficient publications in commerce, management, tourism and services to undertake an analysis of the discipline; however, like economics research, ARC-funded output has only a minor role to play. Nevertheless, ARC output has a relative citation impact well above the discipline benchmark, and its articles are appearing in journals of above average impact.

It must be remembered that only a small proportion of publications in commerce, management, tourism and services are in the indexed journal literature, and this analysis may not be representative of the discipline as a whole.

3.63 Field: Studies in Human Society

WoS journal sets analysed: Sociology; Ethnic studies; Social issues; Social work; Anthropology; Geography (SSCI); Demography; Family studies; History and philosophy of science; Women's studies.

Table 133. Relative Citation and Journal Impact Rates, 2001–2005: Studies in Human Society

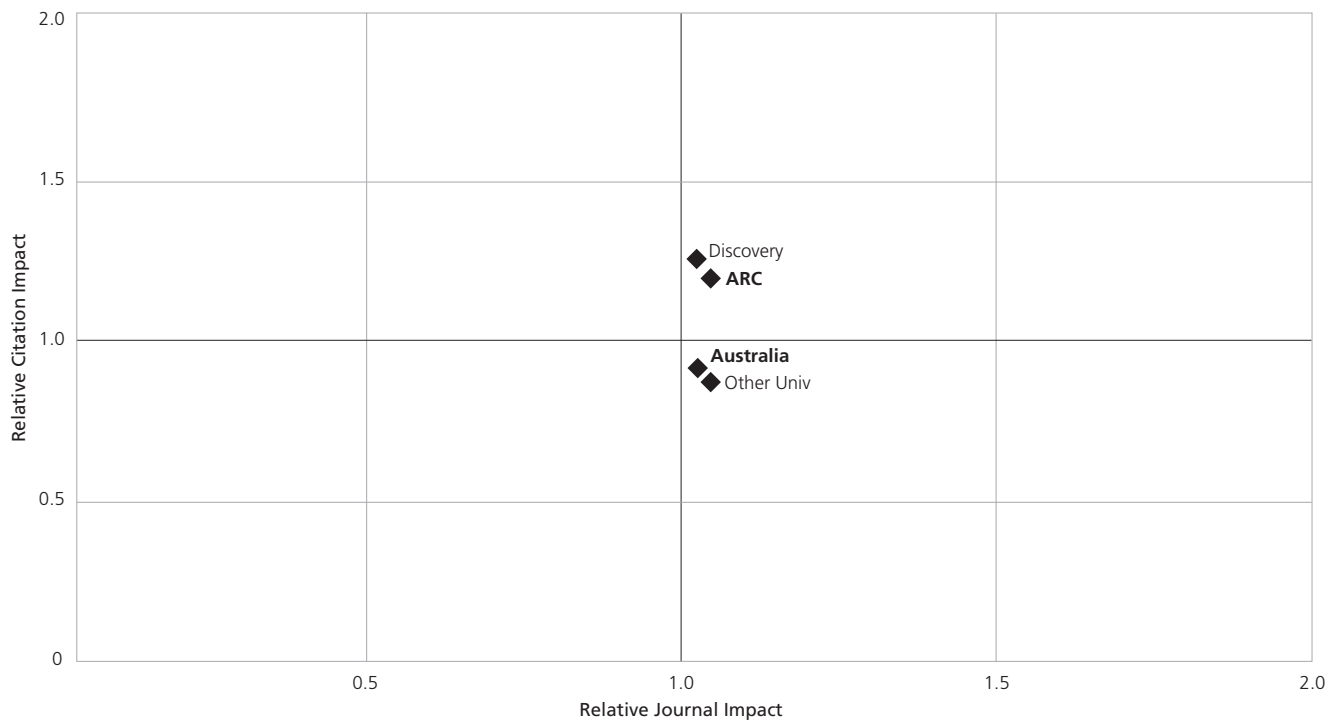
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	139	250	1.03	1.24
ARC Total	211	339	1.06	1.19
Other University	1664	2147	1.05	0.86
Australia	2013	2663	1.03	0.90

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 134. Centile Distribution of Publications, 2001–2005: Studies in Human Society

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects		0.0%	11	7.9%	13	9.4%	12	8.6%	37	26.6%	66	47.5%	139
ARC Total	1	0.5%	11	5.2%	17	8.1%	24	11.4%	56	26.5%	102	48.3%	211
Other University	8	0.5%	56	3.4%	63	3.8%	148	8.9%	392	23.6%	997	59.9%	1664
Australia	9	0.4%	70	3.5%	85	4.2%	182	9.0%	475	23.6%	1192	59.2%	2013

Figure 68. Relative Citation and Journal Impact: Studies in Human Society



Comments

As with other subfields in the social sciences, the ARC accounts for a small proportion of Australian publications in the discipline (10.5%). Its small set has a higher relative citation impact than the country as a whole, and is above the world benchmark. Publications linked to ARC funding appear in journals close to the world average.

It must be remembered that only a small proportion of publications in Studies in Human Society are in the indexed journal literature, and this analysis may not be representative of the discipline as a whole.

3.64 Field: Behavioural and Cognitive Sciences

WoS journal sets analysed: Psychology; Psychology, applied; Psychology, experimental; Psychology, biological; Psychology, developmental; Psychology, social; Psychology, mathematical; Psychology, psychoanalysis; Psychology, clinical; Language and linguistics; Behavioural sciences.

Table 135. Relative Citation and Journal Impact Rates, 2001–2005: Behavioural and Cognitive Sciences

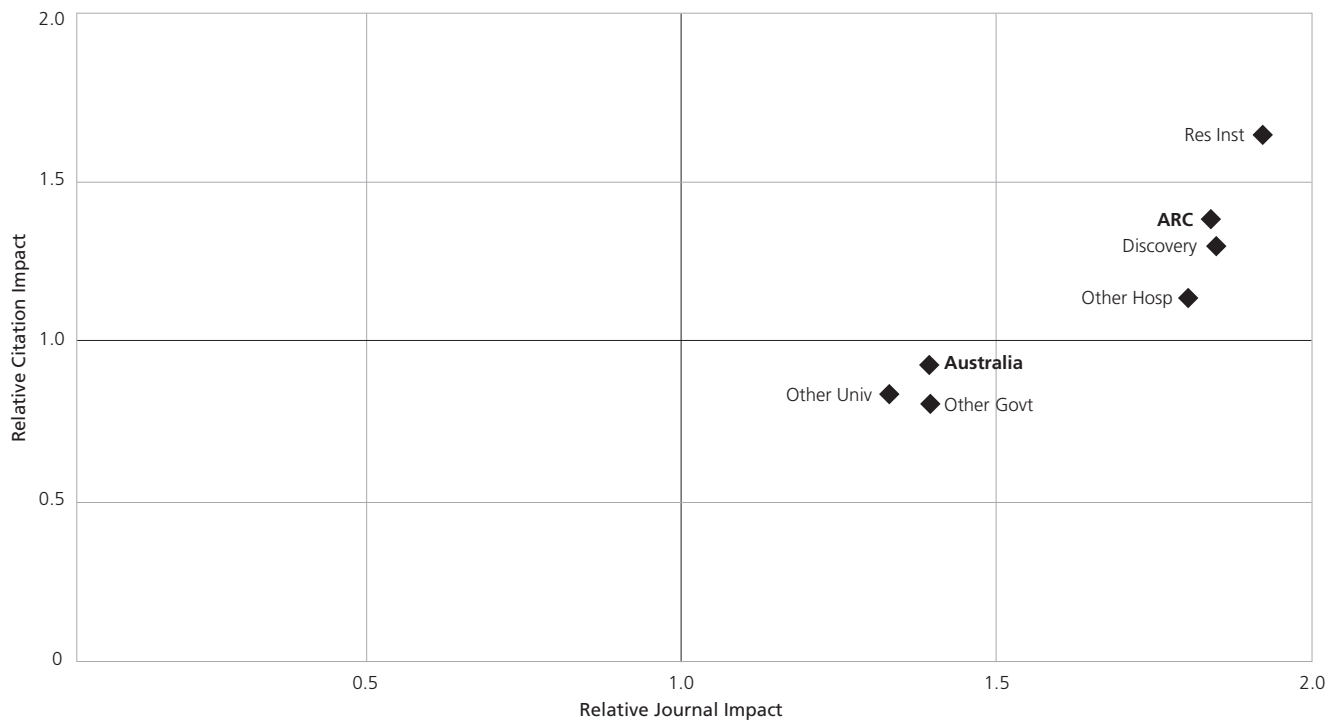
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC – Discovery Projects	595	2218	1.84	1.32
ARC Total	772	3012	1.83	1.41
Other Government	166	439	1.40	0.80
Other Hospital	332	1140	1.78	1.15
Other University	3676	9703	1.34	0.83
Research Institutes	135	674	1.93	1.65
Australia	4751	13755	1.40	0.94

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 136. Centile Distribution of Publications, 2001–2005: Behavioural and Cognitive Sciences

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC – Discovery Projects	6	1.0%	48	8.1%	50	8.4%	92	15.5%	196	32.9%	203	34.1%	595
ARC Total	8	1.0%	58	7.5%	64	8.3%	111	14.4%	246	31.9%	285	36.9%	772
Other Government	1	0.6%	5	3.0%	4	2.4%	25	15.1%	47	28.3%	84	50.6%	166
Other Hospital	3	0.9%	9	2.7%	20	6.0%	40	12.0%	97	29.2%	163	49.1%	332
Other University	24	0.7%	115	3.1%	180	4.9%	332	9.0%	911	24.8%	2114	57.5%	3676
Research Institutes	1	0.7%	6	4.4%	14	10.4%	17	12.6%	40	29.6%	57	42.2%	135
Australia	34	0.7%	183	3.9%	264	5.6%	472	9.9%	1233	26.0%	2565	54.0%	4751

Figure 69. Relative Citation and Journal Impact: Behavioural and Cognitive Sciences



Comments

Behavioural and Cognitive Sciences has the largest set of WoS publications of any of the social science disciplines and so for a number of sectors a more reliable citation analysis can be undertaken using larger journal sets. In addition, compared to other social sciences, journal publication in this discipline is the more common mode of research dissemination.

The largest set of publications come, as in most disciplines, from the other university sector and it is the performance of this set that largely drives aggregate Australian performance, which lies below the world average. The Discovery Projects scheme, and the ARC in aggregate, have strong citation performance, with publications appearing in high impact journals and average citation rates well above the world level.

The Research Institutes sector has the highest relative citation impact in the field, and is publishing in the highest impact journals.

3.65 Field: History and Archaeology

WoS journal sets analysed: Archaeology; Classics; History.

Table 137. Relative Citation and Journal Impact Rates, 2001–2005: History and Archaeology

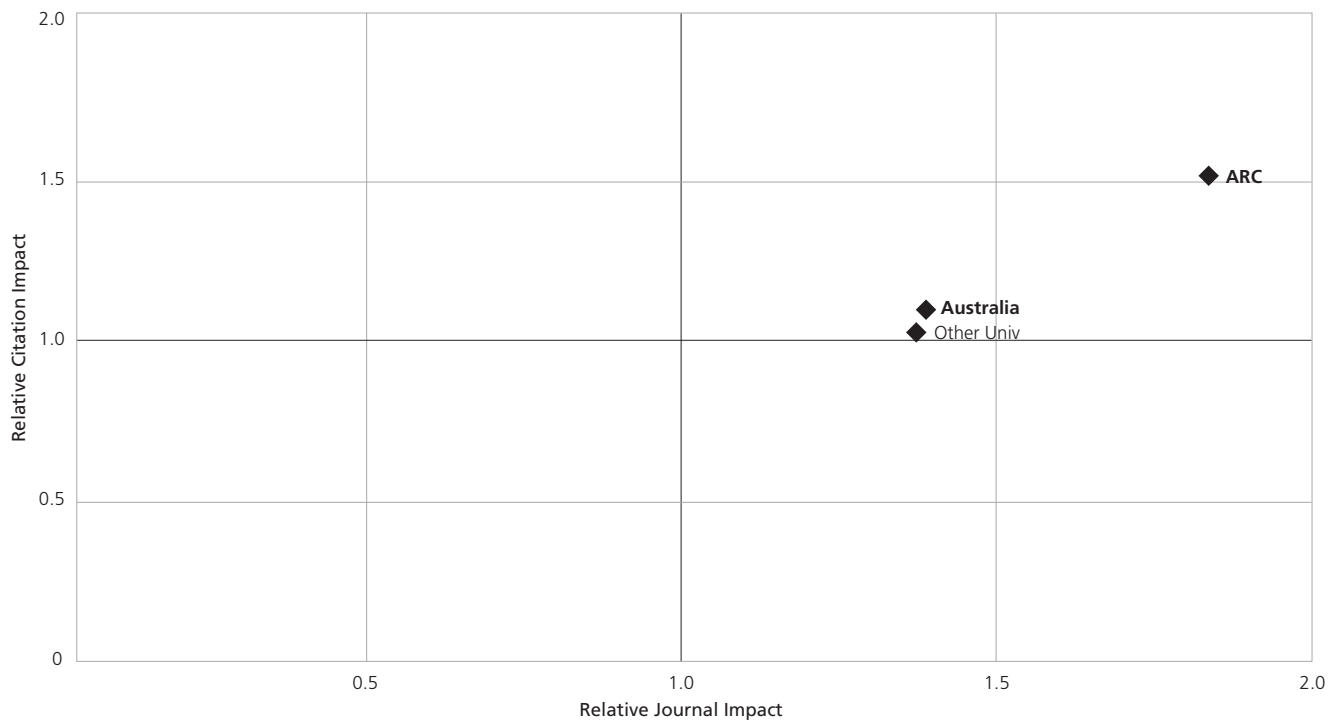
SCHEME/SECTOR	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
ARC Total	110	64	1.81	1.50
Other University	694	287	1.34	1.02
Australia	846	372	1.37	1.09

NOTE: Relative citation impact takes into account the proportion of output appearing in each year from 2001–2005. Direct comparisons cannot be made between sectors and schemes on the basis of citation per publication calculations.

Table 138. Centile Distribution of Publications, 2001–2005: History and Archaeology

SCHEME/SECTOR	TOP 1%		TOP 2–5%		TOP 6–10%		TOP 11–20%		TOP 21–50%		BOTTOM 50%		TOTAL
ARC Total		0.0%	7	6.4%	7	6.4%	11	10.0%	22	20.0%	63	57.3%	110
Other University	8	1.2%	20	2.9%	30	4.3%	69	9.9%	77	11.1%	490	70.6%	694
Australia	8	0.9%	27	3.2%	37	4.4%	83	9.8%	106	12.5%	585	69.1%	846

Figure 70. Relative Citation and Journal Impact: History and Archaeology



Comments

For this study there are now sufficient publications in history and archaeology to undertake an analysis of the discipline. ARC output has a relative citation impact well above the discipline benchmark, and its articles are appearing in journals of above-average impact.

It must be remembered that only a small proportion of publications in history and archaeology are in the indexed journal literature, and this analysis may not be representative of the discipline as a whole.

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T1 The Research Evaluation and Policy Project database

The REPP database was created from data files purchased from Thomson Reuters and at the time this study covered the period 1981–2007. It captures all publications with an Australian address in the Thomson Reuters Web of Science's (WoS) three main indices: Science Citation Index (SCI), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI). The database also contains the yearly counts of citations for Australian publications.

The focus of the database is the departmental and the institutional address(es) given for each publication rather than the names of the authors. REPP 'cleans' the addresses in the database to enable analysis to be done at different levels of aggregation. 'Cleaning' means ensuring that all variations of the same address are identified and that all publications with variants of that address are allocated the one 'standardised address'. The standardised addresses for all Australian universities and other major research institutions are set up in a hierarchical format – from the institution, down through faculties or schools, to the department – enabling tabulations at these different levels of aggregation to be produced. Addresses in most other sectors are 'cleaned' only to the institution level. The REPP database as it now stands contains over 440,000 Australian publications.

There is no consensus in the research policy community about the 'best' way to count publications and citations; we list a series of options available in the REPP database and which have been used for the tables compiled for this analysis:

- the types of publications counted were limited to articles and review articles;
- data was compiled on a publication-year basis, not a tape-year basis (i.e. the year the item was published, not the year its details were entered in WoS's database);
- the period of focus was 2001–2005; and
- the analysis was based on whole publication counts (i.e. where more than one sector collaborated in a publication, each was given a count of 1 for that publication⁵).

⁵ The exception to this rule was in the delineation of comparator sectors – see the discussion in section T6.

T2 Assignment of multi-institutional addresses

Most publications in the REPP database list only one institution in the organisation field of the address. A small proportion, however, refer to two institutions, a phenomenon almost exclusively found in the medical and health sciences. Two examples of this type of address are:

- WOOLLONGABBA/UNIV QUEENSLAND, PRINCESS ALEXANDRA HOSP, DEPT MED
- SYDNEY/GARVAN INST MED RES, UNIV NEW S WALES

Three interpretations can be applied to this form of address:

- i) it represents a collaboration between authors from the two institutions; or
- ii) it represents a joint appointment for a single author; or
- iii) the second segment of the address merely represents the physical location of the first-listed institution.

REPP undertook extensive consultation with universities and funding agencies before deciding how to treat this type of address. These discussions led to the consistent view that in the case of a multi-address referring to a university and a hospital, the publication should be attributed to the university. It was considered that the hospital part of the address was, in the vast majority of cases, merely a reflection of the university department's physical location. This was supported by the distribution of such addresses, which were principally in clinically-oriented faculty of medicine departments.

In the case of multi-addresses referring to a university and a medical research institute, there were more divergent views. However the clear preference of the funding agencies, in particular the ARC and the NHMRC, was to allocate these publications to the medical research institutes, and REPP has adopted this strategy. Relatively few publications are affected by this decision – for example, at The University of Sydney, there were less than 10 such publications per year. It must be noted, also, that these publications may still have been allocated to the university as in some instances additional addresses (from a multi-authored paper) will refer to the university specifically.

T3 Field of research classification

The ideal scenario for field of research analysis is to classify each publication separately. This is usually impossible for large-scale studies, and standard practice is to classify the journal which carries the publication (Narin 1976).

The makeup of journal sets for field of research analysis rests on WoS's classification schemes. WoS has its own descriptive classification system involving around 200 subject categories, and REPP has (for a number of previous exercises) translated these as closely as possible into the fields and subfields of the Research Fields, Courses, and Disciplines (RFCD) classification scheme (ABS 1998). The RFCD was prepared by the Australian Bureau of Statistics for use in the measurement and analysis of research and experimental development undertaken in Australia. Most WoS subject categories slot neatly into one of the RFCD subfields, but some problems were encountered. For example, in contrast to the RFCD, WoS does not distinguish between research that focuses on animals and that which focuses on humans. Subject categories such as Physiology, Virology and Parasitology can have elements of two or more RFCD fields in their composition. To avoid allocating too many categories to interdisciplinary codes, REPP classified a journal set to a particular field where more than half of the journals appeared clearly related to that field. The subject categories ascribed to each RFCD field and subfield are shown at the start of each analysis in Section 3.

It should be noted that WoS allocates some journals to more than one subject category with the effect of some double-counting between fields and/or subfields.

After the commencement of this study, the ABS updated its RFCD classification and published a new Australian and New Zealand Standard Research Classification (ABS 2008). In conjunction with the Excellence in Research for Australia initiative, sets of journals are being developed to align with this new classification scheme, but at the time this report was completed, this was still to be finalised.

T4 Small numbers

A special note of caution is required concerning the small numbers of publications tabulated in some research fields. In the WoS system as a whole, many publications receive no citations at all, and the majority receive less than 5 citations (Garfield 1989). The number achieving a high citation count is extremely small. The very nature of citation practice means that averages can be disproportionately affected by a single highly cited publication. The smaller the number of publications being analysed, the greater the effect such an item will have on the average.

For the bibliometric measures used in this analysis, citation information based on any units with less than 100 publications has been omitted.

Our experience also suggests that extra caution should be used for citation figures based on units with between 100 and 200 publications.

T5 WoS coverage

Before any discussion of publications and citations occurs, it is important to be clear about the proportion of research output from the units under study that is covered by bibliometric measures.

Fields of research vary in the extent to which journal publication can be regarded as the normal mode of research dissemination. The most extensive data relevant to this subject is contained in the Research Quantum Publications Collection from the (then) Department of Employment, Education, Training and Youth Affairs which has been collected yearly since 1993. Table T1 draws on publication details for 1999 to 2001 that universities collect for reporting to the Department of Education, Employment and Workplace Relations. This data, analysed in the Experimental Database constructed by REPP in the course of a recent ARC Linkage Project, compares the WoS coverage of publications in the field of medical and health science.

The data in Table T1 clearly show why bibliometric analysis is problematic in some research fields, particularly disciplines in the applied sciences, social sciences and humanities. Much of the research in these fields is not published in journal articles, and even when it is, the capture rate in WoS indices is very small.

While this study presents analyses whenever the ARC output reaches 100 publications, it is clear from Table T1 that care must be taken in judging the overall performance of a discipline when only a small proportion of the total is indexed journals.

Table T1. Distribution of research by type of publication and field, 1999–2001

Field	DEST PUBLICATION CATEGORIES				WOS PERCENTAGE OF	
	Books	Book Chapters	Journal Articles	Conf. Papers	All Pubs	Journal Articles
Chemical Sciences	0.2	2.1	95.7	1.9	84.6	88.0
Biological Sciences	0.3	6.3	90.7	2.7	75.6	81.7
Physical Sciences	0.1	2.6	90.0	7.3	74.3	82.0
Medical and Health sciences	0.3	6.3	90.5	2.9	69.3	73.7
Agriculture	0.4	5.9	79.0	14.7	63.6	78.7
Earth Sciences	0.9	7.7	82.2	9.2	60.3	72.7
Mathematical Sciences	0.7	4.3	83.8	11.2	56.8	67.2
Psychology	1.5	17.4	76.2	4.9	53.6	69.4
Engineering	0.4	2.5	52.0	45.1	37.2	71.0
Philosophy	6.0	23.8	64.8	5.4	28.1	40.3
Economics	2.9	24.5	64.5	8.0	24.4	37.2
Human Society	3.5	27.8	63.0	5.6	18.7	28.3
Politics and Policy	5.8	37.3	46.1	10.8	16.5	33.6
Computing, Information Sciences	0.4	4.6	32.8	62.3	15.9	47.8
History	11.6	34.0	50.6	3.8	14.5	27.6
Management	1.3	11.7	52.9	34.0	12.6	23.2
Language	6.5	34.0	51.8	7.6	11.4	19.3
Education	2.5	19.3	54.5	23.6	9.7	17.2
The Arts	4.4	20.8	54.5	20.3	9.5	16.0
Architecture	3.0	17.8	35.6	43.6	6.4	17.7
Law	4.1	22.1	71.9	1.9	5.4	6.6
Journalism, library	3.4	15.2	57.2	24.2	4.4	7.6

Source: Derived from ARC Linkage Project experimental database created by REPP (unpublished).

T6 Identification of publications from ARC schemes

A number of methods were used to identify ARC publications resulting from research funded through different ARC grant programs.

T6.1 Discovery and Linkage Projects

T6.1.1 Background to methodology

Discovery Projects and Linkage Projects grants are awarded to individual researchers, or groups of researchers, and the publications linked to these schemes cannot be identified directly from the REPP database. The final reports of grants were used as the source of this information. This methodology is not ideal. A detailed study undertaken in 2000 for the NHMRC (Butler and Biglia 2001) showed that approximately one-third of the published output of a grant does not appear until after the completion of the project, and would be omitted from any analysis resting on details contained in final reports.

The same NHMRC study referred to above showed that extracting acknowledgments information from journal articles accurately identifies publications resulting from a funding body in aggregate, but it does not usually differentiate between the different funding schemes administered by that body. This was particularly significant for the ARC where it was important to differentiate

between Discovery Projects and Linkage Projects (and their predecessors). Hence the decision was made to use the details from final reports, rather than the acknowledgments on publications, while acknowledging the limitations of this methodology.

T6.1.2 Outline of methodology

The methodology aimed at identifying as many of the publications as possible from the period 2001 to 2005 that resulted from ARC-funded research. An outline of the methodology used to identify publications resulting from research funded by the ARC Discovery Projects and Linkage Projects schemes is set out in the box below, followed by a detailed discussion of some aspects of the methodology.

Step 1: An electronic list of all successful grants commencing between 1999 and 2003 was provided by the ARC.

Step 2: Hard copy of the publication output from all grants for which a final report had been received was provided by the ARC.

Step 3: Bibliographic details for all publications in the REPP database for 2001 to 2005, limited to articles and reviews, were extracted.

Step 4: Bibliographic details for journal articles listed in the final reports were matched against the details from the REPP database.

Step 5: Where the final reports provided all bibliographic details and a match was made, the relevant grant number was appended to the publication record.

Step 6: Where the final reports provided incomplete bibliographic details (e.g. at the time of filing the report an article was 'in press' or 'accepted') a search was made of the REPP list of publications to determine whether a match could be made on the limited information provided.

Step 7: Analysis of the resulting publication sets was undertaken.

T6.1.3 Discussion of the methodology

Steps 1–5

The project sought to identify as many 2001–2005 publications as possible that resulted from ARC funding support. Using experience from prior studies, grants that commenced between 1999 and 2003 were targeted. Grants that commenced prior to 1999 were likely to have filed final reports in or prior to 2001, and would therefore have contained few publications for the relevant period. Even though grants that commenced in 2004 or 2005 would have produced some publications for the relevant period, very few had been completed and filed final reports. Coverage of Discovery Projects/DIRD and Linkage Projects grants that commenced between 1999 and 2003 are detailed in tables T2 and T3 below.

Details were obtained from over 85% of the Discovery Projects and DIRD grants that were identified as the most relevant for the study. Full coverage was not achieved, and some grants that commenced outside the target range would have produced publications for the relevant period. However, the proportion of ARC-funded output for 2001–2005, while an underestimate, is sufficiently comprehensive to be confident that the analyses presented in the report will paint an accurate picture.

The coverage of the Linkage Projects scheme was less comprehensive, with only 77% of final reports available; however it was much more complete than the previous study where only 48% of final reports were available. It can be seen that publication in ISI journals is far less common from projects funded by this scheme than it is for other ARC schemes. This is in large part due to the applied focus of the research.

Table T2. Coverage of 1999–2003 Discovery Projects and DIRD Schemes

YEAR GRANT COMMENCED	NO. AWARDED	FINAL REPORTS AVAILABLE		GRANTS LISTING WOS JOURNAL PUBLICATIONS	
		No.	%	No.	%
1999	631	573	91	411	65
2000	636	595	94	451	71
2001	667	628	94	474	71
2002	790	694	88	492	62
2003	948	689	73	451	48
Total	3679	3181	86	2279	62

Table T3. Coverage of 1999–2003 Linkage Projects Scheme

YEAR GRANT COMMENCED	NO. AWARDED	FINAL REPORTS AVAILABLE		GRANTS LISTING WOS JOURNAL PUBLICATIONS	
		No.	%	No.	%
1999	405	346	85	143	35
2000	458	378	83	154	34
2001	485	414	85	154	32
2002	470	364	77	141	30
2003	588	361	61	99	17
Total	2406	1863	77	691	29

Step 6:

In some instances, incomplete bibliographic details were provided for publications. This most commonly occurred where, at the time of submitting the final report, a publication was 'in press', 'submitted' or 'accepted'. A search was made of the REPP list of publications to determine whether a match could be made on the limited information provided. Where basic information, such as article title, journal and list of authors, could be matched to a single publication in the database (and could only be matched to one), it was included in the analysis. It is possible that incorrect matches might have been made, but it was felt that errors due to this would be insignificant.

T6.2 Special Research Centres; Key Centres for Teaching and Research

The ARC provided a comprehensive list of all SRCs and Key Centres that were funded during the 5-year period covered by the study. The REPP database is structured so that publications can be attributed to the institutions of their authors. This attribution is also possible down to the level of faculty and department (or their equivalent) in universities, CSIRO and some government departments. In Australian universities it is possible to assign over 90% of all publications to departments (Bourke and Butler 1998).

Due to the structure of the REPP database, it was a straightforward task to identify the publications for each centre. Where a centre was not funded by the ARC for the full 5-year period, only those publications deemed relevant were selected. It was assumed there would be a year's delay between the commencement of funding and the appearance in the WoS databases of publications with the centre's address on it. As a result, publications for 2003 to 2005 were selected for centres whose funding commenced in 2002. Publications from centres whose funding ceased during the 5-year period were selected for 1 additional year after the termination of funding. For example, publications for 2001 and 2002 were selected for centres whose funding ceased in 2001. It was felt that the 1-year time-lag, while not an entirely accurate reflection of the full delay between receipt of funding and the publication of articles resulting from that support, was a more precise reflection of funding impact than the option of not applying any time-lag at all (although in reality the lag is likely to be somewhat longer).

T6.3 Fellowships awards

A list of recipients of research fellowships across the period 1996–2005 was provided by the ARC. The REPP database was then interrogated to identify publications from 2001 to 2005 for each researcher, using institutional affiliation data to ensure the correct person was identified. Where a researcher was not on a fellowship for the full 5-year period, publications were restricted to the relevant years. As with SRCs and KCs, a 1-year time-lag was assumed between the start or end of funding and the article publication date.

T7 Delineation of comparator sectors

The methodology used in this analysis aimed at creating sectors with quite distinct characteristics and with as little overlap as possible. *It will become clear from the methodology employed that some of the sectors created do not bear a strong resemblance to their commonly perceived definition.*

T7.1 Cooperative Research Centres

The sector covers all publications from CRCs that received funding during the period 2001 to 2005. A full list of CRCs can be obtained from the URL: <https://www.crc.gov.au/>.

CRCs, by their very nature, involve a high level of collaboration between institutions. In some instances, authors list their main institutional affiliation in the address they provide for publications, but the vast majority also acknowledge their association with the CRC. This sector brings together all components of CRCs, whether the authors are staff members of CSIRO, universities, hospitals, private enterprises, government research agencies, or the like.

T7.2 Other Government publications

The sector covers 2001 to 2005 publications from all remaining government departments and agencies including ANSTO, AAO, AIMS, etc; however, publications that were identified in a number of other sectors were specifically excluded, viz. those publications identified with ARC schemes, the CRC sector or the Research Institutes sector. In this respect, *the sector is not a true reflection of the total government sector output, but is more accurately a reflection of output funded principally through departmental and agency recurrent funds. Publications resulting from NHMRC funding, however, will be included in this sector.*

T7.3 Other Hospital publications

The sector covers 2001 to 2005 publications from all Australian hospitals, both public and private institutions; however publications that were identified in a number of other sectors were specifically excluded, viz. those publications identified with ARC schemes, the CRC sector or the Research Institutes sector. In this respect, *the sector is not a true reflection of total hospital output, but is more accurately a reflection of output funded principally through general operating grants and funding agencies other than ARC. Publications resulting from NHMRC funding, however, will be included in this sector.*

T7.4 Other University publications

The sector covers 2001 to 2005 publications from all Australian universities; however publications that were identified in a number of other sectors were specifically excluded, viz. those publications identified with ARC schemes, the CRC sector or the Research Institutes sector. In this respect, *the sector is not a true reflection of total university output, but is more accurately a reflection of output*

funded principally through general operating grants and funding agencies other than the ARC. Publications resulting from NHMRC funding, however, will be included in this sector.

T7.5 Research Institutes

The sector covers all publications from full-time research institutes, specifically the members of the Australian Association of Medical Research Institutes (AAMRI) and CSIRO.

The list of AAMRI institutes is:

Baker Medical Research Institute
Bernard O'Brien Institute of Microsurgery
Bionic Ear Institute
Brain Research Institute
Centenary Institute of Cancer Medicine and Cell Biology
Centre for Eye Research Australia
Child Health Research Institute
Children's Medical Research Institute
Children's Cancer Institute Australia for Medical Research
Garvan Institute of Medical Research
Genomics Disorders Research Centre
George Institute for International Health
Hanson Institute
Heart Research Institute
Howard Florey Institute
Lions Eye Institute
Ludwig Institute for Cancer Research
Macfarlane Burnet Institute for Medical Research and Public Health
Mater Medical Research Institute
Mental Health Research Institute of Victoria
Menzies School of Health Research
Murdoch Childrens Research Institute
National Ageing Research Institute
Peter MacCallum Cancer Centre
Prince Henry's Institute of Medical Research
Prince of Wales Medical Research Institute
Queensland Institute of Medical Research
St Vincent's Research Institute
Telethon Institute for Child Health Research
Victor Chang Cardiac Research Institute
Walter and Eliza Hall Institute
Wesley Research Institute
Western Australian Institute for Medical Research
Westmead Millennium Institute
Woolcock Institute of Medical Research

T8 Overlap between ARC schemes

Given the collaborative nature of many research disciplines, it would be impossible to create completely discrete sectors without severely distorting the analysis. Less than 15% of publications are attributed to a single author and over 50% result from collaboration between two or more institutions (Butler, Biglia and Bourke 1998). The success of the methodology used in this study lies in creating sectors with quite distinct sets of publications and where the degree of overlap has been restricted.

A grid showing the overlap between pairs of ARC schemes was developed. The grid shows the extent of double-counting that occurs through each scheme being given a whole count of one for each publication it is linked to – and it therefore demonstrates why the ARC total is less than the sum of publications from each scheme. The methodology ensured that all duplications were removed in the calculation of total ARC data, and that there was no overlap between ARC publications and the comparator sectors. Table T4 also shows the total number of in-scope publications in each scheme and the total number and percentage of a scheme's publications that appear in one or more of the other sectors.

None of the schemes were composed of discrete sets of publications. This is to be expected, given the collaborative nature of basic research. The issue is particularly significant for the ARC fellowships sectors. Since these represent grants to individual researchers, and yet very few publications are written by a single author, the high level of overlap for these schemes is not surprising. The Discovery Projects and Linkage Projects schemes consist of a more discrete set of publications, but overlap still exists.

Table T4. Duplication between ARC schemes (schemes 1–10)

SCHEME										
APD	APD									
APF	136	APF								
ARF	60	65	ARF							
CE	58	88	18	CE						
Discovery	778	955	410	90	Discovery					
FF	79	150	24	152	231	FF				
KC	11	35		38	82	28	KC			
Linkage	45	118	18	7	190	27	23	Linkage		
QEII	96	36	22	48	481	47	17	16	QEII	
SRC	93	79	73	146	291	117	1	17	82	SRC
Total Publications	1621	2178	1028	574	10528	977	402	1604	1159	1863
Total Duplications	1003	1307	550	394	2963	560	171	378	633	660
% Duplications	62	60	54	69	28	57	43	24	55	35

Appendix: Detailed Statistical Tables

Appendix

Table A1. Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6)

	ARC SCHEMES											COMPARATOR SECTORS					
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEI	SRC	ARC TOT	CRC	Other Govt	Other Hosp	Other Univ	Res Inst	AUST
Mathematical Sciences	80	134	33	9	712	22	1	21	35	18	878	13	46	12	1827	90	2865
Mathematics	78	93	30	8	585	22		19	34	15	725	9	38	9	1585	69	2432
Statistics	3	44	2	2	143			4	2	3	171	6	13	5	350	39	581
Other Math Sci	4	8	1	1	53	2	1	2	3	2	65	5	7	1	190	34	301
Physical Sciences	461	795	358	339	2777	428	98	169	452	604	4584	169	600	122	5325	957	11528
Astronomical Sci	27	79	32		525	82	1	7	68	3	668	33	319		1153	433	2482
Condensed Matter	64	154	14	49	327	51	12	23	100	53	583	7	45	1	588	60	1277
Atom, Mol; Nucl Part	84	130	120	88	559	37	6	12	63	339	1034	11	79	3	1032	63	2204
Optical Physics	74	90	104	149	427	111	7	39	89	142	756	66	19	1	536	33	1417
Other Physical Sci	80	93	36	14	341	24	18	33	27	22	509	33	104	87	892	263	1797
General Phys Sci	253	418	177	240	1230	222	69	80	247	289	2120	63	187	35	2134	196	4680
Chemical Sciences	217	565	149	68	1521	216	88	239	201	209	2732	258	333	102	4664	630	8582
Physical Chemistry	106	239	39	48	514	100	7	85	82	78	981	61	83	2	1386	151	2640
Inorganic Chemistry	38	90	34	10	375	17	5	16	27	25	524	15	68	16	931	70	1597
Organic Chemistry	14	48	13		227	8	4	14	25	24	314	13	14	15	572	37	960
Analytical Chemistry	22	52	56	5	194	20	3	57	29	6	358	48	100	52	926	123	1584
Macromol Chemistry	25	110	6	13	111	47	62	33	26	15	349	65	7		374	83	874
Other Chemical Sci	1	7	1		15	5	2	7	5	2	39	49	42		246	80	445
General Chemical Sci	32	133	23	6	330	41	12	48	36	75	583	35	81	21	996	152	1818
Earth Sciences	177	111	68	1	922	18	43	176	110	367	1596	405	1058		3259	921	6881
Geology	70	31	25	1	272	2	11	29	53	87	438	49	161		883	120	1627
Oceanography	23	15	1		150	3	1	18	16	20	207	124	277		580	233	1289
Atmospheric Sci	11	17	6		151	7		39	2	3	208	92	330		434	311	1266
Other Earth Sci	22		4		64		15	20	13	3	120	38	69		333	64	591
General Earth Sci	72	51	21		363	8	10	62	28	164	633	191	310		1379	312	2690
GeoSci	40	46	17		320	12	17	50	28	115	512	73	186		837	188	1729
Biological Sciences	367	437	312	95	2326	116	85	361	173	326	3663	1029	2117	1260	9983	4237	20407
Biochem & Cell Biol	119	195	166	70	834	57	9	76	57	126	1364	225	204	591	3467	2019	7351
Genetics	50	43	16	18	234	15	1	19	24	72	382	77	98	362	927	627	2195
Microbiology	20	16	42	4	154	1	3	41	8	8	241	70	198	288	1026	314	1871
Botany	57	18	34	10	392	6	12	104	13	12	557	300	471		1492	681	3218

Table A1. Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6) (continued)

	ARC SCHEMES													COMPARATOR SECTORS					
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Other Govt	Other Hosp	Other Univ	Res Inst	AUST		
Zoology	70	87	34	2	407	12	20	56	30	50	605	223	762	28	1924	453	3632		
Ecology & Evolution	117	122	47	3	593	16	54	95	68	109	930	257	704	5	1746	505	3756		
Biotechnology	35	28	64	13	201	17	2	59	26	33	379	141	147	167	1179	503	2360		
Other Biological Sci	3	10		2	44	5		4	2	4	57	5	23	8	236	49	363		
General Biological Sci	49	61	18	10	246	21	6	20	11	22	354	49	139	39	872	254	1615		
Inf, Comp & Comm Sci	23	14	4	6	215	3	7	28	9	17	283	18	26	19	885	75	1312		
Information Systems	3	3	1	1	43	1	4	6	2	4	62	3	8	7	182	14	277		
Artif Int, Sig&Image Pr	10		1	2	50		3	9	5	4	69	5	12	5	234	22	349		
Computer Software	3				27	1		8			37	2	1		116	9	178		
Comp Theory & Math	4	2			67			1	2	4	75	2	5	2	262	5	358		
Oth Inf, Comp, Comm	6	9	3	3	66	2		6	2	8	86	8	9	10	292	40	437		
Engineering & Technol	293	417	126	110	1772	252	81	432	190	300	3083	673	767	187	6256	1177	11989		
Indust Biotech & Food		1	1	20	1	5	24		3	55	80	139	2	443	231	942			
Aerospace Engn	1	6	1		21	2		4		1	33	4	40	79	7	154			
Manufacturing Engn	15	11	5	7	144	21	14	13	5	10	201	13	13	313	27	569			
Mech & Industrial Engn	14	20	7		146	1	2	41			198	15	42	2	501	42	792		
Chemical Engn	34	15	4	11	245	16	7	81	24	79	425	103	32	793	134	1494			
Resources Engn	32	66	4	20	147	21	39	61	14	109	354	85	37	558	124	1202			
Civil Engn	23	22	9	3	185	11	3	57	1	33	297	154	199	3	1060	218	1887		
Elect & Electron Engn	61	76	34	36	390	58	13	65	36	63	621	109	81	10	970	86	1901		
Geomatic Engn	8		4		21	2	1	12		6	48	6	19	3	72	47	189		
Environmental Engn	11	3	5	3	23	2		27	3	1	61	43	94	3	318	61	581		
Maritime Engn					23			2		3	26	1	31	64	14	131			
Metalurgy	15	63	13	9	143	19	2	43	38	3	279	71	21	393	85	874			
Materials Engn	110	182	56	48	539	121	28	96	117	54	1022	150	183	9	1444	252	2987		
Biomedical Engn	4	14	1		44	6		14	14	1	89	21	9	168	352	54	593		
Computer Hardware	2				17				1	6	21	1		102	1	133			
Commun Technol	6	5	1	2	52	3		9	1	40	106	28	30	196	17	391			
Interdisciplinary Engn	20	59	13		266	19		23	18	11	340	30	42	657	78	1142			
Other Engn & Technol											11		11	38	14	67			
Nanosci & Technol	11	14	4	9	76	19	3	8	26	18	132	24	6	150	23	331			
Gen Engn & Technol	20	28	3	11	113	24		14	7	14	178	17	26	334	34	581			

Table A1. Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6) (continued)

	ARC SCHEMES													COMPARATOR SECTORS					
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Other Govt	Other Hosp	Other Univ	Res Inst	AUST		
Agric, Vet & Envir Sci	74	38	39	6	339	13	13	299	40	44	784	1027	2279	74	4929	2234	10255		
Soil & Water Sci	3	1	1		27		1	35	4	2	68	109	163	1	408	263	901		
Crop & Pasture Prod	1	1	1		23			31	3		57	144	215		394	312	1004		
Horticulture	2				11			27		1	39	54	101		207	99	442		
Animal Production			1	1	2		1	31		2	37	157	496	4	577	347	1415		
Veterinary Sci	8	14	10		44	2		45		5	114	91	375	60	1165	389	2089		
Forestry Sci	5	1			11			28	1		41	108	83		155	165	481		
Fisheries Sci	18	2	10		84		1	26	15	10	138	163	338	2	593	255	1320		
Environmental Sci	42	22	20	5	178	11	10	116	18	24	373	228	491	11	1686	472	3056		
Gen Agr, Vet & Environ Sci			1	5			19	1	2	26	271	562		521	407	1472			
Archit, Urb Envi & Bldg	2	1			7		1	2	1	3	17	0	4	1	152	4	184		
Medical & Health Sci	108	145	75	52	829	59	40	173	89	116	1472	513	2073	10889	21287	6506	36142		
Immunology	7	21	5	12	35			16	14	8	106	205	92	599	1312	1043	2851		
Med Biochem & Clin Chem	26	4		25	1		4	1	3	53	3	32	94	335	61	530			
Pharm & Pharmaceut Sci	17	46	16	4	106	5	1	25	2	18	194	37	195	492	1972	441	2929		
Medical Physiology	12	16	19	6	194	10	3	17	12	19	267	29	101	252	1606	368	2352		
Neurosciences	23	13	8	5	233	11	5	11	44	38	349	16	77	714	2454	699	3749		
Dentistry								1		1		2	13	86	384	17	471		
Clinical Sci	44	56	30	24	388	28	15	92	40	41	672	263	1296	9217	13245	4320	23989		
Nursing	4				2			3		8		0	42	137	489	14	560		
Public Hlth & Health Serv	16	2	1	2	75	9	24	33	2	6	150	37	530	759	3219	590	4535		
Comp/Alternat Med												0	1	1	25	1	27		
Human Movt & Sports Sci				27			11	8		43	1	125	189	734	88	995			
Other Med & Hlth Sci		2	3		3			1		1	7	1	11	144	158	34	287		
Medicine – General	4	6	4	5	23	2		15	6	5	62	56	56	345	738	490	1503		
Education	8	7	1	1	67	1	1	20		1	96	1	33	41	1157	17	1331		
Education Studies	3				30			12			42	1	20	22	317	14	405		
Curriculum Studies	1	4	1	1	4	1	1			1	10	0	2	16	153	1	171		
General Education	4	3			42			10			54	0	11	3	723	2	802		
Economics	8	40	2		136	1	2	26	1	202		4	62		1311	26	1612		
Applied Economics		5			1			3			9	0	3		32	1	44		

Table A1. Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6) (continued)

	ARC SCHEMES											COMPARATOR SECTORS					
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Other Govt	Other Hosp	Other Univ	Res Inst	AUST
Econometrics	2	8	1		48		1	3		57		0	9		164	8	237
General Economics	6	35	1		117	1	1	26	1		177	4	56		1239	19	1503
Comm, Manag, Tour & Serv	5	5	3		80	1	6	16	1	1	113	3	17	16	1291	11	1479
Business & Manag	5	2	3		54	1	5	9	1	1	76	3	9	2	1000	9	1122
Banking, Fin & Invest		3			22			4			29	0	2		184		222
Transportation					4		1	3		8		0	6	14	107	2	135
Policy & Political Sci	6	7			56		7	18	1	3	92	4	24		852	6	986
Political Science	6	4			45		3	6	1	2	64	4	16		681	6	773
Policy & Admin		3			11		4	12		1	28	0	9		189		232
Studies in Human Soc	18	10	4		139	9	4	27	3	12	211	5	64	51	1664	41	2013
Sociology	5	5			59	3		14	1	6	86	3	25	9	653	23	799
Social Work	2				5			1			8	0	12	20	146	4	175
Anthropology	6	1	3		29	2					39	0	7	1	207		256
Human Geography	1	1	1		18	2	3	7		2	34	1	5		230	12	279
Demography		2			13	1	1	2	1	18		0	14	23	197	1	230
Hist & Phil Sci & Med	2	1			14			2	1	3	21	0	2	1	123	1	159
Oth Studies Human Soc	4				11	2		3	1	1	19	1	3	2	199	1	226
Behav & Cogn Sci	77	63	7		595	20	11	27	40	73	772	12	166	332	3676	135	4751
Psychology	53	43	5		473	18	11	26	31	65	620	7	147	320	3151	115	4038
Linguistics	11	6			44	2		1	2	13	67	3	2	5	353	2	425
Gen Behav & Cogn Sci	26	38	6		186	4	3	1	9	9	217	5	29	34	404	42	687
Law, Justice & Law Enf					22	4	1	16		9	49	2	104	28	492	22	631
Law					8		1	3		1	13	1	16	9	184		216
Law Enforcement					6	4		4		1	12	0	34	5	199	1	238
Gen Law, Just & Law Enf				15			11		8	34	1	65	23	205	21	298	
Journ, Libr & Curat Stud	3	2	1		35	1	1	5		1	47	2	18	13	306	10	401
Journ, Comm & Media	2	2			22			2		1	28	0	3	2	159	1	198
The Arts	1		1		11			1	1		13	0	15	1	197	1	242
Performing Arts	1				5				1		5	0	1	1	57	1	68
Visual Arts & Crafts			1		2						3	0	14		76		106

Table A1. Distribution of Publications in schemes/sectors by RFCD (Tables 4 & 6) (continued)

	ARC SCHEMES											COMPARATOR SECTORS					
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC	ARC TOT	CRC	Other Govt	Other Hosp	Other Univ	Res Inst	AUST
Cinema, Elec Arts & Multimed				4			1			5	0			73	78		
Language & Culture	3	2	2		30	1		1	5		43	0	2	1	590	1	640
Literature Studies	3	2	2		30	1		1	5		43	0	2	1	586	1	636
Cultural Studies												0			4		4
History & Archaeology	18	10	13		57			6	16	4	110	1	26		694		846
Historical Studies	13	10	3		37			5	9	4	72	0	8		591		683
Archaeology & Prehist	5		10		20			1	7		38	1	18		106		166
Philosophy & Religion	2	5			54	2	1	2	1	32	94	1	4	6	578	17	730
Philosophy	2	5			47	2	1	2		30	84	1	4	5	474	17	591
Religion & Relig Stud					7				1	2	10	0		1	120		155
Science – general	111	57	55	30	564	41	7	109	83	179	1029	395	1002	390	3327	1164	6612
Interdisc Life Sci	64	20	36	18	316	13	2	85	49	143	648	340	894	315	2599	895	5057
Multidisciplinary Sci	47	37	19	12	248	28	5	24	34	36	381	55	108	75	728	269	1555
Soc Sci, Hum & Arts – Gen	10	6			87	8	6	7	4	9	128	3	49	62	1305	37	1570
Area Studies	3				21		5		1	1	29	0	7		264		301
Gen Soc Sci, Hum & Arts	7	6			66	8	1	7	3	8	99	3	42	62	1068	37	1296
Social Sciences	112	107	16		988	43	36	150	43	104	1433	38	840	1106	12005	461	14812
Arts and Humanities	32	19	14		176	3	2	13	22	38	296	2	52	10	2387	22	2842
Total 1621		2178	1028	574	10528	977	402	1604	1159	1863	17246	3245	8247	11967	58874	14199	104319

Table A2. Collaboration patterns by sector (see Figure 1)

SINGLE			GROUP		NATIONAL		INTERNATIONAL		TOTAL
	No.	%	No.	%	No.	%	No.	%	
ARC – Australian Postdoc Fellowships	149	9	795	49	480	30	696	43	1621
ARC – Australian Profess Fellowships	128	6	1138	52	518	24	965	44	2178
ARC – Australian Research Fellowships	69	7	557	54	278	27	451	44	1028
ARC – Centres Excellence	31	5	374	65	157	27	229	40	574
ARC – Federation Fellowships	27	3	502	51	254	26	491	50	977
ARC – Key Centres	40	10	217	54	161	40	141	35	402
ARC – QEII Fellowships	96	8	563	49	314	27	526	45	1159
ARC – Special research Centres	193	10	1068	57	443	24	821	44	1863
ARC – Discovery Projects	830	8	5392	51	2629	25	4504	43	10528
ARC – Linkage Projects	70	4	1128	70	652	41	416	26	1604
ARC TOT	1383	8	9025	52	4503	26	7322	42	17246
Cooperative Research Centres	210	6	1952	60	1932	60	922	28	3245
Other Government	904	11	4052	49	4453	54	2646	32	8247
Other Hospital	742	6	6665	56	7797	65	3495	29	11967
Other University	8991	15	25657	44	16837	29	23073	39	58874
Research Institutes	764	5	7079	50	8139	57	5774	41	14199
Australia	13300	13	48117	46	32400	31	41547	40	104319

Table A3. International collaboration by sector and country (see Table 5)

	ARC SCHEMES										ARC tot	COMPARATOR SECTORS				
	APD	APF	ARF	CE	Disc	FF	KC	Link	QEII	SRC		CRC	Oth Govt	Oth Hosp	Oth Univ	Res Inst
COUNTRY	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	
USA	239	345	121	74	1595	170	38	146	163	317	2526	329	1008	1306	7503	2583
ENGLAND	136	127	66	33	676	77	15	46	110	125	1126	115	544	982	4086	977
GERMANY	81	100	55	22	461	78	29	46	45	104	794	76	206	383	2160	586
PEOPLES R CHINA	63	108	50	20	438	104	11	32	79	64	754	57	125	159	1821	262
JAPAN	68	65	28	9	313	25	19	32	49	58	534	61	172	131	1419	454
CANADA	48	34	21	18	289	34	10	28	26	89	484	62	263	441	1876	422
FRANCE	56	71	29	11	323	17	15	16	22	44	456	73	194	278	1219	436
SWEDEN	28	52	14	6	180	26	2	15	28	22	292	20	59	157	771	203
ITALY	26	51	27	6	171	22	4	4	14	26	286	30	84	291	810	201
NEW ZEALAND	30	38	16	6	115	7	12	28	13	18	235	63	282	243	1290	340
NETHERLANDS	23	29	11	2	122	25	7	19	8	12	209	28	95	230	868	273
RUSSIA	12	33	20	1	123	10	5	6	10	24	200	6	38	15	399	59
SCOTLAND	23	17	4	3	103	11		11	14	18	178	15	141	162	707	130
SINGAPORE	12	26	6	7	98	9	8	5	18	7	163	9	31	79	641	74
SWITZERLAND	12	24	11	4	88	5	6	11	14	23	163	18	82	204	760	188
SPAIN	20	25	10	8	86	13	2	9	6	11	160	15	56	135	465	100
SOUTH KOREA	15	32	4	1	80	6		14	14	12	141	11	32	14	368	39
DENMARK	15	9	9	2	78	2		13	10	9	116	13	45	97	468	106
TAIWAN	7	9	3	5	65	8	3	3	28	8	95	0	16	34	278	19
INDIA	12	7	8	3	63	8		2	6	1	94	17	44	39	382	93
ISRAEL	4	8	9	8	50	12		5	2	22	94	4	26	75	248	81
POLAND	16	16	4	1	70	1	1	4	3	4	91	4	10	52	307	17
SOUTH AFRICA	8	10	2	1	62	2	9	5		4	89	16	83	72	449	80
BRAZIL	16	10	16	8	46	1	1	1	5	15	88	13	30	62	286	47
BELGIUM	7	17	8		57	4			9	4	83	22	33	167	374	134
WALES	18	9	1		44	5	1	6	3	11	83	2	23	32	220	46
AUSTRIA	3	12	4	3	51	2	2	2	3	12	75	11	43	132	384	61
IRELAND	8	8	4	10	21	3	1	1	1	9	51	5	22	57	155	23
NORWAY	6	2	6	1	21	2	1	6	11	6	49	17	38	54	225	45
CHILE	4	11	2	2	18	14	2	1		4	42	4	33	4	127	28
FINLAND	6	6	2	2	25	2		2	2	4	39	5	30	81	230	101
THAILAND	3	1	3		21	3	3	5	1	1	35	8	54	22	281	84
MEXICO	1	13	3		20	1	2		1	2	34	9	22	16	115	31
ARGENTINA	3	2	2	3	18	3	2	2	3	5	33	5	18	34	88	39
CZECH REPUBLIC	5	3	5	1	2	02	1		1	2	29	4	9	24	130	16
HUNGARY	4	3	2		19	3		1		2	26	2	5	21	115	35
INDONESIA	1	2	2	1	18	1		1	2	2	26	13	35	6	177	51
IRAN	3	8		2	13	3		4	2		25	3	7	4	143	8
UKRAINE		8		1	16	3			2		25	0	6	3	60	5
AUSTRALIA	696	965	451	229	4503	491	141	416	526	821	7321	922	2646	3495	23073	5774

Table A4. Relative citation and journal impact: Selected Science Fields, Total ARC (see Figure 2)

FIELD	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
Mathematical Sciences	878	1547	1.16	1.14
Physical Sciences	4584	24158	1.26	1.35
Chemical Sciences	2732	14824	1.44	1.30
Earth Sciences	1596	7211	1.34	1.39
Biological Sciences	3663	24434	1.33	1.04
Inform, Comput & Commun Sci	283	654	1.13	0.86
Engineering & Technology	3083	8254	1.29	1.20
Agric, Vet & Environm Sciences	784	2569	1.61	1.39
Medical & Health Sciences	1472	8156	1.41	1.05

Table A5. Relative citation and journal impact: Selected Social Science Fields, Total ARC (see Figure 3)

FIELD	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
Economics	202	320	1.08	1.18
Commerce, Management, Tourism & Services	113	232	1.12	1.56
Studies in Human Society	211	339	1.06	1.19
Behavioural & Cognitive Sciences	772	3012	1.83	1.41
History & Archaeology	110	64	1.81	1.50

Table A6. Relative citation and journal impact: Selected Science & Social Science Fields, ASC Discovery Projects (see Figure 4)

FIELD	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
Mathematical Sciences	712	1269	1.12	1.12
Physical Sciences	2777	16182	1.32	1.39
Chemical Sciences	1521	9173	1.45	1.33
Earth Sciences	922	4242	1.35	1.45
Biological Sciences	2326	16785	1.31	1.04
Inform, Comput & Commun Sci	215	537	1.06	0.91
Engineering & Technology	1772	5015	1.21	1.15
Agric, Vet & Environm Sciences	339	1407	1.66	1.63
Medical & Health Sciences	829	4413	1.27	0.90
Economics	136	236	1.01	1.23
Studies in Human Society	139	250	1.03	1.24
Behavioural & Cognitive Sciences	595	2218	1.84	1.32

Table A7. Relative citation and journal impact: Selected Science Fields, ARC Linkage Projects (see Figure 5)

FIELD	NUMBER OF PUBLICATIONS	NUMBER OF CITATIONS	RELATIVE JOURNAL IMPACT	RELATIVE CITATION IMPACT
Physical Sciences	169	1016	0.94	1.43
Chemical Sciences	239	1208	1.20	1.22
Earth Sciences	176	486	1.13	0.98
Biological Sciences	361	1359	0.89	0.73
Engineering & Technology	432	1184	1.23	1.25
Agric, Vet & Environm Sciences	299	726	1.49	1.08
Medical & Health Sciences	173	547	1.10	0.72