



**Australian Government**

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**Australian Research Council**

**Excellence in Research  
for Australia (ERA) Initiative**

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**ATN Submission in Response to the  
*ERA Consultation Paper***

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June 2008

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**EXCELLENCE IN RESEARCH FOR AUSTRALIA (ERA) INITIATIVE:  
CONSULTATION PAPER**


**Submission Cover Page**

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Organisation Name (if applicable)	Australian Technology Network of Universities (ATN) Consisting of: <ul style="list-style-type: none"> <li>• Curtin University</li> <li>• Queensland University of Technology</li> <li>• RMIT University</li> <li>• University of South Australia</li> <li>• University of Technology, Sydney</li> </ul>				
Address	GPO Box 2471				
City	Adelaide	State	SA	Postcode	5001

Name of Contact Person	Ms Vicki Thomson				
Position	ATN Director				
Phone	(08) 8302 9107	Email	<a href="mailto:vicki.thomson@unisa.edu.au">vicki.thomson@unisa.edu.au</a>		

Does the organisation consent to having its submission identified in a report on the outcomes of this submission process to be prepared by the ARC, which could be made publicly available on the ARC's website? (Y/N)	Yes
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Name of Authorising Person	Ms Vicki Thomson				
Position	ATN Director				
Phone	(08) 8302 9107	Email	<a href="mailto:vicki.thomson@unisa.edu.au">vicki.thomson@unisa.edu.au</a>		
Signature					

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## Introduction

The Australian Technology Network (ATN) welcomes the opportunity to respond to the Excellence in Research for Australia (ERA) initiative. This submission will address some key issues surrounding the development of a national research quality assurance system that the ATN as a network would like to emphasise, noting that individual ATN members may make their own more detailed submissions to the consultation paper.

The ATN as a network is committed to forging partnerships with industry and government to deliver practical results which contribute to the nation's social and economic wealth.

Therefore, the ATN has for some time been actively engaged in the national higher education sector debate regarding the development of a national research quality assurance system and has particularly advocated the importance of *any* such model recognising research which shows real and tangible translation of research outcomes, i.e. research which is beneficially applied to achieve social/cultural, economic and/or environmental results.

ATN universities have responded energetically to the national innovation agenda by building research programs that:

- promote knowledge transfer and commercial application of research outcomes;
- build sustained partnerships between ATN universities and industry, business, government and the community;
- invest and build scale and focus selectively in areas of our research strengths, opportunities, distinctive profile, and strategic 'fit';
- promote research collaboration between ATN and other Australian and overseas universities, and between universities and Publically Funded Research Agencies;
- promote cross-disciplinary research and research in emerging fields; and
- integrate research and research training to foster 'next-generation' researchers and skilled professionals who will become leaders in industry, business government and community.

Integral to our research frameworks and goals, ATN research programs promote research activity and intensity, quality and translation of research outcomes nationally and internationally.

ATN research in general is focussed on application and knowledge transfer for innovation, wealth creation, and environmental and social sustainability. Nevertheless, we strongly argue that the greatest economic and social benefits will accrue from a national research strategy that supports and bridges fundamental and applied research and promotes knowledge transfer between researchers, and industry and government.

As such, the ATN strongly supports the principles underlying the ERA initiative, with its goal of evaluating the excellence of research undertaken in Australia's universities. However for the ERA to provide meaningful evidence of universities' research strengths, we believe it is vitally important for the indicators used to accurately represent the categories they are designed to measure.

## Issues for Response

### ***Measures of Research Activity and Intensity, pages 7 and 8***

1. *For the 2008 clusters of ERA, research activity and intensity data will be collected at the two-digit FoR level. Collecting this data at four-digit FoR level over the longer term would provide greater granularity of analysis and reporting. We welcome feedback on any implications that this requirement will have for the span of the reference period in terms of retrospective data collection.*

- Currently universities do not report HDR student load or completion data against RFCD codes and hence reporting against FoR codes will require retrospective assignments of candidature. This will not be trivial to do.
- Similarly collection of classifications for publications has not been a formal external reporting requirement. There is hence a considerable data collection process implied in the ERA irrespective of whether the 2 or 4 digit level is used.
- It may not be possible to accurately assign a single 4-digit FoR code to each staff member. 3-digit FoR may be more appropriate
- Revenue is to be collected in different ways. Category 1 revenue is to be collected by 4-digit code but other categories will need only 2-digit codes at least for the first clusters to be evaluated. All revenue, all data in fact, should be collected at the 4-digit level.

2. *We recognise that non-salaried staff (honorary and adjunct) often contribute to the overall research effort of an institution. Therefore, we are seeking comments on the extent (if any) to which these researchers should be incorporated into staff FTE reporting.*

The ATN believes that all honorary and adjunct staff should be excluded, an issue that was widely canvassed during the extensive consultation process which occurred ahead of the Research Quality Framework.

It was agreed during this process that the incorporation of non salaried or adjunct staff in any research performance data collection exercise will result in:

- A confounding of both the activity and intensity indicators – as it will be unclear to what extent the level of performance claimed is related to the institutional capacity and mission or the capacity of a range of associated institutions such as CSIRO, DSTO, teaching hospitals etc
- A likely response by a host of institutions to recruit a range of adjunct staff (many of whom can be associated with more than one University) in order to enhance the likely outcomes in ERA – this would ultimately defeat the purpose of ERA

The ATN supports the position previously agreed whereby institutions nominate staff who are appointed at >0.4FTE for submission in each disciplinary cluster. This allows institutions to specify staff in existing and emerging areas of research strength.

### ***Indicators of Research Quality, page 8***

#### ***3. Are there other core indicators of research quality that could readily be included?***

- It is not clear whether exhibitions, performances and other creative research outputs are excluded from research quality assessment and we strongly recommend they should be included.
  - The list of Research Quality Indicators on Page 8 includes “profile of publications across the four bands of ranked journals, publishers, conferences, etc.,...” and this may be meant to include exhibitions, and galleries but these should be explicitly mentioned.
- Research income as a measure of quality should include categories 2 and 3

### ***Indicators of Success in Applied Research and Translation of Research Outcomes, page 8***

#### ***4. What other discipline-specific measures of excellence in applied research and translation of research outcomes should be considered by the Indicators Development Group, and how should they be benchmarked?***

From the outset of discussions on research quality, the ATN has particularly advocated the importance of applied research and the translation of research outcomes as very important aspects that should be valued as part of such a system.

However, as the consultation paper has noted, developing indicators of excellent applied research and translation of research outcomes is a complex task. **The ATN believes that the translation of research outcomes can be credibly defined, validated and assessed.** In particular, the inclusion of such measures will enable the Australian higher education sector to build up a level of credibility and trust with the end-users of research that may not have previously existed.

Particularly given the ERA initiative’s recognition that it is important to “recognise on-going imperatives to promote collaboration between institutions and between university researchers and end users”, we believe that the Indicators Development Group will need to strongly consider what appropriate measures might be.

As foreshadowed in the consultation paper, it may be the case that in order to ensure meaningful measurement of excellence in applied research and translation of research outcomes, there *are* no universally applicable indicators and that peer review of a sample of outputs is more appropriate.

For an ATN university, the quality of research is not only gauged by measures such as citations in academic journals and membership of learned academies, but by performance indicators which seek to measure whether we are making a positive contribution to the prosperity and well-being of the local, national and international professions, industries and communities in which we work.

This means that we monitor external perceptions of the utility of our research as routinely as we collect data on research performance. We do this through an annual survey of our research customers. Progressively, over the last few years, all ATN universities have begun to participate in this survey that routinely indicates that about 90% of our research clients

are satisfied with our performance and would recommend engaging our services to other prospective clients. The clientele for these surveys range from large multinational companies and government departments to SMEs and community groups in our own states, nationally and internationally.

While the results of the survey may not be a conventional measure of research quality, it is an important indicator of the translation of our research outcomes and value of our research in the wider community and enables us to measure repeat business. Industry members of the Advisory Boards of our research centres judge repeat business to be an excellent indicator of both quality and translation of research.

These same Advisory Board members adopt a similar view of commercialisation. They stress that while patents, licences and spin-off companies are useful indicators of innovative research, they are no more important than the research contracts which lead to incremental process or policy improvements in companies or government departments resulting in increased productivity or efficiency gains.

ATN universities take this advice very seriously as we have all sought to develop multidisciplinary and interdisciplinary research programs which align with industry and community needs. These research programs develop attributes in our staff and our research graduates which enable them to operate as effectively in the board room or the advisory group as they would in the academy, both within Australia and overseas. **Hence, we argue that it is important to develop indicators such as repeat business and penetration of new industry sectors to effectively gauge real-world translation of research outcomes by Australian universities.**

#### **Indicators Development Group and Research Assessment Committee membership**

We note that membership of the Indicators Development Group has not been specified in the consultation paper, and that RAC membership is specified as including “internationally-recognised researchers with expertise in research evaluation together with current and former members of the ARC College of Experts and NHMRC assessment panels.”

The ATN strongly supports the inclusion of industry and community experts as members of both the Indicators Development Group and as part of RACs who can give meaningful insights about the measurement of research outcomes. The ATN cannot overstate the critical role of assessors who understand the end-user effect of research on external communities.

They should bring a depth of actual and repeated experience in collaborative and commissioned research and partnerships with a number of institutions. The ARC’s database of collaborating organisations on research funded under *ARC Linkage Projects* might be a good place to start.

In addition, it should be emphasised that expert Australian and international researchers will need to have the necessary expertise to assess cross-institutional and cross-sectoral collaboration in research. It should not be assumed that international researchers have the expertise to assess the translation of research into economic, social and environmental outcomes. (We know from ARC assessments by international assessors that they frequently have no experience of the integration of research within a broader innovation framework, and no connection with pathways for knowledge transfer.)

### **ATN trial**

In 2006 the ATN and Murdoch University undertook a trial that was designed to assist in the development of practical indicators for the translation of research outcomes. Many of the lessons learned as part of that trial are applicable to ERA Initiative.

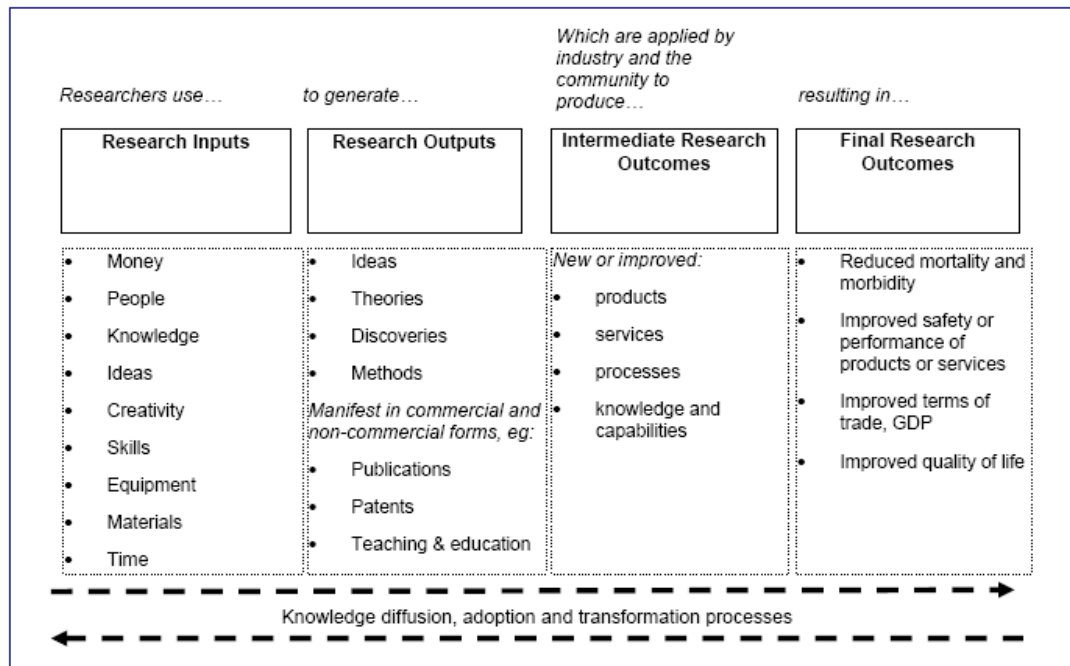
Over 650 researchers from across the six Universities participated in the trial. The ATN trial collected more than 200 case studies of the transfer of research outcomes, each built around appropriate and verifiable evidence. Around 20% of our research group submissions were sent to a group of international end user and expert assessors to moderate our local assessments. Across the broad discipline mix, sound qualitative and quantitative evidence was readily available to support the case study submissions.

The ATN trial also demonstrated the differences between research outputs, intermediate research outcomes and final translation of those research outcomes through the use of clear and relevant descriptors. As a result of this extensive trial, the ATN has shown that the translation of research outcomes can be credibly defined, validated and assessed across many research fields.

### **Defining the “translation of research outcomes”**

The ATN believes there is a need to clarify and define the relevant terminology in relation to the concepts around the translation of research outcomes. A sound understanding of the scope of translation is imperative to get a reasonable and valid set of indicators that can be used to demonstrate success in this area. Clarity around what constitutes the translation of research outcomes and how appropriate indicators can be used to support it is an important element of this, however we would suggest that critical judgement by skilled expert assessors is likely to provide the best means of evaluating the diversity of activity being demonstrated by the Sector.

There are substantive differences between research ‘outputs’ and either intermediate or final research ‘outcomes’, although often these terms are incorrectly used interchangeably. The following diagram, included in a CCST report on Metrics of Research Commercialisation, distinguishes the important differences between these integral concepts.



Source: based on Geisler, E 2004, *Measuring the impacts from public sector science and technology: new methods*, cited in Allen Consulting Group (2005), *Measuring the impact of publicly funded research*, Report for DEST, (p. 2).

This is of value in setting the context since it allows the continuum of research activity to be mapped. At the left, the focus is justifiably on inputs that lead to research outputs whose quality can be measured using standard and novel metrics well known in the research community. The subsequent degree of engagement and adoption of these outputs, and their outcomes having economic, social, cultural or environmental benefit, represents the translation of research outcomes. At the far right of the continuum, these outcomes may be at a national or international level (as per the examples in the diagram) or at a reduced scale with the effect being felt on specific communities and/or industries. A key principle is that there are points on the continuum which can be identified as research outcomes, and at each point its extent could potentially be evaluated.

### Assessment Indicators

While the ATN trial found case studies are integral to presenting evidence of impact for assessment, it is recognised that within those case studies both qualitative and quantitative measures can be used to support the case. The ATN trial demonstrated that both measures were used with varying degrees of effectiveness. To some extent, discipline variations affect the availability and robustness of the indicators, with the commercialisation and economic translation measures being more widely studied and available.

When considering measurement of the translation of research outcomes, one possible approach that the Indicators Development Group should consider is expert review of a sample of outputs/case studies. This possibility is mentioned in the introduction of the ERA consultation paper. The ATN found this approach to be the most effective way of measuring this type of output, and strongly supports the view that expert panel assessment has to be based on a judgement of the case study and the extent to which the case study is supported by credible indicators (qualitative and quantitative). Assessment guidelines are necessary to establish appropriate parameters without being overly prescriptive about the nature of the case study description.

Some measures identified in the ATN trial, which can be reliably attributed to the different stages of the research transfer continuum, are given below. While by no means exhaustive, there is a considerable literature on which to draw to find other examples relevant to various disciplines.

MEASURE CATEGORY	RESEACH OUTPUTS	INTERMEDIATE RESEARCH OUTCOMES	FINAL RESEARCH OUTCOMES
Economic/Commercial	<ul style="list-style-type: none"> <li>• ARC Linkage Grants (no and value)</li> <li>• Licences, options, assignments (no and value)</li> <li>• Royalty agreements (no and value)</li> <li>• Pilots, prototypes, clinical trials (no)</li> </ul>	<ul style="list-style-type: none"> <li>• New products, services (no)</li> <li>• Gross revenue</li> <li>• Start-ups/Spin-outs (no and revenue)</li> <li>• Joint ventures (no and revenue)</li> <li>• Repeat business (% of contracts with previous clients)</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel or time savings</li> <li>• Reduced risk</li> <li>• Increased productivity</li> <li>• Reduced costs</li> <li>• Increased competitiveness</li> <li>• Improved processes/efficiency</li> <li>• Increased employment</li> <li>• Increased investment</li> </ul>
Social/Cultural and Environmental	<ul style="list-style-type: none"> <li>• ARC Linkage Grants (no and value)</li> <li>• Informing government or industry policy</li> <li>• Engagement in community groups</li> </ul>	<ul style="list-style-type: none"> <li>• Changed practice in waste management</li> <li>• Uptake of recycling techniques developed</li> <li>• New or improved government policy</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced consumption of fossil fuels</li> <li>• Reduced waste</li> <li>• Reduced water consumption</li> <li>• Improved health and/or well-being</li> </ul>

### Conclusion

In summary, based on our experience and review of relevant literature, the ATN believe that the following principles are reasonable to be considered for the ERA initiative:

1. The translation of research outcomes is important, and every effort should be made to adequately define and assess it in order to get a complete understanding of the value of research in Australia.
2. It should be clearly identified that translation of research outcomes does not relate to the process of generating research outputs or the initial stages of translating or reporting those outputs to the end user community.
3. translation of research outcomes can be credibly demonstrated in an evidence portfolio, and the use of case studies in such a portfolio should be seriously considered as a part of the ERA initiative assessment process.

4. translation of research outcomes can best be assessed through the use of qualitative and quantitative indicators. Given the expertise likely to be represented by the Research Assessment Committees, strong cases supported by sound evidence should be readily identifiable, particularly if end users are included as members of RACs. With suitable guidelines for both submission and assessment, the extent to which the work has moved along the research transfer continuum should be able to be assessed and compared.

Given the complexities around developing indicators of excellent applied research and translation of research outcomes, it might be useful for the Indicators Development Group to host a national workshop to harness the views of institutions, such as those comprising the ATN, which have a strong focus on translational outcomes, in order to develop a more comprehensive suite of measures.

Clearly there is still much work to be done, but the ATN reaffirms its view that, if we get the model right, a true measure of the translation of research outcomes for Australian research as an aspect of the ERA initiative will not only recognise a diversity of research activities, but also encourage and improve research capabilities across the higher education sector.

5. *We would welcome suggestions regarding types of practitioner-focussed outlets that may indicate excellence in applied research or translation.*

An example of practitioner-focussed outlets that may indicate excellence in applied research or translation is the National Centre for Vocational Education Research (NCVER). Published research reports under DEEWR have always been considered as Category K; that is, the same as a report produced within a university department and not published. The following is proposed as evidence of excellence of this practitioner-focused outlet in applied research:

1. NCVER reports are the result of national competitive grants, which in some years have had lower chances of winning (e.g. 17%) than ARC grants.
2. NCVER reports are double blind peer-reviewed at two points, once in the Progress Report stage and then again just before publication.
3. The reports are available for worldwide sale in print form.
4. They are also accessioned into the UNESCO-UNEVOC electronic database (VOCED), and are available for ready/free download anywhere in the world.
5. Australian VET research has developed substantially since 1996 when national funding first became available, and is extremely well respected by other VET researchers and bureaucrats around the world.

These NCVER reports are therefore excellent examples of practitioner-focussed products of research excellence as a result of the stringent processes involved through to their publication.

Further examples include where the work of researchers is cited in the reports of state parliamentary enquiries, or where work is regularly cited by state governments and

community/church/welfare sector peak bodies in federal government inquiries (e.g. Fair Pay Commission and Work Choices).

In education and other professional areas, academics receive invitations to provide keynotes and other presentations that are not refereed. These presentations may often be practitioner focused, such as public talks, non-refereed journal articles, professional association work, series publications and edited books. This demand for and interest in the work of these researchers and their research by key stakeholders provides evidence of the relevance of the work to the profession.

### ***Research Income Data, page 9***

6. *How feasible is it to collect category 2-4 research income data at four-digit FoR? Are there specific issues for each category for retrospective collection? Are there specific issues for future collections in Category 3?*

- Research income is already collected at the 4-digit level and hence there are no issues in reported data in this way.
  - However, some Category 3 grants, and indeed other categories as well, are sometimes split across more than one 4-digit code. It is not clear how the ERA would treat such grants.
- The issues are in translation from the RFCD codes to FOR (since there is not a 1-1 match). There are no issues foreseen for future collections.

7. *Are all the income categories necessary or appropriate? What additional income streams could be collected under Category 5?*

- All the categories are necessary and appropriate.

Other income that currently falls outside the HERDC includes:

- Infrastructure Grants including peer reviewed ARC LIEF grants, NCRIS and Capital Grants
- ARC Network Grants
- Consultancies

For some disciplines this information may be useful to include in an ERA submission

8. *What would the most useful research income reference period be for ERA, considering this does not need to be the same as the six-year publications reference period (see page 10)?*

- A reference period of 2 years is recommended.
  - This would be consistent with the 2 year periods used when using HERDC data to inform funding schemes such as RIBG, IGS and RTS.

9. *How practical is it to request numbers of successful grants in addition to research income?*

- Institutions can collect and provide these data but this may not be a useful practice as it could inadvertently drive a perspective that it is better to compete and succeed in a myriad of small funding schemes than to build larger programs, centres of excellence and cooperative funding programs.
- The collection of numbers of successful grants could also lead to the same outcome that the current focus on the 'weighted DEEWR publication points' has i.e. that researchers and their institutions will value 'volume' over 'quality'. Given that discipline specific criteria will be used within each cluster to determine what constitutes a level of research activity or intensity that is internationally competitive, the proposal to focus on research funding alone should not disadvantage discipline groups in which high research quality can be achieved at relatively low funding levels. .
- Further, if collecting the number of grants was seen to favour winning large numbers of small grants, this could work against the stated aim (Page 5) of encouraging scale and focus.
- It is questionable as to what "quality" conclusions could be drawn from having, for example, 5 ARC Discovery grants each awarded \$80,000 with 2 ARC Discovery grants awarded \$200,000 each.
- A more relevant metric might be one that measures engagement and participation such as the number of researchers in the discipline that are named on grants.

#### **Research Publications Data, page 10**

10. *A list of other possible publications types is provided in Appendix B of the Consultation Paper. We are seeking feedback on whether there is support for these types to be included for individual disciplines and whether these categories are appropriately identified.*

The ATN is supportive of the inclusion of a broad range of publications and it would be of concern if only the categories of books, book chapters, journal articles and refereed conference publications were to be included given the relevance of many of the other types of publications in specific fields. It will be essential for the Indicator Development Group to consult with professional bodies/associations and with practitioners in relevant disciplines, in order to develop an agreed set of performance indicators where these are not captured in traditional publication format. This process should be as detailed and inclusive as that used to identify the current ranked tiers of publications.

#### **Publication Reference Period(s), page 10**

11. *Should all non-publication data be collected over a shorter reference period? If so, what would that period be?*

- The non-publication data would best be collected over a 2 year period.
  - This would be consistent with the way current HERDC data are used and for HDR load and completion data, it would make the retrospective assignment of 4-digit FoR codes much more manageable.

### ***Attribution, pages 10 and 11***

12. *Please provide comment on the above approaches for attributing publications.*

- The ATN supports option 1 for the reasons outlined in the ERA consultation paper; i.e. that an approach based on where researchers are located at a specific census date will provide for a clear measure of the current research mission and performance of an institution. A fixed census date, which could be the release date of the Government's Policy in this area, would also prevent any potential for 'game playing' within the sector. We consider that option 1 will not require more effort by universities in collecting information from researchers as Universities are required to collect this information regardless of the ERA initiative.
- Attribution by census date will inevitably lead to poaching (when there is money attached to the process). It lends itself to easier analysis but more difficult collection and reporting processes. Universities do not have good data capture mechanisms for new staff - however these processes will improve over time (this might be considerably expedited by a sector data definition that might allow data portability for key inputs and outputs).

### ***Data Suppliers, page 12***

13. *Which citation data suppliers in your experience result in the most meaningful citation analysis for each of the disciplines?*

- Neither of the databases mentioned in the consultation paper (Thompson and Scopus) are ideal and so the choice between them becomes rather arbitrary. These databases are quite expensive and the paper seems to be driving universities to subscribing to both. Further, the requirement for universities to supply a "unique identifier" for each publication is problematic since the unique identifiers used by the two citation databases will be different for the same publication.
- ISI data is widely accepted and respected by Science Disciplines.
- Citation data for non-Science disciplines is generally not well regarded by the sector and we would argue any citation information for non-science research is used sparingly in conjunction with other metrics, if in fact the citation data is deemed applicable at all to a discipline cluster.
- The ATN is aware that there is a range of citation data suppliers emerging for specific disciplinary areas and considers that the learned academies and professional bodies are in the best position to provide an informed view on this issue.

### ***Research Training Data, pages 12 and 13***

14. *Please provide comments regarding research training indicators. Is it possible to provide HDR completions data retrospectively at the four-digit FoR level?*

- Currently we do not report HDR student load or completion data against RFCD codes and hence reporting against FoR codes will require retrospective assignments. This will not be trivial to do and is one reason for recommending a 2 year reference period be used. That said, the ATN can provide the current HDR indicators as contained in the ERA Consultation paper at four digit FoR level (they are currently

specified by Field of Education and this will require an additional coding field for each student).

15. *Do you see value in tagging research outputs as authored by HDR students and value in the analyses this will produce?*

- There are a variety of scoping problems for student data given the time delay that can often occur between completion and publication and very clear guidelines will need to be developed on the inclusion of student data.
- Whilst there is a record of whether a publication has been completed by a student or staff member, there is a grey area where students are RAs and staff are part time students. It is difficult to guarantee complete accuracy in these figures as we have previously only been required to report on internal or external authors.
- We also have a number of students who publish as Honours students and by the time the article is published, the student may be doing their PhD and so depending on whether you want to display publications per type of HDR students this may also be problematic.
- However the main problem with this metric is simply that a student publication may be published while the student is still currently enrolled, recently completed or completed 4 years ago. If the aim of this metric is to try and associate the student publishing figure with the current load or completion figure then this will be a flawed metric.

### ***Submission, page 13***

16. *Institutions are invited to comment on the ease or otherwise of meeting any of the data requirements outlined in this document in addition to the specific questions addressed under particular headings.*

- Since much of the data would be obtained from previous HERDC data, the major workload would be in assigning 4-digit FoR codes to student and staff data. However, universities would need the chance to review the data to ensure that they were accurate and have the opportunity to add revenue, publications, students etc. that were missed at the time.
- The submission would require the outline mentioned in Section 4 on Page 13; this would allow universities to describe strategies relating to emerging areas and also to discuss significant staff movements which would affect future performance if Approach 2 was used and the outputs of new staff were not recognised.

### ***Reporting, pages 14 and 15***

17. *We propose there is considerable value in having maximum flexibility and utility with respect to reporting, however, we also recognise the workload involved for institutions in assigning reporting codes. We welcome feedback on this issue in respect to both the feasibility and value of such an approach.*

- Assignments to academic units will be problematic for universities which have restructured in the past 6 years because year by year data are being collected.

- Also, the unit of assessment is to be the discipline area, as defined by 4-digit FoR codes, and so the academic unit is not relevant.

### ***Examples of Indicators Outputs – Research Training, pages 16 and 17***

18. *Institutions are invited to comment on the feasibility or otherwise of institutions identifying student authorship in previous HERDC collections.*

- We already collect these data and so it would be feasible to report them. However, one problematic area could arise when academic staff are also research students. In this case, we would require some guidance to ensure that such situations were treated consistently.
- We can do this although the data quality may not be high. It is therefore not an immediate priority for this first set of collections and could usefully be deferred to a later point.

### ***Additional Comments***

The consultation paper acknowledges that the ERA must recognise and appropriately reflect the value of quality interdisciplinary research. But there is no clear mechanism for how this will be achieved. First of all, it is not clear whether such research would be assessed by more than one panel (as stated on p 6) or by just one panel which co-opts additional 'expertise' to help (on p13). In either case, genuine interdisciplinary research is likely to be under-rated unless experts are found who actually understand the value-add intrinsic to research done at the intersections between traditional disciplines.

Applied mathematics provides a good example. Much interdisciplinary applied mathematics research is very often published in journals of other disciplines such as engineering or biology. Thus an analysis of research outputs by FoR codes would very likely mask strong contributions from applied mathematicians. This could well lead mathematicians to limit their future research to 'narrower' disciplines where their contribution was more readily recognised.

Such an outcome would be contrary to the declared purpose of the ERA. We recognise that there is great operational benefit in analysing research outcomes by FoR code and we are not proposing to change this. Rather, we are recommending that RACs include researchers and end-users who are experienced in either conducting or commissioning interdisciplinary research and who will therefore be better placed to appreciate the synergies it provides.