



Australian Government  
Australian Research Council

Physical, Chemical and Earth Sciences (PCE)  
and Humanities and Creative Arts (HCA) Clusters

## ERA Indicator Benchmark Methodology

ERA



Excellence in Research for Australia

April 2009

RESEARCH in the national interest - enabling the future

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# 1 Introduction

This document details the methodology that the Australian Research Council (ARC) will use to benchmark indicators for the Excellence in Research for Australia (ERA) initiative. The methodology covers both the development and application of benchmarks, for eligible Australian higher education institutions (hereafter institutions), used in the ERA Cluster One (Physical, Chemical and Earth Sciences) and Two (Humanities and Creative Arts) trial evaluations. It is a supplement to the *ERA Evaluation Guidelines* and *ERA Submission Guidelines*.

ERA will use a range of discipline-specific indicators to evaluate research quality in institutions. The selection of indicators was undertaken in accordance with international best practice and informed by analytical testing of data from the Australian higher education sector (hereafter, ERA development publication dataset).

To assist Research Evaluation Committees (RECs) in their evaluation process, the ARC will develop a range of Australian institution and (where relevant) world benchmarks to apply to the following indicator categories:

- Citation Analysis;
- Ranked Outlets; and
- Income—Research Income and Research Commercialisation Income

A list of further recommended reading is provided at Appendix I.

## 1.1 Benchmark development

The development of benchmarks in ERA has been informed by extensive analytical testing of data, literature review and advice from a range of external experts, including experts in bibliometrics and research administration. The quantitative testing was undertaken using the ERA development publication dataset spanning a five-year period. For the first round of evaluation in ERA, a six-year reference period will be applied.

The ARC will return all publication data with benchmarks and (where applicable) citation counts to submitting institutions once the ERA evaluation process is complete.

## 1.2 Unit of Evaluation and Field of Research code

This document refers to both the Unit of Evaluation (UoE) and the Australian and New Zealand Research Classification (ANZRC) Field of Research (FoR) code. The UoE is defined as the FoR code for a particular institution, whereas the FoR code relates to the particular field of research code, at either the two- or four-digit level.

This is further defined in section 3.3 *Unit of Evaluation and Reporting* of the *ERA Submission Guidelines*.

### **1.3 ERA reference period and citation window**

Benchmarks in ERA will be aligned to the same reference period outlined in the *ERA Submission Guidelines*, that is 1 January 2002 to 31 December 2007.

For citation analysis, the citation window will be 1 January 2002 to 1 March 2009 inclusive. This means that ERA will assess citations up to and including 1 March 2009, of eligible articles published during the reference period.

### **1.4 Low volume**

Low volume thresholds for evaluation are outlined in the *ERA Submission Guidelines*.

Outputs that do not reach the low volume thresholds for a specific FoR code will still contribute to the calculation of both world and Australian institution benchmarks.

### **1.5 Indicator applicability**

The applicability of an indicator category to a FoR code is as per the relevant *Discipline Matrix*. Applicability at the institutional level is dependant on the low volume threshold being met, as outlined in the *ERA Submission Guidelines*.

## **2 Bibliometrics**

Bibliometrics is the “application of quantitative analysis and statistics to publications such as journal articles and their accompanying citation counts”<sup>1</sup>.

Citation analysis is one of the most widely used bibliometric tools for assessing the impact of scholarly research. It involves the scrutiny of the references contained in journal articles, including analysis of reference frequency and patterns, using the abstract and citation databases.

There is some debate regarding the inclusion of self-citations in citation analysis. Currently, there is insufficient evidence that self-citations and ‘citation clubs’ significantly impact on citation analysis at the discipline level, which would warrant the effort of excluding them from the analysis. Additionally, the impact of self-citation and citation clubs tends to follow discipline-specific citing behaviours; this impact is minimised by the use of field-specific benchmarks. Potential impacts are also lessened when the analysis rests on a reasonable number of publications, through the application of low volume thresholds in ERA.

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<sup>1</sup> Thomson Reuters (2008) White paper – Using Bibliometrics: A guide to evaluating research performance with citation data. Accessed online <http://scientific.thomsonreuters.com>.

## **2.1 Applicability of citation analysis in ERA**

Citation analysis is only valid where at least half of the total output of the discipline (including non-journal articles) is indexed by the citation information supplier. Where coverage is lower than this, the risk of misleading and inconsistent results increases and affects the reliability of the analysis. Through workshops and public consultations for each of the eight ERA Discipline Clusters, the ARC has identified the Discipline Clusters that are suitable for citation analysis.

## **3 Citation analysis benchmarks**

ERA uses three bibliometric methods to evaluate research publication quality. These are:

1. relative citation impact, calculated against Australian institution and world benchmarks;
2. distribution of papers against relative citation impact (RCI) classes; and
3. distribution of papers based on world centile threshold and Australian institution average.

### **3.1 Benchmark principles**

#### **3.1.1 Benchmarks are field specific**

All benchmarks used in ERA are specific to the relevant FoR code.

The ARC recognises that each discipline has distinctive citation behaviours and publication timelines. For example, life sciences papers usually accumulate citations faster than pure mathematics papers. For this reason, ERA will derive benchmarks for each FoR code. As ERA uses field specific citation benchmarks, a discipline will only be compared against its own relative performance, thereby overcoming any field specific citing behaviours and publication timelines that may have otherwise arisen.

FoR code-specific benchmarks are constructed from data relating to the journals assigned to each FoR code, or field specific journal set. Journals were assigned to particular FoR code(s) during the ERA journal ranking process. This process was designed to ensure that only journals that publish papers that are core to a particular FoR code are assigned to that FoR code.

#### **3.1.2 Benchmarks are year-specific**

The ARC will use year-specific benchmarks for each FoR code. Each institution will likely have different publication patterns for each FoR code. Some will have a concentration of outputs in the more recent years of the reference period, others in earlier years, while some will have equal distribution across each year of the reference period. For this reason, ERA will use year-specific citation benchmarks and not benchmarks based on averages across the entire period. This will ensure that any heterogeneity in publication patterns across the reference period is taken into account.

For each year of the reference period, for each FoR code, a world and Australian institution benchmark will be derived. Papers published in a specific year will be assessed against the discipline-specific benchmark for that year.

While it is not uncommon to assess citation performance against the citation window average, there are equity concerns with this approach. Table 1 demonstrates the difference in citation rates from 2002 to 2006 for a sample of fields. Publications generally attract few citations in their first year of publication and the yearly rate of attracting citations does not peak until about three years after publication (shorter for some fast-evolving areas of biomedicine; longer for disciplines such as mathematics and engineering).

**Table 1: Example of citation per paper benchmarks for selected fields—Year-specific versus five-year average benchmarks**

FoR code	FoR Name	2002	2003	2004	2005	2006	5 yr av.
0104	Statistics	5.33	3.72	2.96	1.74	0.71	2.77
0201	Astronomical and Space Sciences	14.79	14.61	11.26	7.71	4.14	10.36
0306	Physical Chemistry	11.93	9.98	8.15	5.26	2.41	7.28
0403	Geology	7.35	5.93	4.46	2.88	1.34	4.33
0601	Biochemistry and Cell Biology	26.23	21.59	16.65	10.86	5.15	16.04
1107	Immunology	22.74	20.86	15.36	10	4.6	14.5

For an analysis to rest equitably on evaluation against benchmarks based on a multiple-year average, the UoE would have to show an even distribution across the years.

The methodology of utilising yearly benchmarks takes into account the variations of publishing and citation behaviour of a field throughout the six-year reference period. Yearly benchmarks also ensure that outputs published in the later years of the reference period are not disadvantaged. It is recognised that citations can take sometime to accumulate for a paper. The ARC has allowed a 15 month window from the end of the reference period (i.e. 31 December 2007) to 1 March 2009, for citations to accumulate. Papers published in 2007 will be compared against 2007-specific benchmarks.

### 3.1.3 Benchmarks are derived using papers meeting specific criteria

Citation analysis benchmarks are derived using papers that meet **all** of the following criteria:

- published in the relevant ERA journal list;
- indexed by the citation information provider at the time the article is published<sup>2</sup>;
- published during the reference period (2002–2007);
- have a unique article identifier (for PCE, an EID from Scopus); and
- published in a refereed, scholarly journal meeting the eligibility criteria specified in the *ERA Submission Guidelines*.

<sup>2</sup> Some journal titles may be first 'indexed' during the reference period. This means some journals may only be partly indexed. For example, if Scopus begins indexing *Journal A* in 2005, papers published in the reference period prior to 2005 will not be included in citation analysis, while papers published in *Journal A* from 2005 will be included in citation analysis.

A list of Scopus publication definitions and characteristics can be found in Appendix II. These categories should not be used in isolation to determine whether an output is eligible for ERA assessment. Please refer to the *ERA Submission Guidelines* to determine the eligibility of a research output.

### **3.1.4 Benchmarks are calculated from world and Australian institution datasets**

Two citation analysis benchmarks will be used in ERA; world and Australian institution.

The Australian institution benchmarks are derived using data submitted by the eligible institutions to ERA. That is, the ARC will use bibliometric data of all papers authored by eligible staff of Australian institutions during the reference period to calculate the Australian institution benchmarks. The Australian institution benchmarks do not include Australian authored papers that are not eligible for evaluation in ERA. The world benchmarks are derived using bibliometric data of all papers published in the world (including those authored by eligible staff of Australian institutions), meeting the criteria specified in *section 3.1. Benchmarks are derived using papers meeting specific criteria.*

### **3.1.5 Multidisciplinary and two-digit research outputs will be reassigned**

ERA will reassign journal articles published in multidisciplinary and two-digit FoR coded journals to up to three four-digit FoR codes using an analysis of the cited and citing references of the article. This methodology is routinely used by citation providers to attach articles in multidisciplinary journals to a subject category.

This methodology ensures that outputs tagged to a two-digit FoR code and multidisciplinary journals are not disadvantaged. As previously mentioned, the ARC recognises that each discipline has distinctive citation behaviours. One example would be that in general, life sciences papers accumulate citations faster than mathematics papers. It is plausible to assume that life sciences and mathematics papers could both appear in the same volume of a multi-disciplinary journal. If a multidisciplinary benchmark is used, the mathematics paper would appear to have less impact than the life sciences paper. This could potentially deter researchers from publishing in high quality multi-disciplinary journals.

Once research outputs tagged to multidisciplinary and two-digit FoR codes have been reassigned to one or more four-digit FoR code(s), they will be assessed within the four-digit FoR code(s) to which they have been reassigned.

The ARC is currently undertaking testing to finalise the reassignment methodology. The result of this will be released shortly.

### 3.2 Relative citation impact against world and Australian institution benchmarks

An example of an institution's RCI evaluation as used in ERA is shown in Table 2.

**Table 2: RCI against world and Australian institution average**

Citation analysis: B01 RCI against world and Australian institution average				
Institution: University X				
Discipline Cluster: PCE				
FoR code level: four-digit				
FoR code: 0301				
FoR name: Analytical Chemistry				
Total Publications	Sum of Cites	Institution RCI against:		% Papers Indexed
		World Benchmark	Aust. Inst. Benchmark	
57	927	1.83	3.59	96.3%

Two benchmarks are used in the calculation of this profile. These are world and Australian institution:

$$\text{World benchmark} = \frac{\text{Sum of cites for an FoR code for all papers in the world dataset}}{\text{Total number of papers for an FoR code for all papers in the world dataset}}$$

$$\text{Aust. Inst. benchmark} = \frac{\text{Sum of cites for an FoR code for all Australian institutions}}{\text{Total number of papers for an FoR code for all Australian institutions}}$$

A RCI is calculated for each paper against the year-specific benchmarks. An average of all the institution's RCIs is then derived. The world and Australian institution benchmarks are constructed individually for each FoR, based on the distribution of publications across the reference period. An example of the benchmarks is shown in Table 3.

**Table 3: Example year-specific benchmarks for two- and four-digit FoR codes in Chemical Sciences.**

FoR code	2002		2003		2004		2005		2006		2007	
	World	Aust										
03 <sup>3</sup>	4.9	4.1	3.9	3.9	3.5	3.6	2.6	3.5	2.1	2.7	1.7	1.2
0301	5.2	2.3	3.5	2.1	3.8	2.0	3.1	1.2	2.5	0.9	2.1	0.3
0302	5.1	3.7	4.1	1.1	4.1	2.1	3.9	2.1	2.5	2.1	1.1	0.9
0303	4.2	3.5	3.7	3.1	3.1	2.8	2.8	1.9	2.1	1.7	1.9	0.8
0304	4.5	3.9	4.1	3.9	3.8	2.8	2.8	2.6	2.3	1.5	1.6	1.1
0305	3.9	2.9	3.2	2.7	2.5	2.1	2.1	1.8	2.0	1.1	1.6	0.9
0306	3.2	3.1	3.1	2.5	2.8	1.8	2.5	1.3	1.1	0.8	0.9	0.7
0307	3.1	2.4	2.9	2.3	2.1	1.9	2.0	1.5	1.4	1.1	1.3	0.9
0399	4.1	3.9	3.5	2.1	3.2	1.5	2.9	1.2	2.7	1.1	1.6	0.6

<sup>3</sup> The two-digit FoR code benchmark is for the entire two-digit FoR code (including subordinate four-digit codes). The benchmark is derived using a unique journal set from both the two-digit FoR and four-digit FoR codes.

### 3.2.1 Steps for deriving institution RCI

Table 4 shows an example for deriving the institution RCI. The two benchmarks are applied to each paper submitted to each FoR code. The methodology for deriving the citations profile is:

1. Calculate both RCI (world) and RCI (Aust. Inst.) for each paper for a UoE, where,

$$a. \text{ RCI (World) } = \frac{\text{number of citations}}{\text{World benchmark}}$$

$$b. \text{ RCI (Aust. Inst.) } = \frac{\text{number of citations}}{\text{Aust. Inst. benchmark}}$$

2. Calculate an average of the RCIs derived in 1a. and 1b. respectively, where,

$$a. \text{ Average RCI (world) } = \text{average of all 'RCI (world)' for a UoE}$$

$$b. \text{ Average RCI (Aust. Inst.) } = \text{average of all 'RCI (Aust. Inst.)' for a UoE}$$

The average RCIs are then included in Table 2 as the institution RCI for world and Australia respectively.

**Table 4: Example Average RCI calculation against world and Australian average**

Institution A FoR code: 0301 Analytical Chemistry						
	Yr of Pub	Cites	World cpp	Aust cpp	RCI (world)	RCI (Aust. Inst.)
Pub 1	2002	3	5.2	2.3	0.58	1.30
Pub 2	2002	2	5.2	2.3	0.38	0.87
Pub 3	2003	5	3.5	2.1	1.43	2.38
Pub 4	2006	2	2.5	0.9	0.80	2.22
Pub 5	2005	0	3.1	1.2	0.00	0.00
....Pub 6 – Pub 56....						
Pub 57	2007	3	2.1	0.3	1.43	10.00
Average RCI					1.83	3.59

### 3.3 RCI Classes

To provide further detail, ERA will undertake an analysis to compare the citations received by each paper, compute the relative citation impact for the paper by comparing this to the relevant year-specific world average for the discipline and profile the distribution across relative citation impact classes. Table 5 shows the RCI Class distribution profile for an institution for a UoE. The ARC will use seven classes of RCIs for ERA:

- Class 0 Output with no impact (RCI=0)
- Class I Output with RCI ranging from 0 to 0.8
- Class II Output with RCI ranging from 0.8 to 1.2
- Class III Output with RCI ranging from 1.2 to 1.99
- Class IV Output with RCI ranging from 2.0 to 3.99
- Class V Output with RCI ranging from 4.0 to 7.99
- Class VI Output with RCI scores above 8.0

This is consistent with the approach used by the Centre for Science and Technology Studies (CWTS) at Leiden University, the Netherlands, who have undertaken extensive analysis on identifying differential citation performance in the context of evaluation studies<sup>4</sup>. ERA will also use an expansion of Classes at the high impact end of the scale.

**Table 5: Number of papers across RCI Classes (assessed against the world benchmark)**

Citations analysis: B03 citation impact							
Institution: University X							
Discipline Cluster: PCE							
FoR code level: four-digit							
FoR code: 0301							
FoR name: Analytical Chemistry							
No. of papers	RCI Classes						
	Class 0 (0.0)	Class I 0.01-0.79	Class II 0.80-1.19	Class III 1.20-1.99	Class IV 2.00 -3.99	Class V 4.0-7.99	Class VI ≥8.0
	10	35	85	21	6	0	1

The steps for compiling the RCI Class profile for ERA are:

1. Calculating the RCI (world) for each paper submitted by an institution for a UoE, as shown in Table 4.
2. Assigning a RCI Class to each of the papers based on the RCI (world) score for each paper.
3. Counting the number of papers within each RCI Class.

<sup>4</sup> Van Leeuwen, T.N.; Visser, M.S.; Moed, H.F.; Nederhof, T.J.; Van Raan, A.F.J. 2003. The Holy Grail of science policy: Exploring and combining bibliometric tools in search of scientific excellence. *Scientometrics*, 57(2), 257-280.

Table 5 shows that: ten papers were uncited; 35 papers fell below the field average; 85 papers were around the field average; 21 papers were cited at least 1.20 times more than the field average; six papers in this analysis had a citation impact of between two and four times the field average; and one paper was cited at least eight times the field average.

### 3.4 Centile analysis

ERA also uses centile analysis as a tool in conjunction with RCI to evaluate research quality. Centile analysis investigates the distribution of papers based on world centile thresholds. An example of the centile analysis used in ERA is shown in Table 6.

Two benchmarks are used in this analysis:

1. World centile thresholds—The citation information supplier will derive the number of citations required to be in the top one, five, ten, 25 and 50 per cent of the world for an FoR code. For PCE, these centile thresholds will be derived using the Scopus World Dataset.
2. Australian institution average for each centile—The ARC will derive the average cumulative percentage of papers for an FoR code in the various world centile bands. This is the average Australian institution’s performance against the world centile thresholds and allows comparison of an institution’s performance against its peers.

The centile profile also shows the median number and percentage of papers at the 50<sup>th</sup> world centile for a UoE. This shows an institution’s performance above and below the median.

**Table 6: Centile analysis**

Citation analysis: B02 Distribution of papers based on world centile threshold and field average				
Institution: University X				
Discipline Cluster: PCE				
FoR code level: four-digit				
FoR code: 0301				
FoR name: Analytical Chemistry				
World centile	Institution		Aust. Inst. Average % of papers (cumulative)	% Paper Indexed
	No. of papers (cumulative)	% of papers (cumulative)		
1	3	5.5%	1.2%	
5	9	16.4%	6.2%	
10	13	23.6%	8.9%	
25	26	47.3%	25.5%	
50	42	76.4%	41.1%	
Total	55	100.0%	100.0%	96%
Uncited	2			

## 4 Ranked outlet benchmarks

ERA will apply rankings to some research outlets. For all disciplines, the ARC is undertaking ongoing consultations to finalise cluster-specific journal lists. Some disciplines may also choose to use ranked conferences as an additional indicator. This applies to disciplines where the predominant avenue for presenting new research is via conference publications; for example, in some engineering and information and communications technology disciplines.

The ERA Journal List was developed after extensive consultation with the sector. It consists of over 21 000 unique peer reviewed journals. For inclusion in the list, a journal must be a peer reviewed, scholarly serial. The consultation process was designed to ensure consensus on both the ranking of the journal and the four-digit FoR code(s) to which it was most appropriately assigned.

Most journals are assigned to a single discipline at the four-digit FoR code level. However, those journals that clearly cover a broader range of topics may be assigned to up to three four-digit FoR codes. Journals that cover all or most topics within a broad field are assigned a two-digit FoR code (e.g. 02 Physical Sciences), or where they cover many fields (e.g. *Nature*), they are listed as multidisciplinary. For the purposes of ranked outlet analysis, papers published in multidisciplinary and two-digit journals will be reassigned to up to three four-digit FoR code(s). They will retain the ranking of the journal in which they were published.

Each journal is assigned a single quality rating. It is classified into one of four tiers:

- Tier A\*;
- Tier A;
- Tier B; or
- Tier C.

The tier descriptors of journal ranks are contained in the *ERA Evaluation Guidelines*.

It must be noted that journal distributions do not equate to article distributions. As a general (though not universal) rule, an A\* journal will contain more articles than lower ranked journals. For example, the proportion of A\* journals in Chemical Sciences disciplines, and the proportion of total articles from the discipline that they carry, is shown in Table 7.

**Table 7: Example of percentage of A\* journals—selected Chemistry disciplines**

FoR code	FoR Description	% journals classified A*	% discipline publications in A* journals
0301	Analytical Chemistry	14%	19%
0302	Inorganic Chemistry	12%	17%
0303	Macromolecular and Biomolecular Chemistry	9%	27%
0304	Medicinal and Biomolecular Chemistry	7%	44%
0305	Organic Chemistry	10%	30%
0306	Physical Chemistry (incl. Structural)	14%	24%

The reason for the particularly large discrepancy in the FoR code ‘0304 - Medicinal and Biomolecular Chemistry’, as shown in Table 7, is due primarily to the *Journal of Biological Chemistry*, a weekly journal which has approximately 1000 pages and publishes around 100 articles in each issue.

The ARC will produce data on the divergence in journal and article distributions across the ranks, as this is essential information for the accurate interpretation of relative institution performance on this measure. Having 20 per cent of total output in A\* journals may be regarded as a strong performance in one discipline, but in another (such as the Medicinal and Biomolecular Chemistry, as shown in Table 7) it may be below average.

During evaluation, the RECs will be provided with a suite of ranked journal profiles, including benchmarking against Australian institution performance and indicative world performance (based on citation supplier coverage).

The distribution of publications across reference period years by journal ranks, as shown in Table 8, will be derived. The data provided on the distribution of a university’s output across the six reference period years is important contextual information for citation analysis indicators. It indicates the reason for applying year-specific citation benchmarks for institutions within the same discipline, as benchmarks are adjusted to account for varying output across time.

**Table 8: Distribution of papers across reference period years by journal tier ranks**

Ranked Outlets: A01 Journals						
Institution: University X						
Discipline Cluster: PCE						
FoR code level: four-digit						
FoR code: 0405						
FoR name: Oceanography						
Journal Tier	No. of Papers					
	2002	2003	2004	2005	2006	2007
A*	5	6	8	10	11	15
A	8	12	11	6	9	15
B	10	11	17	18	21	14
C	17	20	18	26	31	28
<b>Total</b>	40	49	54	61	72	72
<b>Distribution of output across the period</b>	11.5%	14.1%	15.5%	17.5%	20.7%	20.7%

## 4.1 Ranked journal benchmarks

Two benchmarks will be applied in the ranked journal analysis. These are:

$$\text{Aust. Inst. Distribution} = \frac{\text{Sum of papers for a specific tier (A*, A, B or C) for an FoR code for all inst.}}{\text{Sum of papers(all tiers) for an FoR code for all Inst.}}$$

$$\text{Indicative World Distribution} = \frac{\text{Sum of indexed world papers for a specific tier (A*, A, B or C) for an FoR code}}{\text{Sum of world papers(all tiers) indexed by the citation supplier for an FoR code}}$$

The two tables below (Table 9) show how the ranked journal indicator can be presented. The first table shows the Ranked Outlet Profile for an institution. The ‘world distribution’ shown in the fifth column is indicative because the world distribution is derived from papers published in journals indexed by the citation supplier. It is not possible to calculate a complete world benchmark for this indicator as the number of articles appearing in all journals is not known. It is only possible to obtain data on total publication numbers for journals indexed by the citation supplier. This will vary across disciplines.

The second table ‘Ranked Outlets Journal Coverage’ in Table 9 provides contextual information on the validity of the ‘Indicative World Distribution’. In order for the ‘Indicative World Distribution’ to be valid, a high percentage of ranked journals for that FoR code must be indexed by the citation supplier.

**Table 9: Institution ranked journal distribution against Australian institutions and indicative world distribution by journal tiers.**

Ranked Outlets: A01 Journals				
Institution: University X				
Discipline Cluster: PCE				
FoR code: 0403				
FoR name: Geology				
Journal Tier	No. of Papers	% of Papers	Aust. Inst. Distribution	Indicative World Distribution
A*	55	15.9%	11.8%	8.7%
A	61	17.7%	20.1%	19.2%
B	91	26.4%	33.1%	30.1%
C	138	40.0%	35.0%	42.0%
<b>Total</b>	<b>345</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
<b>Indicator Coverage</b>				<b>83.9%</b>

Ranked Outlets Journal Coverage		
FoR code: 0403		
FoR name: Geology		
Journal Tier	No. of Journals on ARC List	% of Journals Indexed by Scopus
A*	7	100.0%
A	29	96.6%
B	40	97.5%
C	116	75.0%
<b>Total</b>	<b>192</b>	<b>83.9%</b>

## 5 Income indicator benchmarks

ERA profiles two groups of income—research income and research commercialisation income. Examples of research income and commercialisation income profiles are shown in Table 10 and Table 11 respectively. Additional income tables showing different income breakdowns will also be derived; these include a breakdown of Category 3 income in research income and income breakdown by reference period years. Examples of these can be found in the *ERA Evaluation Guidelines*.

**Table 10: Research income profile**

Research Income: C01 Research Income Profile							
Institution: University X							
Discipline Cluster: PCE							
FoR code level : four-digit							
FoR code: 0301							
FoR name: Analytical Chemistry							
HERDC Category	Research Income Type	No. of grants	Total Amount	Average \$ per grant	Average \$ per FTE	Aust Inst. Average \$ per FTE	Ratio of Inst. against Avg \$ per FTE
1	Australian competitive grants	4	\$690,614	\$172,654	\$14,181	\$15,200	0.93
2	Other public sector research income		\$1,292,400		\$26,538	\$18,000	1.47
3	Industry and other research income		\$1,197,888		\$24,597	\$16,500	1.49
4	CRC research income		\$1,148,800		\$23,589	\$31,201	0.76
<b>Total FTEs</b>		<b>48.7</b>					

**Table 11: Commercialisation income profile**

Applied: F04 Commercialisation Income				
Institution: University X				
Discipline Cluster: PCE				
FoR code level : four-digit				
FoR code: 0301				
FoR name: Analytical Chemistry				
FTE	Total Amount	\$ per FTE	Aust. Inst. Average \$ per FTE	Ratio of Inst. against Average \$ per FTE
3.1	\$50,000	\$16,129	\$24,000	0.67

### 5.1 Income benchmarks

Two benchmarks are used in income profiles for ERA:

1. Australian institution average dollars per grant (applicable to Category 1 research income only).
2. Ratio of institutional dollars per full time equivalent (FTE) against average four-digit code level dollars per FTE (applicable to Category 1 Research Income and Commercialisation Income only).

### 5.1.1 Average dollars per grant

For Category 1 research income profile, the total dollar amount received by an institution for a UoE is divided by the number of Category 1 grants obtained, that is:

$$\text{\$ per grant (Inst.)} = \frac{\text{Total (\$) for a UoE}}{\text{Total number of grants for a UoE}}$$

As Category 1 income is a defined list of Australian grants, ‘\$ per grant’ allows the identification of the proportion of dollars received for each grant. This allows comparison within an FoR code. For example, University Z, a small institution may attain one Category 1 grant during the reference period totalling \$350,000 for ‘0301 – Analytical Chemistry’. If this is compared against University X’s ‘Total Amount’ of \$690,614 for Category 1 income in research income profile as shown in Table 10, it appears that University X is performing better. However, when dollars per grant is considered, University Z is actually performing better. This ensures evaluation is not biased by the size of the institution.

### 5.1.2 Ratio of institutional income per FTE against average income per FTE

Category 1 income in the Research Income Profile and Commercialisation Income Profile are the only two indicators in ERA that use FTE as a denominator. The total amount of income received is divided by the FTE for a UoE to attain income per FTE (\$ per FTE), that is:

$$\text{\$ per FTE (Inst.)} = \frac{\text{Total (\$) for a UoE}}{\text{Total FTE for a UoE}}$$

A discipline benchmark of average dollar per FTE is computed for each FoR code, where:

$$\text{Aust. Inst. Average \$ per FTE} = \frac{\text{Sum of total income for an FoR code for all institutions}}{\text{Sum of FTE for an FoR code for all institution}}$$

The ratio of institutional ‘\$ per FTE’ against discipline ‘Average \$ per FTE’ is then derived, where:

$$\text{Ratio of Inst. against Aust. Inst. Average \$ per FTE} = \frac{\text{\$ per FTE (Inst.) for a UoE}}{\text{Average \$ per FTE for an FoR code (all institutions)}}$$

This ratio provides an indication of whether an institution’s performance in a UoE is above or below the field average. A ratio greater than 1 indicates that the institution is above average, less than 1 is below the field average, while 1 is average. The example of Commercialisation Income table as shown in Table 11 illustrates that University X, with a ratio of 0.67 is below the field average for Commercialisation Income.

## Appendix I

### **Further reading**

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- Sanz-Casado, E., Martin-Moreno, C., Garcia-Zorita, C. & Lascurain-Sanchez, M. (2004). Study of interdisciplinarity in chemistry research based on the production of Puerto Rican scientists 1992-2001. *Information Research*, 9, (4), Paper 182. <http://informationr.net/ir/9-4/paper182.html>

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## Appendix II

### **Scopus publication definitions and characteristics**

**Article in Press (IP):** original research or opinion

*Characteristics:* Articles in Press are peer reviewed accepted articles for a journal. Articles in Press do not have all bibliographic details available yet. They can be cited using the digital object identifier (DOI). When the final article is assigned to an issue of the journal, the Article in Press version will be updated with final volume/issue/page number/publication year details.

**Article (AR):** original research or opinion

*Characteristics:* in peer-reviewed Journals, Articles are usually several pages in length, most often subdivided into sections: abstract, introduction, materials and methods, results, conclusions, discussion and references. However, Case Reports, Technical and Research Notes and Short Communications are also considered to be Articles and may be as little as one page in length. Articles in Trade Journals are typically shorter than in peer-reviewed journals, and may also be as short as one page in length.

**Review (RE):** significant review of original research

*Characteristics:* Reviews typically have an extensive bibliography. Educational items that review specific issues within the literature are also considered to be Reviews. As non-original articles, Reviews lack the most characteristic sections of original articles, i.e. materials and methods and results.

**Short Survey (SH):** short or mini review of original research

*Characteristics:* Short Surveys are similar to Reviews but typically are shorter (not more than a few pages) and with a less extensive bibliography.

**Conference Paper (CP):** original article reporting data presented at a conference or symposium

*Characteristics:* Conference Papers are items of any length reporting data from a conference, with the exception of Conference Abstracts. Conference Papers may therefore range in length and content from full papers to published conference summaries and short items as little as one page in length.

**Letter (LE):** letter to or correspondence with the editor

*Characteristics:* Letter items are individual letters or replies. Each individual letter or reply is processed as a single item.

**Editorial (ED):** item summarizing several articles or providing editorial news

*Characteristics:* Editorial items are typically identified as Editorial, Introduction, Leading Article, Preface or Foreword, and are usually listed at the beginning of the Table of Contents.

**Note (NO):** note, discussion or commentary

*Characteristics:* Notes are short items that are not readily suited to other item types. They may or may not share characteristics of other item types, such as author,

affiliation and references. Discussions and commentaries which follow an article are defined as Notes and considered to be items in their own right. Notes also include questions and answers, and comments on other (often translated) articles. In Trade Journals, Notes are generally shorter than half a page in length.

**Erratum (ER)**: item reporting an error, correction or retraction of a previously published paper

*Characteristics*: Errata are short items citing errors in, corrections to, or retractions of a previously published article in the same journal, to which a citation is provided.

**Book (BK)**: whole monograph or chapter of a book

*Characteristics*: Book items are assigned to the whole monograph or to individual chapters of sources with Sourcetype Book. This item type is not assigned to items in Book Series (Sourcetype K).

**Conference Review (CR)**: additional item summarizing all papers from a conference

*Characteristics*: Conference Reviews are items defined after publication of the conference (i.e. during database production) in which the papers of a conference are summarized in a separate data field created for this purpose.

**Patent (PA)**: item describing a patent

*Characteristics*: Patent items may take any form provided that they describe a patent. Patents are typically published in sources that are exclusively devoted to their publication.

**Business News (BZ)**: item describing news with business content

*Characteristics*: Business News items typically cover news of current business-related events.

**Secondary Abstract (AB)**: abstract of item from a primary source

*Characteristics*: Secondary Abstract is used for items which describe the abstracts of original articles published elsewhere in the primary literature.

**Conference Abstract (CB)**: conference abstract reporting original data presented at a conference or symposium

*Characteristics*: Conference Abstracts are short items that are comparable in length to normal Article abstracts. Their content varies from simple text (indicative abstracts) to text that includes Tables, Figures, Photographs and/or References (informative abstracts). In general, the whole Conference Abstract is used as the database abstract.

**Journal (J)**: any serial publication with an ISSN, with the exception of Trade Journals, Book Series, Proceedings (serial), Newsletters, Secondary Sources or Patent publications.

*Characteristics*: usually a scholarly / academic serial publication in any STM field. A journal can have various physical formats (e.g. print, electronic).

**Trade Journal (D)**: a serial publication covering and intended to reach a specific industry, trade or type of business.

*Characteristics*: usually a glossy magazine type of periodical with articles on topical subjects, many news items and advertisements that will appeal to those in the field.

Trade Journals are seldom refereed and do not always have an editorial board. Abstracts are usually short or non-existent, and few or no references are given. Usually an ISSN is available.

**Book Series (K)**: a serial publication with a series title, an ISSN, and for which every volume and/or issue in the series is also a book and has an ISBN.

*Characteristics*: usually, but not always, each book has a book title separate from the series title and (a) different editor(s). Each book is most often a monographic publication. The series is usually published irregularly.

**Book (B)**: any non-serial publication with an ISBN unless it is a Report, part of a Book Series, Proceeding (non-serial), or Patent.

*Characteristics*: usually a monograph or composed work in any STM field. A Book can have various physical formats (e.g. print, electronic).

**Proceeding (P)**: the published record of the meetings of a society or other formal organization or a collection of papers given at a particular conference.

*Characteristics*: Proceedings can be published as a serial or non-serial, and may contain either the full articles of the papers presented or only the abstracts. The source title usually includes words like 'proceeding(s)', 'meeting(s)', 'conference(s)', 'symposium/ symposia', 'seminar(s)' or 'workshop(s)' (or their synonyms in other languages like 'tagungsberichte' etc.), although some Journals also have titles with the word 'Proceedings'.

**Secondary Source (S)**: any serial publication exclusively publishing citations and/or abstract summaries derived from the primary literature.

*Characteristics*: Secondary sources may be in printed form (e.g. Excerpta Medica Abstract Journals) or may comprise datafeeds from secondary publishers. In the latter case the original source type (e.g. J=Journal) may be used in the BD Database Collection.

**Report (R)**: a non-serial publication giving a detailed account of information or statements, often including opinions and findings, of an individual or group on a particular topic.

*Characteristics*: generally an account of an event, although some reports are simply published findings. A Report can be a formal or official record, as of the activities of a committee or corporate body, or of some special investigation, or the proceedings of a governmental body.

**Patent (T)**: any publication which publishes patent reports.

*Characteristics*: a Patent is a set of exclusive rights granted by a government to a person for a fixed period of time in exchange for the regulated, public disclosure of certain details of an invention.

**Newsletter (N)**: a periodically published document or message, containing short news items and announcements on a specific subject or for a specific interest group.

*Characteristics*: usually not refereed, informal, and compact. Newsletters are often distributed for free to the members of a certain society or organisation.