# ALIA Research Project: Understanding information needs of Australian business organisations

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**Abstract:**
Over the past decade universities have used repositories as channels to create access to research outputs.  Increasingly government and universities are seeking to optimise the impact of their research, particularly to improve public policy. This study looks at the impact of access to research from the perspective of business associations and researchers. It finds that business organisations value trusted, timely, relevant research.  Accessibility and peer reviewed research outputs are highly valued, but little used. Barriers to use of the research include availability (material not openly accessible), discoverability (ranking on search engines), knowledge by trusted mediators and connectivity (presentation as part of a cohort of scholarly knowledge).  Barriers for researchers included lack of rewards and recognition for research outputs focused on these organisations. The theories used in the study include triple helix, Kautto-Koivula and Huhtaniemi's model for knowledge and competence management and actor network theory. The study concludes that significant work is required to improve the accessibility and discoverability of research. In particular the search paradigm is insufficient to provide optimal awareness of and impact of research.

**Implications for best practice;**
- Enabling access to university research outputs through repositories is vital for access by business organisations
- Ensuring accessibility through relevant metadata to support high relevancy ranking on search engines will improve accessibility of the research
- Mediation of information occurs through individuals within organisations with expertise. Creating better solutions to alert or inform these mediators will optimize the impact of research
- Further development to improve visibility of research outputs on an international scale, such as through work with the Confederation for Open Access Repositories is likely to increase the use of an impact of research.

## Introduction

Universities have a major role in creating new knowledge through fostering research practice and publication. These research outputs can contribute to the creation of further knowledge, development of policy and practices that can change the world. Communication or transfer of knowledge is an area that has been explored through studies for many decades.

Libraries have traditionally had a significant role in the transfer of knowledge through providing access to collections including books, journal articles and reports. Studies on knowledge transfer have supported the development of many theories about scholarly communication and research

impact. The number of studies and range of assessment has blossomed since the development of online access to information, particularly since the creation of the World Wide Web.  New dimensions have been identified in knowledge transfer, including in the role of libraries. The online environment offers many new opportunities for the benefits of university research to be realised through the transfer of knowledge.

Much of the world's research is the result of significant public funding. Increasingly public funders are seeking to understand and evaluate the impact of the research they fund. In the United Kingdom, the Research Excellence Framework (REF) has been developed to assess quality of research in UK higher education institutions including the transfer of knowledge through citations and case studies of impact.  In Australia, the Excellence in Research for Australia (ERA) activity "aims to identify and promote excellence across the full spectrum of research activity in Australia's higher education institutions" (Australian Research Council, 2015). It measures transmission of knowledge through citations, patents and in other formats.

The transfer of knowledge from scholarly research to the business community is an important outcome for universities. Communicating knowledge has been an area of study for many decades – the increasingly national and international economies are assessed as dependent upon the communication of knowledge.  The OECD has noted that:

> new scientific and technological knowledge only provides economic and social benefits when it is effectively exploited and leads to innovation. Innovation is a key driver of long-term economic growth, the primary basis for competitiveness in world markets and part of the response to many societal challenges...Public policies must adapt effectively to such changes. Governments face the task of strengthening innovation systems in order to take greater advantage of globalisation and the move to a knowledge-based economy. (OECD, 1999, p. 9).

The responsibilities of universities, in Australia funded significantly by the government, have increasing been seen as delivering public access to knowledge. The return on investment for business, the public and the world research community is an important component of national productivity. Not only are they measured through initiatives such as ERA and indeed Higher Education Research Data Collection (HERDC), university strategic plans reflect the importance of communication. The Australian National University, for example, states "ANU will be recognised as a leading contributor to public policy formulation and debate, addressing the major issues confronted by government, business and society" (Australian National University, 2012, p. 4).

Universities Australia (UA) has also emphasised the importance of transfer of knowledge as a fundamental community benefit. In a recent speech the UA Chief Executive commented "we need to embed a culture of innovation at every level of our economy and ensure that we can continue to produce the graduates to fill the jobs of the future, in industries that we can't yet even imagine. Our universities are pivotal in this effort" (Robinson, 2015). She noted that Stephen Parker, Vice Chancellor of the University of Canberra had observed that "Universities are here to make the world a better place: as their direct purpose, not a byproduct. .(ibid).

Theorists on the role of public tertiary education institutions note that academics have an important role in knowledge creation and transfer.  Oleinik (2014, p. 1) summarises these responsibilities, as "to conduct research (the generation of new knowledge), to be involved in teaching (the transmission of existing knowledge), and to render services to the scholarly community". The further transmission of knowledge is fundamental to the scholarly communication ecosystem, which includes organisations and individuals acting as creators and communicators of knowledge.

The online environment has radically reshaped access to and communication of research. Access to research outputs has been facilitated through institutional repositories which enable the discovery of research through resource discovery services, also include Google, media releases, social media (such as blogs, Twitter, facebook), conference presentations and direct communication to relevant bodies. It is an increasingly complex communication environment (Lawrence, 2014, Swan, 2008, Bekkers and Freitas, 2008)

This project focused on understanding the issues of transfer of knowledge from universities to major Australian industry organisations, using the development of the new policy environment of Australia's focus on developing relations and business with Asia to assess current strengths of the communication system and areas where developments were required. The role of libraries in this communication process was explored, in particular through their role as the provider of institutional repositories to communicate Australian research to the world.

**Theoretical framework and literature review**
The field of communication of research outcomes is a complex one. Detailed studies in science and public policy communication have revealed that there are many factors influencing the impact of communication including the channels used, the nature of the actors in the system (researchers and information consumers) and the attributes of the research outputs.

Fundamentally, successful communication of research is based on an understanding of the role of the university in society. Dewey argued that education was "the social continuity of life" (Dewey, 1916, p.3). His broad view of epistemology as fundamental for a democratic society includes the generation of knowledge and ideas and the sharing of these through society. Citizens are defined by Dewey as critical actors with information requirements to fulfill their need for societal, business and research activities.

To add to this, public funders of universities have committed to principles that recognise there needs to be a return on the investment in research through public accessibility to research outcomes. This can be articulated in benefit from the creation of further knowledge and indeed benefits for the nation (such as that measured in REF and ERA).

The value of independently verified (peer reviewed information) as a contribution to world development has been a strong theme for scientists. In 1945, Vannevar Bush in his report to the President noted:

> The publicly and privately supported colleges, universities, and research institutes are the centers of basic research. They are the wellsprings of knowledge and understanding. As long as they are vigorous and healthy and their scientists are free to pursue the truth wherever it may lead, there will be a flow of new scientific knowledge to those who can apply it to practical problems in Government, in industry, or elsewhere.

Communication of knowledge has also been assessed as highly influenced by the nature of the political culture of different democratic societies. Jasanoff has articulated complexities in communication that suggests that the role of knowledge is not simply a precondition for democracy but must be reinterpreted in different regulatory environment depending upon a wide range of conditions.

The triple helix theory has been developed to explain the complexities of knowledge creation and exchange, particularly in relation to public policy. It adds additional dimensions to the work of those

who review political contexts, suggesting that there is a DNA of knowledge where government, university and industry intersect. The ecosystem (recalling the work of Davenport and Prusack) is one where the interaction between the parties for knowledge transfer is beyond a concept of economic profits. It creatively builds new public knowledge and public spheres which support innovation and thus a "new model of production of scientific knowledge" (Gibbons et al 1994). Further, the triple helix model promotes a central role of universities which increases the benefit of research and can provide significant national leadership in a new way. "The university may be compared to other recently proposed contenders for knowledge leadership, such as the consulting firm" (Etzkowitz, Leydesdorf, 2000 p. 117).

Models of communication are increasingly developed within the context of socially and information active communities. This complexity can be seen in the model produced by Kautto-Koivula and Huhtaniemi.

## A Model for Knowledge & Competence Management

National visions & strategies

Environmental requirements

Individuals
Communities, Enterprises
**Society**
**Investigate Knowledge Needs**
Analyse Experience and Requirements

• New needs
• Opportunities
• Goals for Competence and Knowledge

Exploit Knowledge
**Realize Knowledge Value (Working life)**
Apply Knowledge

Knowledge Sharing, Contacts
*Innovations*
Learning by doing, Tacit-knowledge

Build Knowledge (Education, Training)
**Accumulate Knowledge**
Create, and Share New Knowledge (Research)

Analyzed Information, Knowledge & Competence Assets

**Make Knowledge Available**
Organize and transfer Knowledge & Competence Assets

New Knowledge & Competence Assets

Global Information, Knowledge & Skills Assets

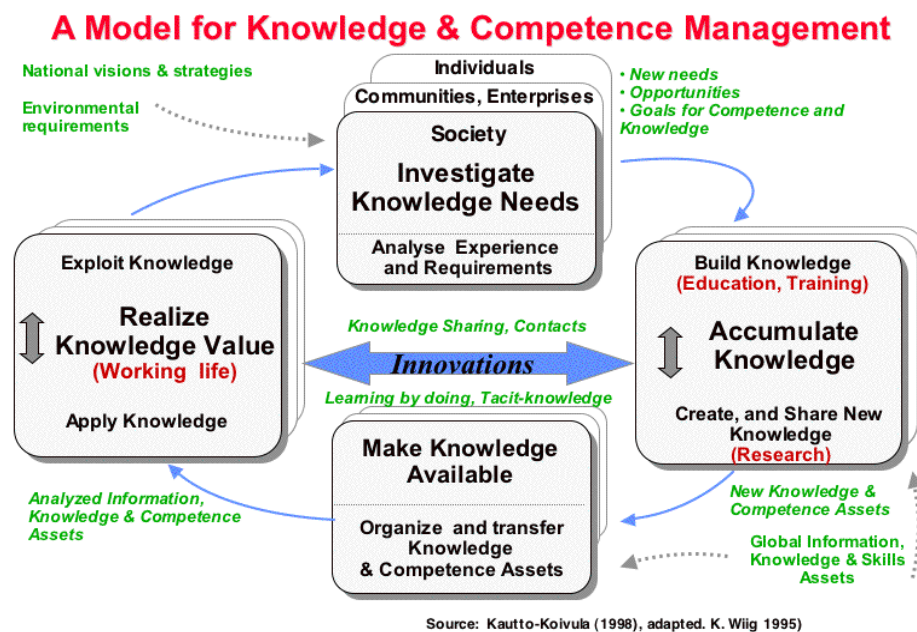Source: Kautto-Koivula (1998), adapted. K. Wiig 1995)

Figure 1: Model for knowledge and competence management>

The model adds a dimension to theories discussed above by proposing that, in a knowledge age of rich resources available online 24x7, knowledge must be translated into the needs and capabilities of each individual for communication to be effective and support national development.

Perhaps the most consistent underlying principle in the development of knowledge theories is the transformation resulting from the development of the Internet and the challenge of sheer volume of accessible information. A common theme has been information overload. Knowledge management theorists such as Dave Snowden (Snowden, 2013), hypothesize that networks rather than repositories are the most important solution to improve the sharing of knowledge. The basic challenge of identifying and accessing research outputs for the industry component of the triple helix has been identified by Swan as a significant impediment to knowledge transfer.

Actor-Network theory is very relevant to this study. Developed by Latour and Callon, it proposes societal constructs that are based on networks created by material (relationships between things) and semiotic (relationships between concepts) objects. Relations exist between both material and semiotic constructs. The network is both influenced and influences objects. The translation or communication through network connections is fundamental to creation and recreation of the society.

Latour emphasizes the importance of "intermediaries" that "transport meaning or force without transformation" (Latour, 2005, p. 39) and "mediators" that "transform, translate, distort, and modify the meaning or elements they are supposed to carry (ibid). The capacity of actors to influence others and transfer knowledge and influence other groups and individuals is a key to the theory. Change is affected by knowledge transfer (or transport), noting that each network activity changes the matter communicated.

In a networked online world the transference of knowledge occurs through electronic and human networks interacting across all domains. Actor-network theory provides a basis for defining the communication of objects, such as research from universities (as tokens).

The dimensions outlined by Snowden and Kautto-Koivula and Huhtaniemi reflect an environment where additional complexities of prior knowledge and context of information requirements, together with competition for information priorities (to prevent overload) mean that actors make decisions on the value and use of information.

By linking these three theories (DNA, ANS and Knowledge & competence management) a framework can be created to analyse the relationship between the knowledge created, that delivered (such as through reports and papers) and the transformation that occurs through interaction with individual actors (information consumers).

In the twenty first century a particular flavor to communication theory can be seen in the open access movement. It perhaps most clearly articulates the benefits of delivery of access to knowledge resulting from publically funded research in universities.

One of the early studies into use of academic research online noted that "new availability (of knowledge) has transformed the information environment within which policy development takes place, and it is altering the role of social scientists in democratic processes." (Willinsky, 2003, p. 2). Open access benefits identified by advocates are available to funders, nations, institutions and researchers through an open flow of research outcomes. Willinsky, a decade ago, found that the fundamental change that supported this flow of information was the Internet which provided the ability to tap into knowledge products with unprecedented ease. As noted above, the nature of the Internet now is that a vast array of information is available, some of high quality peer reviewed research that is highly trustworthy, others products that are unreliable.

Open access advocates and analysts (see Harnard, Suber, Crossick) have outlined arguments for open access focused on public benefit and accountability. For this research project a wider theoretical lens was used to understand communication of research outputs.

An evaluation of access to and use of information needs to consider the above theories in a layered manner to provide insights into knowledge transfer. This can provide a basis to consider information seeking behavior, effects of communication channels, value added services that libraries can provide and factors that can improve the effectiveness of knowledge transfer. .

**Role of libraries**
Research into communication of knowledge including the role of libraries and library staff has been extensive. In 1994 King noted:

> There have been hundreds, perhaps thousands of studies involving scientific and technical communication performed over the past 25 years (King, 1994, p. 2)

His report identified the information life cycle and noted that his study of NASA found that "When faced with obtaining formation to solve a technical problem…they first consult personal stores of information; then, they seek out co-workers within their organizations next they consult colleagues outside their organization…" (p 47) and finally librarians. Other studies cited in the report noted libraries and librarians could be "information stars" actively communicating new information sources.

Over the past 20 years the ecosystem of knowledge has become increasingly complex, with libraries taking an increasingly active role in the scholarly communication system. University libraries have supported the development of scholarly presses (such as Australian National University Press, Monash University Press, University of Adelaide Press, University of Technology Sydney Press) and perhaps most relevantly they have supported ARROW (Australian Research Repositories Online to the World), a three-year consortium project for the establishment of institutional repositories and associated resource discovery mechanisms (Harboe-Ree, 2004). These developments have focused on creating a framework that achieves access to the scholarly outputs of universities.

The achievement of access to knowledge through repositories has been significant. Over 80% of the downloads from the Australian National University and 97% from Queensland University of Technology are to users outside Australia, suggesting that there is an international need for access to university outputs, supporting greater impact of research. The QUT download figure of more than 10 million downloads over the ten years to 2013 (Shaw, 2013) demonstrates a thirst for research outputs of considerable dimensions.

The role of libraries in providing a more direct link between researchers and readers, supporting innovative use of technology for scholarly communication and supporting universities and funders to provide for greater impact of research is one that has been explored intensively in the past decade. Impact measures of these developments have been the number of downloads and the domains of users. Detailed analysis of the needs of potential users and their information behaviour has been undertaken by Swan and Lawrence et. al. focused on communities. This study builds on that work and seeks to add information particularly relevant to Australian business/industry associations.

**New policy context: relationship with Asia**
Australia's place in Asia is a critical policy issue. The need for greater knowledge, capability and access to information has been identified as a key immediate issue by the major political parties, businesses and the research community.

The White Paper on Australia in the Asian Century positions the nation in strategic economic, political and education relationships with Asia, encompassing China, India, the key ASEAN countries, as well as Japan and South Korea. It calls for a new phase of deeper and broader engagement. The urgency of addressing issues including knowledge building is emphasised:

> …as a nation we must do even more to develop the capabilities that will help Australia succeed. Our greatest responsibility is to invest in our people through skills and education to drive Australia's productivity performance and ensure that all Australians can participate and contribute. Capabilities that are particularly important for the Asian century include job‐specific skills, scientific and technical excellence, adaptability and resilience...As a nation we also need to broaden and deepen our understanding of Asian cultures and languages, to become more Asia literate. These capabilities are needed to build stronger connections and partnerships across the region. (Australian Government, 2012, Executive summary)

The Liberal Party's policy statement identifies the importance of developing a national "Asia-capability":

> We will develop more Asia-capable talent and help Australians gain study and work experience, form relationships, learn to adapt behaviour to Asian contexts and learn to work more effectively with Asian governments. We will develop Australia's 'Asia literacy' beyond language skills. We will develop strong people-to-people relationships. Our intention is to develop a 'deep knowledge' of Asia and to broaden and deepen our engagement and relationships in the region. (Liberal Party of Australia, 2013, p.25)

The lack of access to resources has been identified as a significant issue. The Asian Studies Association of Australia has stated that much must be done before Australians can acquire the understanding of their immediate neighbourhood that is essential for cultural, economic and strategic well-being (Asian Studies Association of Australia, 2002, p. xv).

In the decade following this report, policy makers, researchers and libraries have not engaged in developing a role in this critical policy area. This study sits in the context of a new policy and economic environment which requires access to existing and new information resources.

**Methodology**
In order to understand the motivations and experiences of those involved in knowledge transfer, or potential knowledge transfer, a qualitative research approach was used for the study.

Questions were prepared for the interviews based on collecting general information on information seeking and use behavior, with the capacity to explore additional issues. The purpose of creating the opportunity for unscripted discussion was to obtain insights into experiences and motivations of the interview subject, a technique recommended by many including McNamara (McNamara, 1999). The detailed analysis of concepts of the participant used the analysis of design thinking (Brown, Ideo).

While a critical incident set of questions was trialed it was not found to be relevant (see results for more information). The set of questions was based on the most recent readings.

Interviews were sought with organisations selected under defined criteria. First the organisations or business groups represented significant components of Australian industry. Second the industry needed to be affected by the move to develop stronger relationships with Asia. Thirdly the industry was one where there was significant relevant research undertaken in Australian universities.

The interviews were held with senior leaders, policy or communication officers from the Australian Industry Group, Business Council of Australia, Council of Small Business in Australia, Australian Chamber of Commerce and Industry, Export Council of Australia and Minerals Council of Australia.

Discussions were held with relevant researchers (8), again focusing on the experiences of communication rather than using a series of closed questions.

**Results**
*Industry and business participants*
All responses indicated that the context of knowledge transfer and access to research outputs was one where there were an extraordinary set of complex issues. Those complexities echoed the propositions of Snowden that there was a tsunami of information available and the concept of simply keeping up to date with all developments was an impossible and pointless task.

Respondents indicated that they had a **very task focused approach** to knowledge seeking which developed out of the work they were undertaking at that time. There were slightly differing methodologies for seeking policy relevant advice to that for work to develop industry initiatives such as conferences and publications.

The single most important ingredient in spanning the knowledge and obtaining access to relevant material was the use of **trusted subject matter experts and information producers.** This echoes the finding of King in the use of experts, however there are subtle differences in that the boundary spanning aspect of knowledge was reflected in a use of collegiate organisations with expertise as well as experts within the organisation or its members. Factors influencing the use of internal experts were the size of the organization and the nature of the subject in which expertise was needed.

The nature of representational work and the media cycle puts extreme pressures on these organisations. Therefore finding that trust was the most important factor in determining which information mediator to use to access information was not surprising. An example of the general risk of use of unvalidated material can be found in the "Utegate" affair. In this case Godwin Gretch's allegations were pursued in Senate estimates and found to be false, arguably contributing to the change in leadership of the then Liberal Leader, Malcolm Turnbull. This provides a lesson in the importance of validation of information before using information publically.

The trust hierarchy was very similar to that of politicians (Australia Parliament Library, 2007 p 32):
- Authoritative experts within the organisation
- Government resources
- Scholarly materials (i.e. from universities or public research organisations)
- Think tanks of high reputation (e.g. Grattan Institute)
- News
- External (unknown and not affiliated with universities or think tanks) experts.

Comments from participants indicated that while news was not highly trusted there was some differentiation of media sources. Several mentioned that stories in *The Conversation*, *The Australian and The Sydney Morning Herald* were regular sources of information. *The Conversation* appears to be recognised as a means of identifying researchers and a source of "readable" research analysis.

When knowledge was required **rarely was there direct communication with a university expert** at the first stage of an assessment of the issue or investigation. One participant commented that although direct contact had been tried with a number of university researchers, in particular, to develop proposals for funding (for which they had funding), however the researchers had rarely responded to the contacts. AN alternative strategy of communication with Research Offices was found to be the only successful way to reach these researchers. While there was awareness that information about researchers was available, again the building of trusted relationships was a priority. Some organisations had developed strategic relationships with individual universities, however these were few and used to a small degree.

Without doubt the major activity in the first stage of research was to reach for **Google Scholar or Google**. All but one of the participants had searched both and understood the value of access to peer reviewed outputs through Google Scholar. All reported using journal articles and news sources.

Participants adopted a pragmatic satisfying approach which reflected the pressures of time, their ability to call on experts for secondary and primary analysis and their understanding of the policy and political context of issues.

There was low awareness of institutional repositories (2 of 6) however all were aware that increasingly research reports were available online and could be discovered.

Systematic reading was unsurprisingly daily news sources, including online services such as the ABC.

Time pressure was a major factor in limiting scanning of journal literature. Within organisations however keeping an overview of literature was a distributed task. Sometimes Google alerts were used for this purpose.

Finally, the question of responding to the new agenda for engagement with Asia brought a complex set of responses. Industry/business associations have been developing information for members on the Asian market for many years. There have been delegations to Asia and reports which have indicated potential industry development areas. The issue of knowledge of language and complexities in facilitating support for members is an area that requires active development as well as research.

*Academic participants*
All responses also reflected an understanding that the scholarly communication ecosystem was complex and. There was a high level of awareness that those they sought to communicate were using a wide range of information intermediaries including Google.

Media (such as *The* Conversation) and blogs has been sued for communication of research.

The creation of research and its transmission in an era when communication needs to be through social media and blogs to promote peer reviewed research outputs has produced pressures on researchers to develop their knowledge and skills.

Concerns about the visibility of research noted that there are significant rewards in the system for peer reviewed outputs in scholarly journals (ERA, HERDC), however there is not equivalent recognition for research that is written for and communicated to the business community, other than for patents or products that could result in commercial income.

**Discussion**
Academic engagement communities and knowledge transfer is one where the motivation for communication has been as varied as the types of outputs produced – ranging from data focused on sharing with colleagues to journal articles and blog posts designed for the general community. Citations within traditional scholarly publishing, for example, have been analysed (Harwood, 2009) as having 11 different purposes including signposting to further knowledge, positioning of the author, advertising and engaging in critical dialog with selected other researchers.

In addition, transfer of knowledge has been found to vary by discipline (Bekkers and Freitas, Martinelli, Meyer and von Tunzelmann), age/experience of researcher (Perkmann et al) and relationship with industry (Ponomariov).

While other studies (e.g. Bekkers and Freitas) have found variation of the effectiveness of knowledge transfer based on the format of the resource, for example journal articles, conference papers, this was not validated in this study.

The most significant factor in ensuring knowledge transfer from the perspective of business/industry groups was found to be that the information was known or easily available to the subject experts (or perhaps better termed as information mediators) used by those in the organisations.

Recognising that much of the literature used by the organisations is "grey literature", resources that include conference papers, discussion papers, working papers and blog posts, it is worth comparing the finding of this study with the *Grey Literature Strategies* report (Lawrence et al). That study found that these resources are used most commonly by public policy participants and that topic and convenience are key criteria for their use.

This study found that the use of peer review was assumed for research outputs from universities. This is significant as not all grey literature from universities has the same level of peer review as journal articles, books and book chapters.  If trust is the most important issue in selecting and using research outputs, steps are required to ensure that the grey literature outputs have gone through a rigorous review process for them to be as trusted as more scholarly outputs. The *Grey Literature Strategies* report found that topic and accessibility outranked discoverability and trust.

Convenience of access – i.e. the research outputs are able to be found through the Internet and the material is available open access without a paywall or other barrier - was found to be extremely important in both studies.

The second most important factor was the reputation (i.e. trustworthiness) of the source. Universities were highly ranked, although some comments about the readability (or lack of) of outputs were commonly made by the business organisations. Accessibility through having an abstract or executive summary was highlighted as likely to improve usability of the research output. Comments were made about the high value of full reports and articles, with no suggestion that long reports were avoided.

Perhaps most interesting was the heavy reliance of all organisations who participated on data. Openly accessible data form institutions such as the Australian Bureau of Statistics was used on a weekly basis by most organisations. International data was also an essential component for reports analysis for information for members and for advocacy. Most did not use much data from universities – based on three major issues. The first was simply the experience of the organisations was that only a limited amount of data was available from universities. In an age of increasing emphasis by the ARC and NHMRC on data management this is a serious issue for action. The second issue was discoverability – none of the participants had used the Australian National Data Service web service Research Data Australia nor had found easy paths to the data. The third was that the data was not expected to necessarily be friendly for reuse, which given the limited resources that are available in the organisations to use and analyse the data, is a significant drawback.

Discovery is a critical issue for access to resources. The challenges of finding the most useful resources in an online world is a critical issue. The World Ranking of Repositories provides a ranking based on a number of factors including the successful delivery of access through Google Scholar. Issues for improving findability include application of correct metadata, timeliness of entry of data into the repository systems and the quality of the metadata. The research shows that resources spent on maximising discoverability will improve use.

The Confederation for Open Access Repositories recently published a roadmap noting that there are many issues still to be addressed to improve access to research outputs, validating that the barriers identified in this study exist on an international scale. The report outlines nine priorities from which Australian universities consider creating actions or joining international actions to improve the user experience and consequently the impact of the research.

The visibility and "trustfulness" of experts within universities was an issue that was underdeveloped in terms of the details of information available through the web. Linking up researchers, research publications (including grey literature) and data would provide a stronger set of key information for the industry and business groups to access university research quickly and effectively. It is likely to also overcome the complaint that research from universities may be too late to influence policy and may lack industry focus.

In terms of the new agenda for developing greater relations with Asia, organisations noted the need for more research and more effective access to the outcomes of new research.

From the perspective of academics, a challenge for those who wish to actively promote their expertise and research outputs is the turnover of staff in groups they wish to reach. A number of organisation participants in the survey were in positions where the occupant had changed during the period of the survey.

The critical issues from the perspectives of academics (resources and skills) vary significantly from those of business and industry participants. Separate actions are needed to improve the ability for both communities to connect better.

**Conclusion**
While it may be self-evident to state that the Internet is the transformational mechanism that supports the greatest intersection between academics and this community in terms of knowledge transfer, it is clear that the release of research outputs into the online environment is not fully effective. Paywalls remain frustrating, as does searching for resources that have not been made available through repositories or other easily accessible services. Continuing developments in repositories and reconceptualization of what "access" means is vital for improvements in knowledge transfer.

The UK initiative of the Research Councils to develop a "gateway to research" is a model that takes the issue of increasing research accessibility for knowledge transfer to a new level. It is an innovation that may prove a valuable model for greater success in knowledge transfer. International analysis on innovation for greater access to research outputs through integrated gateways can also be seen in the recommendation to investigate the possibility of constructing the world's first all-scholarship repository in the recent report *Mapping the future of scholarly publishing* (Open Science Institute, 2015).

A major finding from this study is that the quality including reliability of research outputs is critical for its use by organisations. Peer review is the major mechanism to ensure quality research outputs. The future of peer review is under active debate. Discussions are occurring about the potential to recognise or reward this activity (Byrne, 2014).

Finally, to return to the theoretical models proposed for this study, it is clear that there is a complex range of factors influence the transfer of knowledge through research outputs. Communication of knowledge has not operated as a rational, linear system. The variations in terms of academics' expertise and knowledge, as well as limitations in the promotion of research, produced an environment where the most valuable linkages, not recorded in the Kautto-Koivula and Huhtaniemi model, were the information intermediaries or subject experts within the organisation. Thus while each organisation acted as one comprised of individual actors who formed networks within their organisations and with other organisations, the need for mediators rather than intermediators (to use the actor-network-theory definitions) was a key factor in the information ecosystem.

The "making knowledge available" block in the Kautto-Koivula and Huhtaniemi model therefore consists both of those, such as libraries, providing access through repositories and information mediators within organisations.

An important question remains as to what innovations could provide better infrastructure to communicate research outputs. At present the mechanisms available are primarily search systems such as Google and Google Scholar. Australia is without a single solution such as the UK gateway. Participants noted that their research need was not limited to Australian research, and subject access was critical. This suggests that working with COAR on international discovery systems could provide a valuable initiative that would result in more effective access to research and greater impact.

The Association of Research Libraries, the Association of American Universities  and the Association of Public and Land-grant Universities have partnered to develop a new initiative, SHARE to ensure the preservation of, access to, and reuse of research outputs (Association of Research Libraries, 2015). It may provide a model that will go beyond that proposed by the Asian Studies Association of Australia and traditional repositories to provide a broadcast in addition to a search based solution.

Waiting for overseas developments is not sufficient, however, to ensure that there is optimal return on the investment in the Australian university sector. The major library sector associations should consider what can be done to develop better practice around a "joined up" ecosystem of research and academics and fostering further discussion with research funders.

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