An international comparison of performance-based research funding systems (PBRFS)

Executive summary

This report presents an international comparison of performance-based research funding systems (PBRFS) in the tertiary education sector. The discussion in this report is based on a comparative analysis of objectives and policy design features of PBRFS in Australia, the United Kingdom, Hong Kong, Denmark, Norway and Sweden. The report also considers the implications of the findings for New Zealand’s Performance-Based Research Fund (PBRF).

PBRFS are designed to assess research quality and encourage research excellence by allocating funding to reward high performance. All of the PBRFS examined seek to increase the quality of research along with other objectives. Although all PBRFS have a strong focus on assessing research excellence, what is measured and how varies by country.

All PBRFS measure research outputs, which generally account for 30% to 80% of the weighting of PBRFS. Research outputs may be measured through bibliometrics (quantitative counts of publications and/or citations) and/or peer review (qualitative assessments of a range of research outputs and research-related activities). The flexibility of peer review means that PBRFS that use peer review are significantly better at assessing a wider range of research outputs and research-related activities than PBRFS that solely use bibliometrics.

All PBRFS in this review include external research income (ERI) as a proxy indicator for research quality. The weighting given in each system to ERI varies significantly, from 10% to 50%. The type of ERI recognised though PBRFS varies in different countries. Measuring post-graduate qualification completions is the most common indicator in PBRFS behind measurements of research outputs and ERI. The weighting given in each system to post-graduate qualification completions varies less than ERI, from 18% to 30%.

The frequency at which research activities are assessed and the unit of assessment are linked to system design. Information measured by metrics is collected annually; information collection and assessment under systems that use peer review is undertaken less frequently. Assessment at the departmental or discipline level is common under peer-review systems; assessment at the institution level is common in systems that use metrics indicators.

In common with the other PBRFS, New Zealand’s PBRF allocates funding based on an assessment of the quality of research outputs, ERI and post-graduate qualification completions. The frequency of peer-review and metrics assessment is similar to other countries that use these approaches. The weightings given to ERI and research degree completions (RDC) are broadly in line with international practice, though the weighting for ERI is at the lower end of a wide range. New Zealand’s PBRF is alone in conducting peer-review assessments at the level of the individual researcher.

There has been growing international interest in the prospect of increasing the value of public investment in tertiary education research to enhance its contribution to economic growth and to support research in areas of priority. The United Kingdom’s new impact measure is broadly conceived to assess the impact of tertiary education research in all fields of study. New Zealand’s PBRF does not systematically measure research impact outside academia.

There is little indication that PBRFS directly recognise indigenous research methodologies, research topics, researchers and/or languages.
Introduction

1. This report focuses on PBRFS in the tertiary education sector. PBRFS are designed to assess research quality and encourage research excellence in the tertiary education sector by allocating funding to reward high performance.

2. The discussion in this report is based on a comparative analysis of objectives and policy design features of PBRFS in the following countries:
   
a. Australia: Research Block Grants (RBGs) and Excellence in Research for Australia (ERA)
   
b. United Kingdom: Research Assessment Exercise (RAE) and Research Excellence Framework (REF)
   
c. Hong Kong: Research Assessment Exercise (RAE)
   
d. Denmark: Bibliometric Research Indicator (BRI)
   
e. Norway: Performance-Based Reallocation (PBR)
   
f. Sweden: (unnamed).

3. While these are not the only countries that operate PBRFS, we chose them to give a cross-section of different systems. The PBRFS in Australia, the United Kingdom and Hong Kong were models for New Zealand’s Performance-Based Research Fund (PBRF) and contain significant elements of peer-review assessment. The discussion of these systems examines, in part, changes they have undergone since the PBRF was introduced. The remaining countries have introduced PBRFS more recently and use a formulae-based approach to identifying high performance based on quantitative indicators, making them quite different systems to those in the United Kingdom, Australia and Hong Kong.

4. A table comparing key system design features of the PBRFS in the six countries examined is found in appendix one. Appendix two includes information on performance indicators available for use in PBRFS. Detailed descriptions of each country’s system are provided in appendices three to eight.

5. PBRFS are just one of the ways in which governments support research in the tertiary education sector. All of the countries in this review provide additional core and/or contestable funding to public research organisations to build research capability, support research projects, concentrate research effort in areas of national priority, and encourage business investment in research.

---

1 While a few countries (notably the United Kingdom) have had PBRFS for some time, the introduction of PBRFS in most countries is still a fairly recent development. This means that there are gaps in the information on these schemes, notably in terms of evidence of effectiveness of these different systems and in terms of funding amounts and running costs of these different systems.

2 Australia currently has two systems in place to evaluate research, though the evaluation undertaken through the RBGs informs a greater portion of funding than that of ERA, as will be described in this report. This report considers both PBRFS.

3 The United Kingdom’s PBRFS has recently undergone changes: the RAE was last run in 2008, and it is being replaced by the REF, which will have its first evaluation round in 2014. This report considers both PBRFS.
Key literature

6. This report draws on key literature on PBRFS, including the Organisation for Economic Co-operation and Development’s (OECD’s) 2010 conference proceedings on PBRFS and a 2008 major comparative study of PBRFS in sixteen countries.

7. The 2008 study found that the combination in New Zealand’s PBRF of peer-review and metrics assessment situates it as one of the most comprehensive systems, in terms of being able to account for, reward and encourage a wide range of research activities. The study used the following criteria to assess the design of the sixteen PBRFS:

a. validity – a good system should produce conclusions that are logically correct and justifiable

b. credibility – a good system should produce conclusions that are believable to relevant audiences

c. utility – a good system should be designed for use

d. cost-effectiveness – a good system should be economical in terms of the benefits produced

e. ethicalness – a good system should be conducted in a legal, professional and otherwise appropriate manner.

8. The study ranked New Zealand’s PBRF as the highest against all five assessment criteria: it was the only system to be assessed as excellent or very good. The primary weaknesses of the PBRF were its complexity and high costs (transactional and financial).

9. Four other systems were considered good or satisfactory, including all of the peer-review systems examined in the study. The remaining systems were evaluated in the lowest category, as being “absent of merit; clearly inadequate; [having] fatal deficiencies”, including all of the metrics systems examined in the study.

Objectives of PBRFS

10. The stated objectives of PBRFS are broadly similar in the six countries included in this review. The main differences between PBRFS appear to primarily be a product of different decisions about how PBRFS should seek to meet their objectives, rather than differing views on what those objectives should be.

11. All of the PBRFS seek to increase the quality of research undertaken in the tertiary education sector. Other common objectives of PBRFS include:

   a. concentrating funding at, or redistributing funding to, high-performing institutions

---


5 The results of this study were published in several places, including: Chris L. S. Coryn, “The Fundamental Characteristics of International Models and Mechanisms for Evaluating Government-Funded Research,” Critical Perspectives on Communication, Cultural & Policy Studies 27, nos. 1 & 2 (2008): 9-25. Note that the introductions of the REF in the United Kingdom and the ERA in Australia came after this study.

6 Hong Kong, the Netherlands, the United Kingdom and the United States.
b. identifying or directing funding toward areas of research strength and emerging areas of research excellence

c. strengthening the international competitiveness of tertiary education research

d. making reliable information about research and the performance of tertiary education institutions publicly available.

12. Additional objectives for PBRFS in particular countries include:

a. ensuring that research supports teaching (New Zealand)

b. preventing an undue concentration of funding (New Zealand)

c. supporting postgraduate students and new researchers (New Zealand, Australia – RBGs)

d. developing and maintaining research infrastructure (Australia – RBGs)

e. addressing any funding gaps in the cost of research (Australia – RBGs)

f. informing policy development (the United Kingdom – RAE)

g. assessing the impact of excellent research (the United Kingdom – REF).

13. Large-scale system changes often include changes in objectives. For example, chief among the changes in the United Kingdom from the RAE (last run in 2008) and the REF (to begin in 2014) is a new focus on research impact – the reach and significance of research beyond academia (discussed in more detail below).

Policy design features of PBRFS

Overview of key system design choices

14. Although all PBRFS have a strong focus on assessing research excellence, what is measured and how varies by country. Some PBRFS rely heavily on peer-review assessment informed, to varying degrees, by metrics (quantitative indicators). Other PBRFS use only metrics.

15. The approach to assessment, the number and type of indicators selected, and the relative weight placed on each indicator reflect different government priorities and tradeoffs between comprehensiveness, reliability and efficiency. PBRFS that rely entirely on metrics are generally considered to be less expensive to administer and less compliance-heavy than systems that use peer review. However, PBRFS that use peer-review are more comprehensive and appear to have greater credibility and sector buy-in, meaning that PBRFS have status incentives as well as funding incentives.

16. Figure one shows countries and systems on the spectrum of metrics systems to peer-review systems.
17. All PBRFS assess the quality of research outputs such as publications. Additional system design choices include:

a. which types of research outputs should be assessed and how (i.e. using bibliometric indicators and/or peer review)

b. whether, or the extent to which, to measure research quality through the use of proxy indicators, such as external research income (from government, the not-for-profit sector, or business)

c. whether, or the extent to which, to measure research quality through the use of proxy indicators, such as post-graduate student enrolments or qualification completions

d. frequency of assessment and unit of assessment.

18. These system design choices depend, in part, on the intended use of information from PBRFS. For example, while all PBRFS are able to inform the allocation of funding across tertiary education institutions, only systems that incorporate some element of expert peer review provide detailed information about the quality of research undertaken within academic departments or by individual researchers.

19. These system design choices also depend on whether, or how, to measure research outcomes. Good research outcomes (or high research impact), more so than research inputs or outputs, are crucial to ensuring research value. But, measuring research outcomes or impact is rarely done directly. Incentivising high-quality research inputs and outputs can help to ensure good research outcomes. Outcomes can also be measured indirectly, through citations (recognising academic impact) and external research income (recognising industry impact, for example), and directly, through impact case studies (as will be implemented in the first round of the REF in the United Kingdom in 2014).

20. The following sections discuss key system design choices in detail. The table in appendix one gives details on the designs of PBRFS by country.

21. There is also a choice regarding the amount of funding allocated according to the results of PBRFS. The range of funding affected is wide, with some PBRFS like Norway allocating a very small proportion of research funding (2%). Further information on funding can be found in the detailed country descriptions in appendices three to eight.

Measuring research quality through research outputs

22. In most of the systems covered in this review, research outputs account for 30% to 80% of the weighting of PBRFS (see appendix one). Research outputs may be measured through bibliometrics (quantitative counts of publications and/or citations), peer review (qualitative assessments of a range of research outputs and other research-related activities), or through a combination of both.
Bibliometrics

23. Bibliometrics provide a formula-based methodology for assessing the quality of academic research publications. Specific indicators include:

a. number of articles in peer-reviewed journals (and in some cases, other types of research publications such as books, theses, or conference presentations)

b. publication type (to provide a higher weighting for articles in higher quality journals, or for books, relative to articles)

c. rates of citations, to assess academic impact.

24. The use of bibliometric indicators to assess research quality reflects the importance of academic publication as a primary route through which academics communicate the outcomes of their research. In addition, academic publication generally involves peer review in the process, which acts as quality assurance. However, bibliometric approaches work better in some types of disciplines than others: for example, they do not recognise applied research or research commercialisation activities that do not result in academic, peer-reviewed publications (other complementary metrics measuring patents, commercialisation income, etc. are discussed below).

25. The type of publications assessed through bibliographic metrics varies in different countries. For example, Sweden only includes peer-reviewed journal articles, while Denmark includes journal articles, books, anthologies, dissertations and doctoral theses.\(^7\)

26. The approach adopted by Sweden has some strengths. By focusing solely on journal articles, Sweden is able to collate results directly from existing bibliometric databases produced by Thomson Reuters. This means that the collection and assessment of information is relatively low cost.

27. However, some say existing bibliometric databases frequently contain mistakes and inaccuracies.\(^8\) The process of correcting and refining data from existing bibliometric databases can be time and cost intensive to researchers, institutions and government agencies. Journal articles also make up a relatively narrow subset of research outputs in some disciplines. This may not fairly reflect the quality or quantity of research activity in disciplines such as fine arts, design, or information technology, which rely less on publication in peer-reviewed journals.

28. Denmark and Norway establish their own bibliometric databases so as to have more control over collecting and managing publication data. Institutions report publication data to national research councils that manage the data and processes to determine eligibility and rankings of publication routes. Benefits of this approach are that publications beyond journal articles can be counted. This results in a more accurate assessment of actual research activities.

29. Customising bibliometric databases also means that publications can be ranked and recognised within a country-specific context. This could help to prevent an undue focus on the quantity rather than quality of research outputs, and means that additional

---

\(^7\) Denmark also collects information on patents through its bibliometrics measure; this is technically beyond the realm of bibliometrics (which, by definition, measure information on publications).

research-related activities can be incentivised. For example, the Danish system assigns a higher weighting to publications with more than one author, thereby incentivising collaboration. The Danish system also assigns higher weightings to local publications or publications in the local language, thereby incentivising research with local relevance.

30. The process of customising bibliometric databases is more accurate, but also more time-intensive and costly than relying on information from existing databases.

Peer review

31. Peer review is the qualitative measurement of research outputs and research-related activities. Peer review has long been accepted as a method of quality assurance in academia, and therefore has a high level of credibility within the tertiary education sector. Peer review is undertaken by discipline-specific panels of experts that review research outputs submitted by researchers and academic departments. The judgement of peer-review panels can be, and often is, informed by bibliometric indicators.

32. The key strength of peer review is that it is a flexible method for assessing research outputs and research-related activities, often informed by quantitative measures of research productivity (such as lists of publications and other research outputs). This means that PBRFS that use peer review assess quality across all disciplines and incentivise a broad range of research outputs as follows:

a. New Zealand’s PBRF assesses a wide variety of research outputs including such non-traditional outputs as commissioned reports for external bodies, poster presentations at conferences, films, patents, oral presentations, computer software, images, and food products.

b. Australia’s ERA assesses journal articles, books, book chapters, conference publications, original creative works, live performances, recorded works, curated exhibitions and events, and portfolios of non-traditional research outputs via peer review.

c. The United Kingdom’s RAE and REF assess a wide variety of research outputs including such non-traditional outputs as new materials, devices, artefacts, buildings, patents, performances, and exhibitions.

d. Hong Kong’s RAE assesses a wide variety of research outputs including such non-traditional outputs as patents, artefacts, performances, computer software, and architectural drawings.

33. Beyond research outputs, panels evaluate many other research-related activities. This requires researchers and tertiary education organisations to provide a wide range of both quantitative and qualitative contextual information to support the assessment process. Typical measures of research-related activities include:

a. peer esteem (awards, prizes, editorial posts, etc.)

b. collaboration (evidence of involvement in research networks)

c. research application (publication in high-impact journals, reports to governments or business clients, patents, etc.)

d. research strategies (long-term departmental research plans)
e. post-graduate research supervision and/or post-graduate qualification completions.

34. Some PBRFS – like Australia’s ERA and New Zealand’s PBRF – require institutions and/or researchers to submit this information; other PBRFS allow for such information to be submitted optionally, giving a more complete view of an institution’s research-related activities.

35. The United Kingdom’s REF will also collect information on the impact of research outside academia, by having academic departments submit impact case studies for peer-review evaluation (discussed further below).

36. While the information collected in the peer-review process is thorough and detailed, the burden on researchers and institutions to report information is higher than with bibliometrics. This is the key weakness of peer review.

37. Overall, the flexibility of peer review means that PBRFS that use peer review are significantly better at assessing a wider range of research outputs and research-related activities than PBRFS that solely use bibliometrics. For a more thorough discussion of the strengths and weakness of peer-review evaluation and of alternatives to peer review, refer to the report, “Assessing research performance – peer assessment and quantitative measures”.

Measuring research quality through proxy indicators

38. This section addresses the two most-used indicators: external research income and post-graduate students. For a comprehensive list of possible indicators along with their uses and limitations, see appendix two.

External research income (ERI)

39. All PBRFS in this review include ERI as a proxy indicator for research quality. This recognises that tertiary education institutions compete for ERI, and that organisations that fund tertiary education research will only do so if they consider they are getting good value. Measuring ERI also incentivises tertiary education institutions to seek out this type of funding, which may increase the impacts of tertiary education research outside of academia. The weighting given in each system to ERI varies significantly, from 10% in Hong Kong to 50% in Sweden (the weighting given to ERI in New Zealand’s PBRF is 15%) (see appendix one).

40. The type of ERI recognised though PBRFS varies in different countries. Hong Kong’s RAE and Norway’s PBR only recognise ERI from peer-reviewed grants and/or academic research funding councils. While this approach does serve to reward institutions that attract prestigious academic research grants, it does not actively encourage tertiary institutions to conduct business-led research, or to engage in knowledge transfer activities.

41. In countries such as New Zealand, Australia, Sweden and Denmark, PBRFS recognise research funding from the public sector (for example, through contract research or contestable research funds), the non-profit sector, and business. A broad approach to defining ERI serves to reward high quality public good research, and research aligned to strategic national priorities, as well as contract research designed to meet specific business needs.

42. Although PBRFS recognise different types of ERI, none of the countries in this review appear to weight ERI differently according to funding source. However, the United
Kingdom has another mechanism, the Higher Education Innovation Fund (HEIF), which allocates performance-based funding to tertiary education institutions based on ERI. This scheme uses ERI as a proxy indicator for knowledge transfer activities between tertiary education institutions, communities and industry, rather than research excellence.

43. The HEIF has a particular focus on increasing the relevance and impact of tertiary education research, with a view to generating social and economic benefits to the United Kingdom. The scheme provides a higher weighting for research income from small and medium enterprises (SMEs). This is designed to recognise the value of tertiary education institutions working with SMEs, and the higher costs that this entails.

44. Compared to peer-review assessment, measuring ERI requires relatively simple data collection and analysis that is not time or cost intensive.

**Post-graduate students**

45. Four of the six countries in this review include an explicit indicator measuring post-graduate student enrolments or qualification completions as a proxy indicator for research quality. Measuring post-graduate qualification completions is the most common indicator in PBRFS behind measurements of research outputs and ERI. The weighting given in each system to post-graduate qualification completions varies less than ERI, from 18% in Denmark to 30% in Norway (the weighting given to research degree completions in New Zealand’s PBRF is 25%) (see appendix one).

46. Measuring post-graduate student enrolments and/or qualification completions reflects an assumption that students who choose to undertake lengthy, expensive and advanced degrees (especially doctorates) tend to search out departments and supervisors who have reputations in the relevant fields for high-quality research and research training. These indicators also capture, at least to some degree, the connection between staff research and research training, thus providing some assurance of the future capability of tertiary education research.

47. There are advantages to measuring post-graduate student completions rather than student load or enrolments. A focus on qualification completions incentivises institutions to maximise their qualification completions rates, with benefits to students, employers and tertiary education organisations. In contrast, the Australian approach, which measures student load and enrolments as well as qualification completions, may incentivise institutions to keep post-graduate students in study longer, or to enrol students who are less likely to complete.

48. Compared to peer-review assessment, measuring post-graduate student enrolments or completions requires relatively simple data collection and analysis that is less time and cost intensive than peer review.

---

9 The HEIF aims to encourage knowledge transfer activities leading to social and economic benefits to the United Kingdom. The HEIF has been reformed several times. The current formulae-based allocation method is entirely performance based, and replaces an earlier allocation method which provided capability funding via contestable grants.

10 Sweden and Hong Kong are the exceptions.
**Frequency of assessment and unit of assessment**

**Frequency of assessment**

49. The frequency at which research activities are assessed is linked to system design. Collection of quantitative information is generally easier than peer-review evaluations, so information measured by metrics is collected annually.

50. Information collection and assessment under systems that use peer review is more resource and time intensive and so is undertaken less frequently. Peer-review assessments are conducted at intervals of as little as two years (the first and second iterations of Australia’s ERA were conducted in 2010 and 2012) and as much as eight years (Hong Kong’s RAE was conducted in 2006 and is planned for 2014). Assessments are generally conducted less frequently the longer a system has been in place. See appendix one for the frequency of assessment in each country.

51. The longer assessment periods under peer-review systems mean that the information that informs funding allocations becomes outdated: there is a considerable time lag between any changes in provider performance and revised funding allocations. In contrast, because metrics information is collected more frequently, funding allocations are based on more up-to-date information.

52. More frequent data collection and assessment means funding allocations can be more responsive to changes in government priorities and to the nature of change sought through PBRFS (i.e. increased research quality), but in peer-review systems this must be balanced with the burden of collection and assessment.

**Unit of assessment**

53. The unit of assessment reflects the level by which an institution’s research outputs are collected and assessed. Regardless of the unit of assessment, funding allocations are made in all cases at the institutional level. Different units of assessment then place the burden of assessment in different places. They also recognise differently the source of research and the contribution of the individual researcher to an institution’s research activities.

54. As with frequency of assessment, the unit of assessment is linked to system design (see appendix one). Assessment at the departmental or discipline level is common under peer-review systems. This recognises the collegial nature of much research activity and the importance of collaborative research arrangements.

55. Choices around the unit of assessment in peer-review systems affect the burden of assessment and the impact of each individual researcher on the funding allocation:

   a. Assessment at the level of the individual means that the burden of assessment is higher for researchers, each of whom must account for their research activities, and means that each eligible researcher contributes evenly and directly to an institution’s funding allocation.

   b. Assessment at the level of the academic department or research discipline shifts some of the burden of assessment to the department and means that the contribution of each researcher to an institution’s funding allocation may not be even or as direct.
c. Assessment at the level of the institution matches the level at which funding is allocated and further shifts the burden of assessment away from the individual researcher. It also further distances each researcher’s contribution from the institution’s funding allocation.

56. Assessment at the institution level is common in systems that use metrics indicators and ensures metrics remain relatively less costly. The United Kingdom and Australia (ERA) collect metrics information at the departmental and discipline level respectively to inform peer review. New Zealand’s PBRF is alone in conducting peer-review assessments of individual researchers, while assessing external research income and post-graduate completions at the institutional level.

57. Choices around unit of assessment reflect priorities around the use of data. The more specific the unit of assessment, the more nuanced the information that is collected. Bibliometric indicators and other quantitative measures do not give reliable information at the level of the individual researcher, or department or discipline, because of variances in publication activities across disciplines (though they can provide information at the subject level). Countries that value performance information about the quality of departments or disciplines, as well as institutions, incorporate an aspect of peer review into their PBRFS.

The development of PBRFS over time

58. While a few countries have had PBRFS for some time, the introduction of PBRFS in most countries is still a fairly recent development. The United Kingdom and Australia have been at the forefront in developing their PBRFS. Recent changes are discussed here, with a focus on how they maximise the effectiveness, efficiency and impact of their PBRFS.

United Kingdom

59. The United Kingdom had two main objectives in making changes from the RAE to the REF, which will be implemented in 2014:

a. reduce the burden and cost of assessment

b. assess the impact of research.

60. The government initially sought to achieve the first objective by relying more on metrics assessment rather than peer review. However, after a series of consultation and pilots, changes are not as significant as had been proposed, in large part because consultation confirmed widespread confidence in peer-review assessment.

61. In lieu of a more drastic change from peer-review to metrics assessment, several changes were made to the peer-review process to lower the burden and cost of assessment. These include:

a. reducing the number of assessment panels (the 2008 RAE involved 67 sub-panels and 15 main panels; the 2014 REF will involve 36 sub-panels and four main panels)

b. eliminating peer esteem as a distinct element in the assessment process
c. reducing and standardising the information collected regarding research environment.

62. The introduction of this explicit assessment of impact reflects the increased priority the government is placing on ensuring value-for-money from the research it funds. Impact is defined as an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia. The REF measures research impact by collecting impact case studies from participating departments (see appendix four for more information).

63. Changes have also been made from the RAE to the REF, such that there is greater consistency in the assessment process, including standard weightings between the three elements of assessment (outputs, impact and environment) and standardisation of a number of criteria, data requirements and procedures.

Australia

64. Australia had two main objectives in introducing ERA in 2010:

a. provide a comprehensive assessment of the quality of research undertaken in Australian higher education institutions at regular intervals

b. undertake a practical, cost-effective approach to assessment.

65. The introduction of ERA and the first of these objectives reflect that the existing RBGs allocate funding to higher education institutions based on their performance, but do not involve an evaluation framework that allows for comprehensive evaluation and comparison of research excellence.

66. Informed by international comparisons and trials, the Government determined that in order to meet its objectives of both comprehensiveness and cost-effectiveness, ERA would need to strike a balance between quantitative and qualitative measures of research quality.

67. In undertaking assessment, the range of disciplines is split into peer-review disciplines and citation disciplines, based on expert advice from the research community about appropriate indicators for assessing research excellence and the availability of robust data. In the majority of science, engineering and medical disciplines, the assessment indicators include bibliometrics, with an emphasis on citation analysis. In the remaining discipline clusters, the emphasis is on peer review by international experts.

68. To meet the objective of comprehensiveness, ERA measures a broader range of research outputs and research-related activities than the RBGs, including research application and esteem measures. The research application measures focus on commercialisation income and other indicators that reflect relevance to industry. The measures do not assess research impact as broadly as the United Kingdom’s REF.
What does this mean for New Zealand’s PBRF?

Assessing the effectiveness and efficiency of New Zealand’s PBRF, relative to other PBRFS

69. According to the OECD, the quality and/or quantity of research produced in the tertiary education sector has increased in countries that have introduced PBRFS. However, there is very limited comparative performance information available to judge the relative effectiveness of different countries' PBRFS in meeting their objectives.

70. In common with the other PBRFS, funding through New Zealand's PBRF is allocated to institutions based on an assessment of the quality of research outputs, external research income and post-graduate qualification completions. The frequency of peer-review and metrics assessment is similar to other countries that use these approaches. The weighting given to research degree completions is broadly in line with international practice. The weighting given to external research income (15%) is also broadly comparable with other countries, though at the lower end of a wide range (10% to 50%).

71. The New Zealand PBRF is unique in its use of a peer-review process based on the individual (rather than department or school) as the unit of assessment. This approach sets high expectations for academic staff, and provides detailed performance information that can inform strategic planning and resource allocation within institutions. However, it also means that the PBRF is complex and costly to administer, with relatively high transaction costs for Government, institutions, academic departments and individual academics.

Increasing the impact of tertiary education research through PBRFS

72. There has been growing international interest over recent years in the prospect of increasing the value of public investment in tertiary education research to enhance the contribution of the higher education sector to economic growth and to support tertiary education research in areas of social, cultural and economic priority. As the OECD notes, addressing these types of goals may be done through one of two ways:

a. PBRFS could include more objectives to measure and incentivise research on specific research topics and/or additional research-related activities, such as knowledge transfer and research commercialisation. This approach is likely to increase the complexity and costs of PBRFS.

b. PBRFS could continue to focus mainly on research excellence, with other funding mechanisms used to distribute research support to meet alternative objectives. This would not affect the complexity and costs of PBRFS, but may require new research funding sources.

73. The example of the United Kingdom shows that the relevance and application of tertiary education research beyond academia can be measured two ways:

a. indirectly, through proxies like external research income, as is done through its HEIF


b. directly, through peer-review assessment of case studies, as will be done through its REF.

74. New Zealand’s PBRF already includes a relatively wide definition of research, which means that a wide range of research outputs are able to be measured, assessed and rewarded through the existing quality evaluation. A wide range of research-related activities are also assessed through a focus on peer esteem and contribution to the research environment. Together with the use of ERI as a proxy measure for research excellence, this means that the PBRF provides indirect support for research in areas of national priority, knowledge transfer and research commercialisation.

75. The PBRF does not systematically measure research impact outside academia. However, the introduction of the Professional and Applied Research Expert Advisory Group in the 2012 quality evaluation was to assist peer review panels to go beyond the usual academic excellence criteria to assess the significance, quality and impact of applied and professional research. This new process covers a small subset of the research outputs assessed through the PBRF quality evaluation. We will report on the impact of this new group once the results of the 2012 quality evaluation are available in March.

76. In contrast, the United Kingdom’s new impact measure is broadly conceived to assess the application and take-up of tertiary education research in all fields of study. It is too early to judge the effectiveness or efficiency of this approach. However, recent evaluations of the HEIF indicate that performance-based funding for business and community engagement does generate significant social and economic benefits.13 One study found that nearly £600 million has been put into higher education (primarily through the HEIF), and estimated that this has generated a minimum of between £2.9 and £4.2 billion in value.14

77. This shows that rewarding tertiary education institutions on the basis of ERI is a relatively simple and effective way to increase the impact of tertiary education research. The weighting for ERI in New Zealand’s PBRF is at the lower end of the range used by other countries. This indicates that placing a higher weighting on ERI may serve to increase the incentives for tertiary education organisations to undertake research and research-related activities that generate innovation (i.e. new products or processes). However, the advantages of this would have to be considered against potential disincentives to engage in beneficial research that does not attract ERI and against refocusing emphasis from other priorities to the PBRF.

78. Finally, it is important to recognise that PBRFS are just one of a number of ways in which governments seeks to meet their tertiary education, research, science and innovation goals. In the New Zealand context, the Government also supports research capability in the tertiary education sector through tuition subsidies ($2 billion in 2011/12, with higher funding rates for post-graduate student enrolments) and Centres of Research Excellence (CoREs, $34 million in 2011/12). The Government also provides significant funding to support research capability, focus research in areas of national priority, and promote

13 Public and Corporate Economic Consultants (2012), Strengthening the Contribution of English Higher Education Institutions to the Innovation System: Knowledge Exchange and HEIF Funding, Report for HEFCE by PACEC.
14 Public and Corporate Economic Consultants (2009), Evaluation of the effectiveness and role of HEFCE/OSI third stream funding, Report to HEFCE by PACEC and the Centre for Business Research, University of Cambridge.
business investment in research through Vote Science and Innovation ($760 million in 2011/12).

**Supporting mātauranga Māori**

79. Little information is available to inform this area of focus for the review of New Zealand’s PBRF. In the PBRFS in Denmark and Hong Kong, steps are taken to support research in the native language and to recognise research with a local impact respectively:

a. Danish-language publications are automatically assigned a higher weighting.

b. Panels in Hong Kong are issued instructions that research that addresses local issues can still meet internationally recognised standards of rigour and scholarship (i.e. measuring research outputs against international standards of excellence does not mean that the research must have an international impact).

80. Otherwise, there is little indication that PBRFS (other than New Zealand's PBRF) directly recognise indigenous research methodologies, research topics, researchers and/or languages.
## Appendix 1: Design features of PBRFS by country

<table>
<thead>
<tr>
<th>Country</th>
<th>Metrics</th>
<th>Peer review</th>
<th>Frequency of assessment</th>
<th>Unit of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>Research degree completions (25%) External research income (15%)</td>
<td>Peer review (60%) by expert panels assesses individual researcher’s:</td>
<td>Peer review: 2003, 2006, 2012, then every six years</td>
<td>Peer review: individual researcher Metrics:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• research outputs</td>
<td>Metrics: annual</td>
<td>institution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• peer esteem (such as fellowships)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• contribution to the research environment (such as evidence of collaborations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frequency of assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia – RBG</td>
<td>Funding for each scheme is calculated by a quantitative-based formula using some of the following metrics:</td>
<td>None</td>
<td>Annual</td>
<td>Institution</td>
</tr>
<tr>
<td></td>
<td>• research student total load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research student total completions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research publications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• previous program payments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia – ERA</td>
<td>Evaluation is undertaken by a combination of metrics (bibliometrics or peer review), and using other different indicators in four categories, including:</td>
<td>Peer review by expert panels assessed academic departments’ research outputs, sometimes informed by information about:</td>
<td>2010, 2012 and planned for 2016</td>
<td>Research discipline</td>
</tr>
<tr>
<td></td>
<td>• research quality: citation analysis, peer-reviewed Australian and international research income</td>
<td>• charity income</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research volume and activity: total research outputs, research income and other research measures</td>
<td>• business research income</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research application: research commercialisation income and other applied measures</td>
<td>• post-graduate research supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• recognition: a range of esteem measures (such as fellowships)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• charity income</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• business research income</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• post-graduate research supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frequency of assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unit of assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Metrics</td>
<td>Peer review</td>
<td>Frequency of assessment</td>
<td>Unit of assessment</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>United Kingdom – REF</td>
<td>None</td>
<td>Peer review by expert panels will assess academic departments':</td>
<td>Upcoming in 2014</td>
<td>University department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● research outputs (65%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● impact (assessed by case study) (20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● research environment (includes doctoral degrees, external research income and research strategies) (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td>None</td>
<td>Peer review by expert panels assesses cost centres':</td>
<td>1993, 1996, 1999, 2006 and planned for 2014</td>
<td>Cost centre (academic discipline)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● research outputs (80%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● peer-reviewed research grants and esteem measures (such as awards) (20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>External research income (36%)</td>
<td>None</td>
<td>Annual</td>
<td>Institution</td>
</tr>
<tr>
<td></td>
<td>Number of PhD graduates (18%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research outputs (publications) (46%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Research outputs (publications) (30%)</td>
<td>None</td>
<td>Annual</td>
<td>Institution</td>
</tr>
<tr>
<td></td>
<td>Number of doctoral degrees awarded (30%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External research income (40%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● European Union Framework Programme for research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Research Council of Norway</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Research outputs (publications) (30%)</td>
<td>None</td>
<td>Annual</td>
<td>Institution</td>
</tr>
<tr>
<td>Sweden</td>
<td>External research income (50%)</td>
<td>None</td>
<td>Annual</td>
<td>Subject area</td>
</tr>
<tr>
<td></td>
<td>Research outputs (journal publications) (50%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2: Performance indicators available for use in PBRFS

Possible indicators

1. Literature on performance indicators generally and research indicators specifically describes characteristics of good indicators:
   a. Good performance indicators are clear, relevant, economical, reliable, credible and monitorable.
   b. Good research indicators are also fit-for-purpose, verifiable, fair, appropriate and capable of facilitating comparisons across disciplines and institutions.

2. There are many different indicators, but knowledge about their accuracy and limitations is inadequate. In 2010, the Organisation for Economic Co-operation and Development (OECD) published a list of 19 metric indicators that may be used to inform PBRFS. The table below shows different indicators with their uses and limitations.

3. Comparing these characteristics of good indicators with the indicators listed in the table shows that no single indicator meets all of the characteristics. The most common limitation of indicators is difficulties in recognising variances between academic disciplines. Certain research activities are more common in some academic disciplines than others; when indicators cannot account for this variance, the research activities of some researchers will not be accurately measured. PBRFS account for this by relying on several indicators or using a combination of peer review and indicators.

4. For example, not all research generates intellectual property that can be licensed or patented; if this is the only measure of research quality and/or productivity used, it would show low or no research activities in some research fields when this is not, in fact, the case. However, if measures of licenses and patents are combined with indicators that measure publications and non-bibliographical outputs, such as artworks and music, then the combination of indicators would result in a more accurate measurement of an institution’s research activities.

Possible indicators (proxies) of research performance, grouped by type, and showing their uses and limitations

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>USES</th>
<th>LIMITATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input indicators</strong> reflect an institution’s reputation through its abilities to attract people and funding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| External funding | • shows something about institutions’ competitiveness on funding markets  
• when defined as peer-reviewed external funding, includes an aspect of quality | • competitiveness does not fully coincide with quality  
• networks play a role  
• availability varies across disciplines |
| Recruitment of PhD students and academic staff | • shows something about institutions’ competitiveness  
• shows something about graduates’ and applicants’ assessment of the research environment | • graduates’ and applicants’ choices depend on many factors |
| **Process indicators** reflect an institution’s reputation through its activeness in face-to-face research sharing | | |
| Seminar and conference activity | • may be used as a proxy for quality, impact and peer esteem | • conference activity may reflect research tourism |
| Invited keynotes | • may be used as a proxy for quality, impact and peer esteem | • may reflect networks rather than quality  
• variance makes cross-disciplinary comparison difficult |
| International visiting research appointments | • may be used as a proxy for peer esteem | • may reflect networks rather than peer esteem  
• variance makes cross-disciplinary comparison difficult |
<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>USES</th>
<th>LIMITATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure indicators reflect an institution’s research infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff active in research</td>
<td>shows something about research capability and intensity</td>
<td>needs to be considered alongside output to assess activity</td>
</tr>
<tr>
<td>Number of PhD students</td>
<td>shows something about research capability and intensity</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Research collaborations and partnership</td>
<td>shows something about research involvement and scale of activity</td>
<td>difficult to define and can take place informally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Reputation and esteem</td>
<td>shows something about peer esteem though memberships of editorial boards, committees and learned societies</td>
<td>may reflect networks rather than recognition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Research infrastructure and facilities</td>
<td>shows something about research involvement and scale of activity</td>
<td>includes many indicators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>variance makes institutional comparison difficult</td>
</tr>
<tr>
<td><strong>Output indicators reflect an institution’s research productivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publications</td>
<td>common to most academic disciplines</td>
<td>emphasis on quantity not quality</td>
</tr>
<tr>
<td></td>
<td>peer-reviewed publications can be a proxy for quality</td>
<td>disciplines value different types of publications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ranking journals is difficult</td>
</tr>
<tr>
<td>Non-bibliographical outputs</td>
<td>recognises outputs like artworks or music</td>
<td>not easily measured/compared</td>
</tr>
<tr>
<td>Number of PhD graduates and completion rates for graduates</td>
<td>shows something about the effectiveness of PhD programmes</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td></td>
<td></td>
<td>may be affected by recruitment and external employability</td>
</tr>
<tr>
<td>Public outreach</td>
<td>shows something about the visibility of research in society</td>
<td>visibility may be loosely coupled to research activities</td>
</tr>
<tr>
<td><strong>Effect indicators reflect the impact of an institution’s research activities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citations</td>
<td>provide information about impact and visibility</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Number of awards and prizes</td>
<td>shows something about research quality and impact</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Employability of PhD graduates</td>
<td>industry and governmental employment of PhD graduates can shows something about the quality and contribution to industry and society</td>
<td>sensitive to other factors like regional or national economy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td>Knowledge transfer and commercialisation of research-generated intellectual property (IP)</td>
<td>shows something about impact through patents, licenses or start-ups</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
<tr>
<td></td>
<td>links IP, commercialisation and economic benefits</td>
<td></td>
</tr>
<tr>
<td>Commissioned reports, consultancy and contracts</td>
<td>shows something about end-user esteem and contribution of research</td>
<td>may reflect networks</td>
</tr>
<tr>
<td></td>
<td>can be a proxy for quality</td>
<td>variance makes cross-disciplinary comparison difficult</td>
</tr>
</tbody>
</table>

Appendix 3: Australia

Overview

1. From 2002, Australia has operated the Research Block Grants (RBGs), which provide base research funding to higher education providers (HEPs) determined by performance against a series of metrics.\(^{15}\) Forty-one universities are eligible for funding through the RBGs.

2. From 1990 until 2001, the funding arrangements for universities under the relative funding model (RFM) included the research quantum, which was initially set at about 6% of operating grants to support research activities other than those directly linked to teaching and research training.

3. From 2001 the research quantum was rolled into the RBGs. This base funding contributes through general revenue to maintaining the capability that is needed for competitive grant-supported research as well as supporting other research such as that of staff at an early stage of their career, which is solely funded from general university funds.

4. Beyond base funding, government funding for research conducted by universities is provided through grants and other sources administered by the Australian Research Council (ARC), the Department of Innovation, Industry, Science, Research and Tertiary Education (DIISRTE), and the National Health and Medical Research Council (NHMRC). The ARC and the NHMRC administer competitive grants for which researchers apply directly.

5. In the years leading up to 2007, the Research Quality Framework (RQF) was developed, which would have allocated some university block funding on the basis of discipline-based peer review of research quality, rather than the metrics-based formula used for the RBGs. This scheme was not implemented.

6. The Excellence in Research for Australia (ERA) scheme was developed in place of the RQF. The ERA is a quality assessment based on a combination of peer review and metrics. The first round of ERA was undertaken in 2010, and was directly tied to the Sustainable Research Excellence (SRE) funding component of the RBGs. The second round was run in 2012 and the results will continue to inform some funding decisions for RBGs.

Research Block Grants (RBGs)

7. RBGs are independent of funding for specific research projects, programs, or fellowships. HEPs have considerable autonomy in deciding what research projects, personnel, equipment and infrastructure this funding should support.

8. Funding allocated by RBGs in 2013 will be approximately A$1.7 billion. This represents approximately 12% of total higher education funding in 2013. The cost to administer the RBGs is approximately A$1.2 million per year.

\(^{15}\) The Research Infrastructure Block Grants were established earlier, in 1995.
Objectives

9. DIISRTE manages six RBGs to support research and research training in Australian HEPs:

a. Australian Postgraduate Awards (APA)
   i. support postgraduate research training
   ii. provide financial support to postgraduate students of exceptional research promise

b. International Postgraduate Research Scholarships (IPRS)
   i. enables international students to undertake a postgraduate research qualification in Australia and gain experience with leading Australian researchers

c. Research Training Scheme (RTS)
   i. to support research training for students undertaking Research Doctorate and Research Masters degrees

d. Joint Research Engagement (JRE)
   i. replaced the Institutional Grants Scheme (IGS) from 2010
   ii. may be used to fund any research and research training activity

e. Sustainable Research Excellence (SRE)
   i. to addresses the gap in funding for the indirect costs of university research supported by Australian competitive grants

f. Research Infrastructure Block Grants (RIBG)
   i. to enhance the development and maintenance of research infrastructure.

Approach to assessment

10. Funding for each scheme is based on metric measurements of HEPs’ overall research performance. Funding is calculated by a formula using some combination of the following metrics:

a. research student total load

b. research student total completions

c. research income

d. research publications

e. previous program payments.

11. Publications were ranked from 2003, thereby adding an element of quality evaluation.
Criticisms

12. Criticisms of the RBGs include that:
   a. game playing takes place at institutions to make conference and journal outputs fit eligibility requirements
   b. the focus is on quantity of research rather than quality
   c. too much weight is given to historical funding patterns rather than to the current quality of research.

Outcomes

13. The RBGs have resulted in increased productivity, especially in lower-impact journals, though productivity increased in higher-impact journals after the introduction of journal rankings from 2003 onwards.

14. The RBGs have also resulted in improvements in universities’ strategic focus on research and research performance.

Research Quality Framework (RQF)

15. Plans for Australia’s RQF came into being in 2007 (and the years prior). The RQF was developed as a system-wide and expert-based mechanism to measure both research excellence and the wider impact of academic research. Funds were to be allocated on the basis of outcomes.

16. Research impact was concerned with the social, cultural, economic, and/or environmental outcomes for Australia. In terms of impact assessment, set features were an impact scale against which to report and judge the level of research impact; and, research groups submitting an impact statement linking the group’s research to claimed impact outcomes, the beneficiaries, the measurable difference made by the research, and the details of end users who may confirm research groups’ impact claims. Impact definitions and scales were questioned in the consultation which informed the RQF development.

17. The 2007 election resulted in a change of government, which then announced that the RQF would not proceed because it was “poorly designed, administratively expensive and relies on an impact measure that is unverifiable and ill-defined”. The government set about planning the ERA in its place with a focus specifically on quality, and not the impact approach which had been proposed for the RQF.

Excellence in Research for Australia (ERA)

18. ERA is designed to provide a comprehensive review of the quality of research undertaken in Australian higher education institutions at regular intervals. The first ERA was conducted in 2010, the second in 2012 and the third is planned for 2015. Forty-one universities are eligible for participation in ERA.

19. ERA identifies and examines the quality of research across the full spectrum of research activity in eligible higher education research institutions. ERA is intended to reflect the Australian government’s commitment to a transparent, streamlined approach to the evaluation of the quality of research undertaken in Australia’s universities.

20. ERA is included as a key measure of performance in the 2011-2013 mission-based compacts between the Australian Government and institutions and has already informed the development of the Government’s Research Workforce Strategy (RWS). ERA 2010 was not directly tied to funding. ERA 2012 outcomes will inform:

   a. the allocation of some funding (approximately A$114 million) through the Sustainable Research Excellence in Universities (SRE) initiative
   b. the 2014-2016 mission-based compacts between the Australian Government and institutions
   c. the new minimum standards for higher education research and research training, to be administered by the Tertiary Education Quality and Standards Agency (TEQSA).

21. ERA was originally funded for A$35 million to cover development and consultation processes, the 2009 trials, and the 2010 and 2012 assessment rounds. This funding will continue to cover some preparation costs for the 2015 round.

Objectives

22. The objectives of ERA are to:

   a. establish an evaluation framework that gives government, industry, business and the wider community assurance of the excellence of research conducted in Australia’s higher education institutions
   b. provide a national stocktake of discipline-level areas of research strength and areas where there is opportunity for development in Australia’s higher education institutions
   c. identify excellence across the full spectrum of research performance
   d. identify emerging research areas and opportunities for further development
   e. allow for comparisons of Australia’s research nationally and internationally for all discipline areas.

Definition of research

23. ERA takes a broad definition of research based on the OECD 2002 Frascati Manual:

   For the purposes of Excellence in Research for Australia (ERA), research is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it is new and creative.

   This definition of research is consistent with a broad notion of research and experimental development (R&D), one that recognises research as comprising creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise applications.
Approach to assessment

24. The ERA unit of evaluation is the discipline within the institution, defined by the Australian and New Zealand Standard Research Classification (ANZSRC) Field of Research Codes (FoRs).

25. Evaluations in ERA are undertaken by eight Research Evaluation Committees (RECs) established at the discipline cluster level and by external peer reviewers where peer review is an ERA indicator. RECs comprise distinguished researchers with expertise in research evaluation who evaluate the overall research performance of disciplines within institutions, using a range of discipline-specific indicators.

26. ERA evaluations are informed by a range of indicators:

a. *Indicators of research quality:* Research quality is considered on the basis of a publishing profile, citation analysis, ERA peer review, and peer-reviewed Australian and international research income.

b. *Indicators of research volume and activity:* Research volume and activity is considered on the basis of total research outputs, research income and other research items within the context of the profile of eligible researchers.

c. *Indicators of research application:* Research application is considered on the basis of research commercialisation income and other applied measures.

d. *Indicators of recognition:* Research recognition is considered on the basis of a range of esteem measures.

27. The indicators are largely metrics-based with an emphasis on citation analysis the vast majority of science, engineering and medical disciplines and peer review by international experts in the remaining discipline clusters. Thus, disciplines in ERA are either peer-review disciplines or citation disciplines, as is considered appropriate for a robust and valid evaluation.

28. Units of evaluation (disciplines within institutions) are assessed on a five-point rating scale which was designed to be broadly consistent with approaches taken in research assessment processes in other countries, in order to allow for international comparison. The scale uses “world standard” as the guide (i.e. well above, above, at, below, or well below world standard).

29. Initially, in the 2010 round, journals were assigned rankings as a measure of quality. Following the release of the ERA 2010 outcomes, the Australian Research Council conducted two major rounds of public consultation. In general, there was support from the sector through the consultation for minimal change to ERA for 2012 both as a reflection of confidence in the sector about the ERA approach, and the desire to ensure broad comparability of the ERA 2010 and 2012 results. Based on the consultation feedback and experience from the ERA 2010 process, however, the journal rankings were not used for ERA 2012.
Appendix 4: United Kingdom

Overview

1. The Research Assessment Exercise (RAE) was an exercise undertaken six times on behalf of the four United Kingdom higher education funding councils to evaluate the quality of research undertaken by British higher education institutions (in 2011, 165 higher education institutions were eligible for participation in the RAE, including 115 universities).

2. The system was designed to maintain and develop the strength and international competitiveness of the research base in United Kingdom institutions, and to promote high quality in institutions conducting the best research and receiving the largest proportion of grant. The outcomes are published to provide public information on the quality of research in higher education throughout the United Kingdom. The results may also be used to inform policy development.

3. The assessments are based largely on peer-review evaluation of research outputs of university departments.

4. In 2006, the Government announced that it presumed that after the 2008 RAE, the system for assessing research quality for the purposes of funding allocation would become primarily metrics based. The Government was keen to reduce the burden of assessment and reduce the cost of the RAE, while still measuring the quality of research.

5. After a series of consultations and pilots, the changes were not as significant as the Government might have envisioned in 2006. The majority of the exercise, now named the Research Excellence Framework (REF), still involves peer review as the assessment measure, but there were, nonetheless, some important changes, including the introduction of an assessment of research impact. The REF will first occur in 2014.

Research Assessment Exercise (RAE)


7. Any funding awarded to departments was designed to reflect both the volume and quality of a department’s work and also the relative cost of research in the field.

8. From 1996, no funding was given to departments that received the lowest two grades. From 2001, no funding was given to departments who received the lowest three grades.

9. Funding allocated from the results of the 2008 RAE was £1.9 billion in 2009/10 (the results of the 2008 RAE will inform £11 billion of funding over six years from 2009/10 to 2014/15).

10. It cost the Government around £12 million to administer the RAE in 2008. Costs include administration (staff and systems), panel meetings and fees paid to the assessors. The cost to participating institutions for preparing their submissions to the 2008 RAE is

---

17 The RAE was originally known as the Research Selectivity Exercise. Assessments were carried out by the following organisations: the University Grants Committee (1986); the Universities Funding Council (1989); the Higher Education Funding Council for Wales, the Higher Education Funding Council for England, the Scottish Funding Council, and the Department for Employment and Learning (Northern Ireland) (1992 to 2008).
approximately £35 million. The Government regards these figures as reasonable in context of the £11 billion allocated as a result of the 2008 RAE, and notes that the RAE is cheaper to run (compared to funding allocated) than most grants-based funding.

Objectives

11. The RAE had four main objectives:

   a. maintain and develop the strength and international competitiveness of the research base in United Kingdom institutions
   b. promote high quality in institutions conducting the best research and receiving the largest proportion of grant
   c. provide public information on the quality of research in higher education throughout the United Kingdom
   d. inform policy development.

Definition of research

12. Research is defined as original investigation undertaken in order to gain knowledge and understanding. This includes:

   a. work of direct relevance to the needs of commerce, industry, and to the public and voluntary sectors
   b. scholarship
   c. the invention and generation of ideas, images, performances, artefacts including design, where these lead to new or substantially improved insights
   d. the use of existing knowledge in experimental development to produce new or substantially improved materials, devices, products and processes, including design and construction.

13. This excludes routine testing and routine analysis of materials, components and processes such as for the maintenance of national standards, as distinct from the development of new analytical techniques; and the development of teaching materials that do not embody original research.

Approach to assessment

14. The RAE was predominantly a peer review process, though the following indicators were also sometimes considered:

   a. charity income
   b. volume of business research income
   c. volume of postgraduate research supervision
   d. research culture
   e. peer esteem.
15. The emphasis of assessment was on peer review of up to four research outputs per staff member for each university department. Criteria for assessing research outputs were determined by separate panels. University departments were given ratings based on the quality of all research outputs submitted.

16. The number of panels, organisation of subpanels and umbrella panels, and eligibility of panellists changed from each assessment in order to balance comprehensibility, consistency and transparency.

17. By 2001, more recognition was taken of staff circumstances, such as stage of research career, career breaks, long-term projects, and secondments.

18. A review of the RAE was undertaken in 2003, led by Sir Gareth Roberts. Some reviewers believed a move could be made to assess research via performance indicators. It was determined that while metrics could be useful in helping assessors to reach judgements on the value of research, peer review was the only assessment method in which academics would have confidence.¹⁸

**Criticisms**

19. Some criticisms have focused on various biases in the assessment process, including towards English universities, established universities, large institutions, and panellists’ own universities.

20. Concerns have also been raised at several points about staffing, including that institutions would “poach” high-performing staff soon before an assessment round in order to claim all of the researcher’s work. It was also determined that some departments would designate staff members as non-research active in order to exclude them from the exercise rather than risk a low assessment of their research activity.

21. Criticisms have also focused on changes in research activities as a result of the RAE’s focus on research outputs, especially publications. Concern was expressed that the RAE has led some authors to view successful publication itself as the objective of their work, rather than the focus being on the dissemination of knowledge and ideas. Concern was also expressed that publication was seen as the best form of research output, thereby incentivising some researchers to publish even if it is not a typical activity in their field. Concern were also raised that the RAE incentivised researchers to publish prematurely.

**Outcomes and reviews**

22. Comparisons of the results from exercises show an improvement in ratings assigned to departments. The number of staff given the highest rating has also increased.

23. Evidence also shows that the RAE had stimulated universities into managing their research and has ensured that funds have been targeted at areas of research excellence.

---

Research Excellence Framework (REF)

24. In 2006, the Government announced that it presumed that after the 2008 RAE, the system for assessing research quality for the purposes of funding allocation would become primarily metrics based. The Government was keen to reduce the burden of assessment and reduce cost, while still measuring the quality of research. The original proposals to meet this failed: it was determined that they did not measure research quality, would have greatly increased the cost of assessment, would have shifted costs to individual academics, and would have had a distorting affect on behaviour.

25. After a series of consultations and pilots, the changes from the 2008 RAE to the 2014 REF were not as significant as the Government might have originally envisioned. The majority of the exercise still involved peer review as the assessment measure, but there were, nonetheless, some important changes.

26. Consultations about reforms to the assessment framework confirmed widespread confidence in discipline-based expert review founded upon expert judgement.

27. The REF aims to assess all types of research without distorting the activity that it measures or encouraging or discouraging any particular type of research activity, other than providing a general stimulus to enhancing the overall achievements of the United Kingdom research base.

28. The Government estimates funding allocated as a result of the REF to be similar to allocations resulting from the 2008 RAE. It is thought that costs to run the 2014 REF will be higher than the 2008 RAE, reflecting that research impact as well as research outputs will be assessed.

Objectives

29. The REF has two main objectives:

   a. assess all types of research without distorting the activity that it measures or encouraging or discouraging any particular type of research activity, other than providing a general stimulus to enhancing the overall achievements of the United Kingdom research base

   b. assess the impact of excellent research undertaken within each submitted unit.

Definition of research

30. Research is defined as a process of investigation leading to new insights, effectively shared.

31. Inclusions and exclusions are the same as the RAE’s definition of research.

32. Impact is defined separately (see below).

Approach to assessment

33. As with previous RAES, the assessment process is based on expert review. Each subpanel will examine the submissions made in its unit of assessment, taking into account all the evidence presented. They will use their professional judgement to form an overall
view about each submission. In doing so, the sub-panels will assess three distinct elements of each submission:

a. research outputs: accounts for 65% of the assessment
b. impact: accounts for 20% of the assessment
c. environment: accounts for 15% of the assessment.

34. Panels have been instructed to define criteria and adopt assessment processes that enable them to recognise and treat on an equal footing excellence in research across the spectrum of applied, practice-based, basic and strategic research, wherever that research is conducted; and for identifying excellence in different forms of research endeavour including interdisciplinary and collaborative research, while attaching no greater weight to one form over another.

35. HEIs are strongly encouraged to submit the work of all their excellent researchers. To enable this, institutions may reduce the number of research outputs submitted for individuals whose circumstances constrained their ability to work productively throughout the assessment period. Panels will assess their work on an equal basis without any penalty for reducing the number of submitted outputs.

36. Esteem is no longer included as a distinct element in the assessment.

Assessment of research outputs

37. The sub-panels will assess the quality of submitted research outputs in terms of their ‘originality, significance and rigour’, with reference to international research quality standards.

38. Some sub-panels will make use of citation information, provided by the REF team on a consistent basis, as additional information about the academic significance of research outputs.

Assessment of impact

39. The sub-panels will assess the "reach and significance" of research on the economy, society and/or culture that were underpinned by excellent research conducted in the submitted unit, as well as the submitted unit’s approach to enabling impact from its research.

40. For the purposes of the REF, impact is defined as an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia.

41. Impact includes, but is not limited to, an effect on, change or benefit to:

a. the activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding
b. of an audience, beneficiary, community, constituency, organisation or individuals
c. in any geographic location whether locally, regionally, nationally or internationally
d. the reduction or prevention of harm, risk, cost or other negative effects.
42. Excluded is:

a. impacts on research or the advancement of academic knowledge within the higher education sector (the submitted unit's contribution to academic research and knowledge is assessed within the 'outputs' and 'environment' elements of REF)

b. impacts on students, teaching or other activities within the submitting HEI.

43. The REF aims to assess the impact of excellent research undertaken within each submitted unit. This will be evidenced by specific examples of impacts that have been underpinned by research undertaken within the unit over a period of time, and by the submitted unit's general approach to enabling impact from its research. The focus of the assessment is the impact of the submitted unit's research, not the impact of individuals or individual research outputs, although they may contribute to the evidence of the submitted unit's impact.

44. To enable subpanels to assess impact, units submit:

a. a completed impact template, accounting for 20% of the impact assessment, describing the submitted unit's approach to enabling impact from its research

b. impact case studies, accounting for 80% of the impact assessment, describing specific impacts that have occurred during the assessment period that were underpinned by excellent research undertaken in the submitted unit

   i. the underpinning research must have been produced by the submitting HEI in the 20-year period leading up to the assessment

   ii. the number of case studies required depends on the number of full-time equivalent staff members in the unit.

   iii. impact could be measured through many ways, including: public awareness, attitudes, understanding, or behaviour; and professional advice or expert testimonies.

Assessment of environment

45. The approach to assessing the research environment has been revised. It will be based on a structured template for textual information, and a significantly reduced set of standard data requirements.

46. The sub-panels will assess the research environment in terms of its 'vitality and sustainability', including its contribution to the vitality and sustainability of the wider discipline or research base.

47. Environment is measured through quantitative data on research doctoral degrees awarded and ERI, and through qualitative information provided by each unit on the research environment (including information on research strategies, staff development, contribution to the discipline, etc.).
1. Since 1993, the University Grants Committee (UGC) has conducted four Research Assessment Exercises (RAEs) to assess the research quality of the eight universities eligible for funding from the UGC and to encourage world-class research. Evaluation rounds took place in 1993, 1996, 1999 and 2006. The next is planned for 2014.

2. Hong Kong’s RAE is modelled in the United Kingdom’s RAE.

3. The RAE results are used to inform the distribution of the research portion of the UGC Block Grant to institutions in a publicly accountable way.

4. The RAE aims to assess through peer review the quality of research of the UGC-funded institutions by cost centre (academic discipline). In essence, the RAE measures the research quality of a cost centre within an institution in comparison with cost centres of a comparable discipline in other institutions (e.g. History with History, not History with Physics), using international benchmarks.

5. Until 2005, UGC funding of each institution was made up of two main elements: provision for teaching (about 75%) and provision for research (about 25%). Starting in 2005, 10% of funding was allocated based on the newly developed Performance and Role Related Funding Scheme. The purpose of this scheme is to encourage institution-wide performance against an agreed role statement for each institution, thereby encouraging differentiation among the eight institutions involved.

6. The UGC is currently considering a policy that would see, over a period of nine years starting from 2012/13, half of the portion of the funding reserved for research progressively awarded competitively based on individual institution’s success in gaining the Research Grants Council’s (RGC) grants. In other words, research funding would equally be determined by the results of the RAE and by institutions abilities to attract RGC grants. This policy is subject to a review before the end of the 2012-15 funding triennium.

Definition of research

7. In early rounds, outputs had to be research-related, publicly accessible by academic peers and contain a sufficient element of innovation. In the 1999 and 2006 rounds, outputs also had to be of interest to peers and generalisable. For 2014, outputs must contain an element of innovation, contribute to scholarship, and be publicly accessible.

8. The Carnegie Foundation definition of scholarship was adopted for the third RAE (and continues through the 2014 round). Starting in 1999, then, the RAE identifies and measures, on the basis of outputs, the following kinds of scholarship as identified by the Carnegie Foundation: scholarship of discovery, scholarship of integration, scholarship of application, and scholarship of teaching.

Approach to assessment

9. The RAE rates cost centres (academic disciplines), not individual staff members. Throughout the different exercises, efforts have been made to limit effects on individual staff members. For example, individual quality assessments are not reported. In 1999 it was noted that the term ‘active researcher’ would no longer be used, in order to stress that the focus is on cost centres and institutions rather than individuals. Further, it was
emphasised that departments should not impose sanctions on staff members who did not submit research outputs, or attempt to deduce individual scores for the purposes of internal evaluation.

10. Cost centres are evaluated on three measures: research outputs, research inputs and esteem:

   a. Research outputs account for 80% of the total evaluation rating.
   
   b. Research inputs (i.e. peer-reviewed research grants) and esteem research measures (e.g. research awards and industry research grants and contracts) together account for 20% of the rating. The default weighting split between peer-reviewed research grants and esteem measures is 10/10, but a panel may justify a departure from the default weighting split (to either 15/5 or 5/15).

11. Starting in the third round (and continuing through 2014), institutions submitted a research strategy statement reflecting the institution’s research philosophy, vision and priorities in relation to its role and stage of development, and the distribution of research efforts in the four categories of scholarship and (where appropriate) across disciplines.

Assessment of research outputs

12. Research outputs are assessed by discipline-specific panels of experts.

13. The number of panels has increased over each round. The inclusion of non-local experts on panels has also increased, as has the use of experts from business, government, industry and the arts. For 2014, to ensure that non-traditional output items receive adequate attention, a sub-group with suitable membership (including members drawn from outside academia, where appropriate) may be constituted under each panel to evaluate non-traditional items separately, and to make recommendations regarding their assessment to the full panel.

14. For each round the threshold for assessing quality was raised. By the second round, greater emphasis was given to the quality of the research, and panels were instructed to set higher threshold standards which included assessing against international standards.

15. For the third and fourth rounds, panels were also expected to give special recognition to items societal relevance, which have had or are likely to have impacts on industry, commerce, government, culture and/or society.

Assessment of research inputs and esteem

16. Each cost centre is required to fill in form to provide data on competitive peer-reviewed grants from outside the institution. Panels evaluate the submissions against other comparable cost centres within the same panel.

17. Each cost centre is also required to submit a description of no more than four esteem measures for each eligible staff member. Esteem measures should be conferred by a body outside the institution. They should demonstrate the distinguished achievement of individual researchers, groups or the cost centre as a whole. They may include:

   a. editorship of academic journals
   
   b. research-based awards, honours, or prizes
c. significant grants or donations for research which are not competitive or peer-reviewed (e.g. some industry research grants).

18. Peer-reviewed research grants and esteem measures are assessed on the same scale as with research outputs.

**Criticisms**

19. Despite the overall acceptance of the RAE, there has still been significant criticism of the review. The emphasis on counting research productivity based on refereed articles in prestigious international journals was seen as jeopardising local journals and being unfair as the major indicator of the quality of research. Some participants indicated that the RAEs encouraged a glut of publications that were more mediocre with little substance or originality.

20. There were those who felt that there had been a shift of effort away from teaching and counselling students towards research. Higher teaching loads were used as a negative sanction for those who did not publish enough.

21. A number of people have indicated that the RAE may benefit natural and physical scientists more than social scientists.

22. Academics have expressed concerns about the increased paperwork and even more complex bureaucracy that the RAE was creating.

23. Concern has also been raised that Hong Kong too readily adopted the United Kingdom’s model, thereby maintaining colonialist ties and resulting in a bias against local research and local journals. This concern has been directly addressed since the third assessment round, in which panels were instructed that research that addresses local issues can still meet internationally recognised standards of rigour and scholarship.
Appendix 6: Denmark

Overview

1. Starting in 2010, performance-based research funding to universities in Denmark is allocated based on three indicators:
   a. research activities measured by external funding (36%)
   b. number of PhD graduates (18%)
   c. research activities measured by the Bibliometric Research Indicator (BRI) (46%).

2. Combined, the three indicators account for 55% of new basic funding for universities in Denmark, under the so-called Globalisation funds.

3. Funding under these indicators was phased in over three years from 2010 to 2012.

Objectives

4. The objectives of the system are to strengthen the quality of Danish research and to encourage publication in the most approved/esteemed peer-reviewed publication channels.

Definition of research

5. Monographs, journal articles and anthologies published in eligible peer-reviewed publications are accepted, as are dissertations, doctoral theses and patents.

6. Editorials, commentaries, discussions, foreword, afterword, comments, notes, book reviews and encyclopaedia articles are not considered.

Bibliometric indicator

7. Recognising the need for reliable publication data and recognising that existing databases were problematic, the government determined it best to establish its own database of publications based on the approach used in Norway.

8. To do so, 67 panels of academics establish annually (since 2004) a list of eligible journals and publishers. These publication channels are then ranked annually by the panels, who divide them into two quality categories, assigning the top 20% of publication channels, including all Danish presses, into the higher quality category.

9. In addition to weighting by quality category, outputs are also weighted by type: for example, books are weighted more than journals. A weighting is also applied to collaborative outputs, such that they are weighted 25% more than sole-author outputs.

10. This process of selecting and weighting eligible publication channels is intended to:
   a. establish a database that is more reliable than pre-existing databases:
   b. be particular to the research environment in Denmark
   c. incentivise increases in both quantity and quality of publications.
11. To be eligible, research outputs must be peer reviewed prior to publication, with at least one peer reviewer being external from the author’s home institution.

12. Data is collected by universities entering and validating their own research activities.

13. The data collected reflects publication only, not citation.

**Criticisms**

14. Several concerns about the system have been raised, including that it:
   
   a. marginalises publications in Danish (despite the higher weighting for these)
   
   b. prioritises publication over citation (impact)
   
   c. does not recognise a wider range of research activities
   
   d. is not transparent around funding for post-graduate students and patents.

**Outcomes**

15. The system, particularly the BRI, has increased publication rates in the top tier of journals.
Overview

1. The Norwegian Performance-Based Reallocation (PBR) is a metrics system introduced in 2006 that allocates a portion of the annual budget for research to higher education institutions (six universities and forty other institutions) based on four indicators:
   a. publications (30%)
   b. funds from the EU Framework Programme for research (20%)
   c. funds from the Research Council of Norway (20%)
   d. number of doctoral degrees awarded (30%).

2. The PBR was first used for budget allocations in 2006, based on publication counts for 2005.

3. The PBR redistributes approximately 2% of the annual budget for basic research.

Objectives

4. The purpose of the PBR is to redistribute annually basic research funding among institutions in the higher education sector (six universities and 40 other institutions) based on performance. A bibliometric indicator counts all scholarly publications in all research fields annually.

5. There are three goals for the PBR:
   a. to give researchers and institutions incentives to publish in the most rewarding channels
   b. to create valid and reliable national publication data
   c. to provide public insight into the model.

Definition of research

6. Monographs, journal articles and anthologies published in eligible peer-reviewed publications are accepted.

Bibliometric indicator

7. Recognising the need for reliable publication data and recognising that existing databases were problematic, the government determined it best to establish its own database of publications.

8. To do so, the national research council establishes annually a list of eligible journals and publishers (publications have been counted since 2004). These publication channels are then ranked annually by panels of academics, who divide them into two quality categories, assigning the top 20% of publication channels into the higher quality category. This approach is seen as easier than that used by Denmark, as the list of eligible publications is determined by the research council, without the input of the panels of academics.
9. In addition to weighting by quality category, outputs are also weighted by type: for example, books are weighted more than journals.

10. This process of selecting and weighting eligible publication channels is intended to:
   a. establish a database that is more reliable than pre-existing databases:
   b. be particular to the research environment in Norway
   c. incentivise increases in both quantity and quality of publications.

Criticisms

11. Concerns have been raised that the PBR may discourage experimental and new research and reward less risky behaviour, regardless of benefits to society.

Outcomes

12. The introduction of the PBR has led to substantial growth in publications from the higher education sector in Norway, with the increase in publications spread evenly over the two quality categories of publication channels.
Appendix 8: Sweden

Overview

1. In 2008, the Swedish government introduced two quality indicators as the basis for distribution of 10% of its direct funding to its 14 universities and a number of university-colleges. The indicators measure bibliometrics, sourced from an existing database, and external research income, and each is weighted equally in funding calculations.

2. The Swedish Research Council (SRC) is responsible for collating the necessary data and undertaking funding calculations. It is also responsible for developing and evaluating the system.

3. The choice of bibliometrics and external research income as the two indicators reflects a desire to establish a relatively simple system that could be initiated quickly. The Norwegian system of establishing a country-specific bibliometric database was considered, as was a peer-review system, but both were determined to be too time-intensive.

4. Funding decisions are based on previous years: for example, funding for 2010 is based on information from 2005-2008.

Objectives

5. The government sought:
   a. to strengthen Sweden’s standing as a research nation, thereby strengthening its international competitiveness
   b. to contribute to an increase in sustainable economic growth and welfare in Sweden
   c. to reward research quality more directly.

Definition of research

6. Journal articles covered in The Web of Sciences database are accepted.

Bibliometric indicator

7. The bibliometric indicator reflects publications and citations, thereby containing incentives both to increase the quantity of research (publications) and increase its impact (citations).

8. Data for the bibliometric indicator is provided by The Web of Sciences. A university’s bibliometric index is calculated based on the number of publications and citations in these databases over a certain period of time.

9. The SRC undertakes a series of refinements and calculations with the data received from The Web of Science, including:

---

19 The Web of Sciences database is produced by Thomson Reuters and includes Science Citation Index Expanded, Social Science Citation Index, and Arts and Humanities Citation Index. The Web of Sciences contains journal articles published since 1982 and citations. It has approximately 30 million records and 560 million citations. The database is updated one each year, in March/April. The database classifies articles as belonging to one of a number of document types and subject fields.
a. cross-checking authorship to institution
b. reclassifying publication type and subject to SRC categories
c. classifying multidisciplinary work into an SRC subject category
d. undertaking complex normalisation calculations to correct for differing publication rates, citation rates and database coverage for different fields of research.

Criticisms

10. The reliability of The Web of Sciences database has been questioned for a number of reasons, including:

   a. the database does not account for the full range of research outputs:
      i. books are not included
      ii. articles will be omitted if they are missing attribution information (for example, an article produced by a researcher at a university hospital will be omitted from the database if only the hospital name is attributed to the article, but not the university name)

   b. the database does not account for all authors, only first and second authors

   c. attribution to institutions is not always correct or clear, so needs much work from the SRC to determine correct attribution

   d. differing publication rates, citation rates and database coverage for different fields of research makes comparison unreliable and difficult

   e. the database includes only limited coverage of research outputs in the humanities and social sciences.

11. Aspects of the correction factors were found to be unreliable following in-depth evaluation following the first round of data collection.

12. As a result of the concerns about the correction factor and other problems, the SRC (with the support of universities) urged the government in 2009 to suspend the system for at least a year to allow serious problems in the system to be fixed. This did not occur.