Investing in research excellence
Strategic Planning for 2016-20,
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Foreword

As we discuss the development of our Strategic Plan for 2016-20, I have been excited to see many hundreds of colleagues across the University make important contributions to the debate. To date, our conversations have focused on proposals for a distinctive undergraduate education in place of our current somewhat complex offering.

In this second discussion paper we outline proposals aimed at enhancing our research. The University has a great responsibility to serve society through the quality of our research; both excellence in the disciplines and high-quality multidisciplinary work that addresses the great questions that our community is facing.

While celebrating our achievements in areas of undoubted strength, we reflect on what it means to be “excellent in research” and we highlight opportunities to drive quality and maintain research excellence in key disciplinary and multidisciplinary areas. We propose a new model for deciding where to invest in research – a model that will enable us to accelerate quality and scale in areas in which this University can become clearly pre-eminent.

Again, I encourage the whole University community to consider these proposals, engage at each opportunity, and contribute your feedback. These are important decisions for all of us: addressing these questions effectively will enable the University to build upon its proud tradition of world-class research and to realise its full potential.

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1 Introduction

This is the first of two discussion papers on the future of research at the University of Sydney. The papers come at a point in our history when, having achieved a great deal, we are faced with significant challenges – but also considerable opportunities.

Our overall vision is clear. We want to be, indisputably, the finest university in Australia and among the very best in the region and the world. Our challenge now is to develop a plan for achieving this vision, building on our achievements to date.

There are four pillars to our research vision:

− an unstinting commitment to research excellence
− a willingness to harness that excellence to address some of the vital national and global challenges of our time
− a desire to engage with the communities for whom our research has real meaning and consequences and from whom we can learn – whether in the private or public sector, local or global
− new initiatives to develop, nurture and support our researchers; that is, to develop not only brilliant minds, but also research leaders.

These four pillars provide the foundations for building a culture of research excellence.

This paper addresses the first two pillars – investing in disciplinary and multidisciplinary research excellence. The second paper will focus on research-led community engagement and researcher development. Together, these papers will provide the framework for our research vision for 2016–20.

A new approach
The University of Sydney aspires to be both a distinctly Australian university as well as a truly global one. The quality of our disciplinary and multidisciplinary research, and its impact, should be judged against the very best in the world. We also have a fundamental commitment to our national mission as Australia’s oldest and most comprehensive university. As part of this mission, for example, through our Wingara Mura – Bunga Barrabugu (“thinking path to make tomorrow”) strategy, we are committed to leading in research aimed at improving the lives of Australia’s Aboriginal and Torres Strait Islander peoples, as well as Indigenous peoples around the world.

Our fundamental commitment has been, and will remain, research excellence. We also have a special responsibility to conduct our research in ways that serve the public good. Our community and supporters – including government, industry, community organisations, public and private foundations, donors and alumni – expect nothing less. But we can do even more and do it better. Just as we are yet to fully realise the potential for providing our students with the extraordinary educational experience they deserve, so are we yet to realise fully our potential as one of the leading research universities in our region and the world.

Underpinning these discussion papers is a growing spirit of ambition across the University. Our staff and students want us to aim high. In the recent University Strategy Survey, while staff and students were supportive of the direction we set for ourselves in the 2011-15 Strategic Plan, they also expressed a desire that we embrace a bold vision for the future, including support for strategic investment in the key areas of both existing and emerging research excellence. We believe this can be achieved while at the same time building a supportive, inclusive and high-performing research culture across the entire university.

What do we mean by research excellence? In a university as large and diverse as ours, there will be a range of definitions. However, at a basic level, we mean:

− that our research and scholarship will make an original and significant contribution to the pursuit, creation and application of new knowledge and understanding
− that our research will ask important and difficult questions and be bold in challenging existing paradigms and dogma;
− that it will influence and shape our world, helping to make people’s lives better.

Every researcher at Sydney, in their own way, will aspires to be a leader in their field in these senses.

What is distinctive about research at Sydney? It is indeed the extraordinary scale and depth we bring to our disciplinary and multidisciplinary endeavours. We can do things that other universities in Australia cannot, just given our size, quality, breadth and depth across the humanities, social sciences, creative arts, physical sciences, life sciences and health and medicine. We also have an extraordinary capacity for influence, given these strengths. In our next Strategic Plan, we need to find new ways to realise these capacities fully.
To take full advantage of our position, we need to become a more agile and outwardly focused institution. We need to find ways to empower our researchers, to create a culture that rewards excellence, supports continuous development and improvement and that fosters creativity and innovation. We need to be bold and hold ourselves accountable for producing research and scholarship that is considered among the best in the world, and is also addressing questions our communities need answered.

What has defined our approach to investment in research until now has been, broadly speaking, to play to our strength as one of the most comprehensive universities in the region. The net result of this approach over the past decade, however, is that even with this breadth, there are relatively few disciplines in which we can claim genuine national and global pre-eminence and thus enjoy the advantages that come with it: a truly global reputation; a magnet for the most talented students and researchers; increased research income; and more opportunities for local, national and global engagement and impact. Our ability to demonstrate excellence will be even more important in coming years as national and global competition for staff and research funding becomes more challenging.

We have also tended to focus on the quantity of our research, rather than its quality. This has been, in part, a rational response to external funding drivers. But those drivers are changing and we need to change too. Critical mass and scale is undoubtedly a crucial part of research success. But as other leading universities in Australia and our region have been targeting the quality of their research, we have taken a more laissez faire approach. As a result, and as we demonstrate below, despite our success in many areas, we are also losing ground in many of our disciplines – for example, our Australian Research Council and National Health and Medical Research Council success rates are flattening and we have fewer highly cited researchers than our peers.1 We are yet to establish a systematic approach for encouraging high-quality publication that links the support we provide at both University and faculty level, including in our hiring, retention, and performance development and management processes.

However, we are beginning to see the possibilities and advantages of a new approach.

We have begun, for example, to leverage the breadth of our research expertise to address large-scale societal issues in innovative, multidisciplinary ways. We have:
- launched the Charles Perkins Centre
- created the China Studies Centre, the Sydney Southeast Asia Centre and the Australian Institute for Nanoscale Science and Technology
- invested in new interdisciplinary initiatives addressing vital issues such as mental health and neuroscience, environmental change and sustainable agriculture, infectious diseases and social justice, among others.

These initiatives have begun to demonstrate what strategic, focused investment can achieve:
- building a critical mass of researchers
- raising the quality of research
- increasing the impact and visibility of our research outcomes
- attracting outstanding staff, students, supporters and further resources.

Our initiatives are framing a distinct set of high-level areas of focus for the University, starting with: the pressing health challenges of our time (diabetes, obesity and cardiovascular disease, as well as mental health and neuroscience); understanding and engaging our region (China and Southeast Asia); and exploring the extraordinary new possibilities of nanoscience.

But we can do more, and our staff and students are ambitious to do more. We are yet to take a strategic approach to investment in research excellence across both multidisciplinary domains and in our disciplines. Faculties have rightly identified their own strategies and priorities for supporting research excellence, but have not typically had the resources to take full advantage of the opportunities on offer. And as an institution, we are yet to identify and commit to supporting those disciplinary (and subdisciplinary) areas in which we have the opportunity, through additional investment, to build quality and scale such that we can genuinely aim to national, regional and global pre-eminence in those fields and thus the benefits that come with such excellence.

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1 Sydney hosts one highly cited researcher out of the 59 listed as belonging to Australian universities.
Three key themes

Three key themes underpin this paper:

- We should be relentless in our focus on the quality of our research. Conducting the highest quality research possible should be the aspiration of every researcher and every discipline in the institution.

- We ought to invest more strategically in disciplines and cross-disciplinary areas that have the best prospect of becoming genuinely world leading, as well as having the greatest “multiplier effect” for other aspects of our research endeavours. Every discipline in the University should aspire to be among the top 25 in the world. But we should also aim to have a considerable number among the top 10.

- We need to identify the next major societal challenges that we will tackle by harnessing our extraordinary breadth and expertise, and along with our existing major areas of focus, present a coherent, clear portfolio of socially relevant research that distinguishes our efforts globally.

These whole-of-university, multidisciplinary projects should help address some of the “wicked” problems of our time and lead to genuine improvements in human wellbeing.

Our belief is that by pursuing strategies that build on these propositions, we can raise the quality, reputation and impact of all research being done at the University of Sydney. In doing so, we can prepare the University to meet the challenges of increased competition for outstanding staff and students and declining government funding for research, and yet also greater expectations from the community that we use our research expertise to tackle the key social, cultural and economic problems today and in the future.

New investment in disciplinary and cross-disciplinary excellence will mean:

- more opportunities for our researchers to be supported to realise their full potential

- more opportunities to work collaboratively with the leading people in their field

- better infrastructure

- new modes of engagement between the university and the broader community.

In this paper, we pose two key questions for the university community to consider:

- How should we invest to support disciplinary and cross-disciplinary excellence, without necessarily undermining our breadth and existing strengths? And if we do, in which disciplines and by what mechanisms can we be confident of their success?

- Building on and complementing our existing multidisciplinary initiatives, how should we identify the next crucial national and global challenges for us to tackle and where we can make the greatest contribution?

In this paper, we will not seek to identify the particular disciplines or multidisciplinary domains we might invest in. Rather, the focus will be on the criteria and process that will enable these decisions to be made.

Before turning to a discussion of our future, where are we now in terms of our research performance?
2 How do we compare nationally and internationally?

The University of Sydney has an abundance of strong disciplines. In this section, we examine the comparative data on both the scale and quality of our performance nationally and internationally. We will consider the impact and influence of our research later.

2.1 How we compare nationally

ERA results

Our results in the 2012 Excellence in Research Australia (ERA) process were impressive (Table 1) and exemplify our impressive breadth as an institution. At the two-digit field of research (FoR) level, we received the highest rating of 5 – that is, “outstanding performance, well above world standard” – in the areas of mathematical sciences, agricultural and veterinary sciences, engineering, medical and health sciences, psychology and cognitive sciences, law and legal studies, language, communication and culture, history and archaeology, and philosophy and religious studies.

The ERA process, however, has some limitations. It is retrospective, subject to optimising strategies, and measures performance against a standard benchmark rather than directly comparing institutions – all of which means that the results may belie performance issues within particular disciplines and subdisciplines.

To supplement our analysis of the ERA results, along with other indicators of research performance described below, we commissioned a high-level external evaluation of our performance as measured against the sector in Australia and in the Asia-Pacific region. This report is based on publication data from Thomson Reuters going back to 2012, and focuses mainly on measures of research performance that influence our rankings in international league tables. For this reason it is indicative only, but nonetheless, in combination with other indicators, it provides a useful starting point for thinking about the scale and competitive standing of our research relative to our main competitors.

Overall, the report concludes: “The University of Sydney evidently needs a renewed focus on research quality and performance management across all fields. But the entire institution would also gain a reputational benefit if the University of Sydney were able to establish national dominance in a greater subset of fields.”

The report acknowledges that determining which fields to invest in is an extremely complex process, requiring careful consideration of many different – and often competing – factors.

Some key findings of the report are:

- **Quality has been an issue.** The University of Sydney tends to do better in rankings of total publication counts than in rankings of total citation counts, or rankings of citations per paper, which demonstrates an historical emphasis on quantity rather than quality.

- **Growth is essential.** The University of Sydney would need to grow its aggregate research metrics overnight – that is, citations and publications – by about 10 percent to match the University of Melbourne, which is the national leader in research. In 2012, this would have been roughly equivalent to an increase of $100 million

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2 These are the most recent ERA results. The outcomes of ERA2015 will be known later this year.

3 Thomas Barlow, University of Sydney Strategy Background 2015, derived from the Asia 100 – Barlow Report 2014 barlowadvisory.com/asia-100.html (A copy is available in the University library.)

4 Thomas Barlow, University of Sydney Strategy Background 2015, p46.
in our research expenditure\(^5\) – a combination of direct expenditure by the University, flow-through research grant income and research block grant income.

- **Growth in non-clinical fields in the life sciences should be a priority.** Relative to its competitors, the University of Sydney has a high degree of focus on and investment in clinical health and medical research. Improving our reputation as a leading research institution, as well as rankings in international league tables, will require success in more than this one (albeit large) domain. Success in the humanities and social sciences offers further opportunities, given it is a genuine point of difference across the Group of Eight (Go8) and globally, but raises challenges for identifying appropriate criteria for investment, which we discuss below.

**Historical patterns of investment**

Our historical pattern of investment in research has tended to be faculty-focused, rather than whole-of-university oriented. In many cases, this has been appropriate and important. We have seen the emergence of outstanding individuals and groups – areas of relative scale in a school or department – that are able to leverage and build substantial resources and capacity to deliver high-quality and productive research.

However, faculty-driven approaches have led to dispersed investment in some fields, with little incentive or capacity to bring overall structural coherence and scale. We have tended to be less proactive in seeking out opportunities for strategic investment, as opposed to reacting to opportunities as they arise, which can have unintended organisational consequences. Staff appointments, for example, are sometimes made without due consultation and coordination across all of the relevant disciplines, resulting in a poorer outcome for all. Our pattern of investment has also meant that even where we do have quality and/or scale, it is often less visible to the outside world than similar levels of activity at other universities.

Our biomedicine research is one example of the effect on disciplines of our current organisational arrangements. The Health and Medical Research Strategic Review drew attention to this issue, suggesting that because of Sydney Medical School’s overall focus on clinical science, the School of Medical Sciences was not organised strategically to support fundamental biomedical science research. The review went on to say that “one could consider structuring to encourage coherence and greater interaction between researchers who share research interests in biomedical science”\(^4\). The challenge and opportunity are in fact greater, given the numerous other parts of the University involved broadly in this space – the Schools of Molecular Bioscience, Chemistry and Psychology in the Faculty of Science, the Faculties of Pharmacy and Health Sciences, and many other parts of Sydney Medical School and medical research institutes affiliated with the University.

However, the current Life Earth and Environmental Sciences project is an excellent example of the University taking a more proactive and holistic stance, tackling a similar structural challenge in the life sciences across science, agriculture and veterinary science. The goal of this project is not only to reduce duplication in teaching and administration in core discipline areas across the different faculties, but to create new opportunities for coordination and concentration of research capacities as well. It is a challenging project, but early indications are that it will have important benefits for the university as a whole.

It is only relatively recently that we have begun to make some research investments on the basis of a whole-university approach, while many of our Go8 peers have been doing so for much longer – especially in health and medical research. We are, however, starting to see the benefits of these kinds of investments at Sydney. The development of the Charles Perkins Centre research and education hub, the Brain & Mind Research Institute and the pending Australian Institute for Nanoscale Science and Technology building, along with our Core Facilities Program and the Westmead project, are beginning to generate reputational benefits and excitement, as well as helping to leverage new resources, including being able to recruit outstanding researchers in ways we have struggled to do in the past.

\(^5\) The Australian Bureau of Statistics regards research and development expenditure as including capital expenditure for research such as land, buildings and other structures, staff costs for the reported staff effort devoted to research (including university-funded and grant-funded), scholarships for research higher degrees, and other current expenditure (indirect costs) on research.
Research income

Our performance has been good in this area, but that of our peers has been even better.

In category 1 (figure 1a) (national competitive grants such as NHMRC (figure 1b) and ARC (figure 1c)), the data shows both that funding in the sector as a whole is flattening, and that our growth in recent years has lagged others. These trends are highlighted even more acutely when looking at the NHMRC and ARC’s two flagship project funding schemes, where funding is either flattening or trending down. Moreover, our performance in terms of applications and rates of success in individual fellowship schemes, such as NHMRC Research fellowships and ARC Future and Laureate fellowships, is flattening relative to our peers.

In category 2 (figure 2a) (other public sector funding) our performance has been in clear decline, despite a stronger result in 2013. The data suggests there is a need and opportunity to better engage with state and federal governments in a more strategic and concerted way (we have not had such an approach previously).

In category 3 (figure 2b) (industry, philanthropy and international research income, including international research students) our performance is strong, though the overall numbers are volatile because of the different elements involved. If we look specifically at the industry component for Australian industry contracts and grants income (figure 2c), we see good relative performance, though again with great scope for growth.
In category 4 (figure 2d) (Cooperative research centres) our performance is poor, though we have focused minimal effort on this program, given opportunities elsewhere. While we are now more engaged and taking a more strategic approach, the program’s future is not clear, following the recent federal budget and review.\(^7\)

Although we have pursued strategies to improve our performance at the discipline level, particularly since the advent of the ERA rankings, we have not yet been successful in elevating the University to a position of genuine leadership in Australia. The 2015 Quacquarelli Symonds (QS) international discipline rankings, for example, based on a combination of quantitative performance metrics (Scopus publication data sets), and qualitative information from staff and employer reputation surveys, show that while we have the same number of disciplines in the top 100 as the University of Melbourne, we have one fewer in the top 10 and seven fewer in the top 50 (see figure 3). In only three of these 35 discipline areas are we the highest-ranked Australian university. What we also see, particularly between 2014 to 2015, is the rate at which other universities are improving their standings in these rankings. This pattern of more often than not being ranked second or third in a field rather than first is borne out in other data. The lack of focus on any given area (clinical research aside), is further shown in figure 4 (b is an explosion of a), which plots the proportion of Sydney’s expenditure (internal weighting) in each of the 21 Thomson Reuters fields against our share of all Australian universities’ spending for 2008 and 2012.\(^8\)

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\(^8\) Thomas Barlow, University of Sydney Strategy Background 2015, derived from the Asia 100 – Barlow Report 2014; barlowadvisory.com/asia-100.html
Most fields now account for between 1 percent and 5 percent of the University’s research and development spending, and for between 5 percent and 12 percent of national spending. Across both dimensions (internal weighting and national share), the distribution of values is tighter in 2012 than it was in 2008, for virtually all fields.

What tables 4a and 4b show, in other words, is that between 2008 and 2012, while we maintained a high degree of specialisation in medical and health sciences, we have reduced the degree of specialisation across the rest of our disciplines. We have tended to spread our resources thinly across as many areas as possible, as opposed to focusing strategically on areas in which we can have the greatest impact.

Figure 5a shows how we are performing in these Thomson Reuters fields compared with other institutions and contrasts it with a similar view of the University of Melbourne’s outputs (figure 5b).

This data shows that compared with Melbourne, Sydney has fewer disciplines where quality dominates over scale, and also that we have a more scattered pattern of activity. We see similar evidence if we look at total citation counts. By this measure, the University of Melbourne has national leadership in well over a third of the Thomson Reuters fields, while Sydney has leadership in about a fifth. This is a big gap in performance.

This data arguably reaffirms the importance of this University identifying fields in which we can improve the underlying quality of outputs and be top-ranked by total citation count or citations per paper, while ideally maintaining the scale of our current research. Of course, we also need to continue measuring our performance by the actual impact it has on the communities we serve – especially for our multidisciplinary initiatives.

Figure 3. Number of top-ranked QS international disciplines across the Go8 universities in 2014-15.
2.2 How we compare internationally

Our position on the international rankings tables has been relatively stable, albeit fragile, over the past five years, as more institutions focus on improving their rankings performance. University league tables must be treated with caution, as they all use different methodologies and factors for ranking institutions. The three most commonly used international rankings measures are the Academic Ranking of World Universities (ARWU), Quacquarelli Symonds (QS) and Times Higher Education World University Rankings. Each ranking system uses a different set of criteria, weighted in different ways.

The ARWU uses quality of graduates (as measured by alumni winning Nobel prizes and Field medals), quality of researchers (as measured by highly cited researchers and those winning Nobel Prizes and Fields Medals), research output (total publications and those published in Nature and Science) and per capita performance as measures. It leaves out, almost entirely, the quality and impact of research in the humanities and creative arts, areas of genuine strength for the University. The QS is based on academic reputation, citations per staff, staff/student ratios, reputation amongst employers and percentages of international staff and students. The Times Higher Education ranking measures citations, research volume, research reputation (survey), research income, teaching (including survey), international outlook and industry income.

A new international ranking system, US News & World Report Global University Ranking, commenced in 2014 and may become an influential system in coming years. In 2015, Times Higher Education put us at 60th place globally (3rd domestically); QS at 37th globally (3rd domestically); and the ARWU now has Sydney out of the top 100 globally (4th domestically). Aside from the ARWU result, all represent increases from the previous year (figure 6). The more recent US News ranking placed us 45th globally (2nd domestically).

We see similar results and trends at the discipline level. With only two exceptions, there is a pattern of increasing strength across the breadth of disciplines, but without genuine pre-eminence in any. In the ARWU, in which virtually all Australian universities perform relatively poorly, Sydney's strongest areas are the social sciences, physics and chemistry, where we are in the 76-100 band.
In the 2014 Times Higher Education discipline rankings:

- **arts and humanities**
  Sydney 18th; ANU 16th
- **clinical and pre-clinical health**
  Sydney 23rd; Melbourne 13th
- **engineering and technology**
  Sydney 46th; Melbourne 37th
- **life sciences**
  Sydney 65th; Melbourne 29th
- **physical sciences**
  Sydney outside top 100; ANU 28th
- **social sciences**
  Sydney 31st; Melbourne 19th.

The QS rankings provide the greatest level of disaggregation across 36 disciplines. These include a measure of employer reputation and thus also evaluate the perceived quality of our education in those disciplines (though when this data is excluded from the analysis there is little change in our research performance). There are also some standout disciplines, notably the only three (of all the ranking measures) in which we lead nationally:

- **English language and literature**
  Sydney 18th; Melbourne 20th
- **medicine**
  Sydney 17th; Melbourne 18th
- **veterinary science**
  Sydney 11th; UQ 22nd

A total of 25 subjects at Sydney were ranked in the top 50.

Other strong disciplines in the 2015 QS Rankings include:

- **education**
  Sydney 9th; Melbourne 5th
- **law**
  Sydney 13th; Melbourne 8th
- **architecture**
  Sydney 17th; Melbourne 15th
- **civil and structural engineering**
  Sydney 19th; UNSW 14th
- **accounting and finance**
  Sydney 19th; UNSW 12th.
Figure 7. Plot of how close a particular discipline at Sydney is to the international leader (share), against the change in performance in that discipline from 2014 to 2015 (growth). The data is drawn from research-related scores from the QS Subject rankings (excluding employer surveys). The size of the points reflects the proportional contribution of that discipline to the University of Sydney’s overall university ranking. The disciplines on the 0% growth line are new this year in the QS assessment.
A graphical representation of the QS discipline data is given in figure 7, which shows the relative performance in research measures of disciplines at the University of Sydney against the leading institutions in each discipline and the rate of improvement of each discipline in the QS Subject rankings. At the most aggregated subject level, for 2014-2015, we find similar results to the Times Higher Education rankings:

- **arts and humanities**
  - Sydney 21st; ANU 10th
- **engineering and technology**
  - Sydney 44th; Melbourne 23rd
- **life sciences and medicine**
  - Sydney 19th; Melbourne 17th
- **natural sciences**
  - Sydney 47th; ANU 29th
- **social sciences and management**
  - Sydney 23rd; ANU 13th.

Finally, when we turn to the broad research strategies of leading global universities, we see clear patterns. The best universities have embraced the challenge of harnessing their resources to tackle the big questions of our time, as well as continuing to invest in disciplinary excellence. They do so through a combination of strong support for and consultation with schools and faculties, but also a clear whole-of-university strategy. For example, University College London has pioneered the “grand challenge” agenda in the UK, focusing on sustainable cities, human wellbeing, global health and intercultural interaction.\(^\text{10}\)

The University of Toronto has embraced both “strategic leadership” and “disciplinary excellence” as their lodestars – and identified seven multidisciplinary research clusters in which they are seeking to make a whole-of-institution contribution.\(^\text{11}\)

### 2.3 Summary: where we are now

In reviewing the data we can see that, although we have accomplished an enormous amount, we need to adapt to face new challenges for the future of our research and support for our researchers. In short, in many parts of the University, our performance is good but also under pressure, as our national and global competitors are improving at a faster rate than us and the prospects for research funding are changing, with governments and other funding agencies refocusing their priorities. The good news is that we are already seeing the benefits of change in many parts of the University. We need to build on this success for the future.

\(^\text{10}\) ucl.ac.uk/research/grand-challenges

\(^\text{11}\) research.utoronto.ca/wp-content/uploads/2012/10/SRP-2012-web.pdf
3 Strategic investment for excellence

Our view is that we need to focus additional and sustained strategic investments in a number of selected areas to deliver the highest quality research at scale, as well in various new areas that tackle major societal and global challenges.

Why is this the best approach? The danger is that by not investing our discretionary research funding more strategically, we will:

- struggle to retain and recruit outstanding staff and students
- be ill-equipped to respond to the changing research funding environment
- fail to realise fully our true potential for impact and influence as a leading research-intensive and socially engaged university.

It is important to make clear, however, that the case for strategic investment for excellence should not come wholly at the expense of existing disciplines, nor the work that individual researchers pursue and are passionate about. The arguments in this paper address how we should invest our discretionary resources strategically. This is not an argument that researchers shouldn’t still be free to pursue research that they think is important and valuable; it is an argument for using our discretionary resources in new ways, as well as releasing more funds for research more generally across the University. It is not a zero sum game.

What would an individual researcher in their discipline see as a result of such additional strategic investment? They might see:

- an increase in the number and quality of colleagues
- better and more enabling research infrastructure
- greater opportunities to collaborate and be part of a larger, externally engaged, cross-disciplinary group of talented colleagues from across the University
- the chance to tackle research questions in ways they would never be able to on their own.

3.1 Which criteria?

In our staff and student survey, both staff and students overwhelmingly chose the quality (69 percent/61 percent) and impact (55 percent/51 percent) of research as the major determinants for strategic investment. These criteria were followed by international collaboration and opportunities to partner with other universities and organisations (staff: 33 percent), and addressing global priorities (students: 37 percent).

In essence, there are three key elements: research quality, societal impact and reputational impact. In addition, we will need to consider the resources available in relation to each element, including recruiting outstanding researchers, collaborating with quality partners and generating future external research income. This will need to be accompanied by a thorough external and competitor analysis, identifying the full range of opportunities for growth and improvement.

We begin by considering how we should proceed in terms of measuring research quality.

Research quality: understanding and measuring

Measuring the quality of research can be contentious, especially when making comparisons across disparate disciplines. What we aim to do, therefore, is base our process on comparative performance for each discipline against the leading institutions for that discipline in Australia and the world, using the most appropriate metrics and indicators of quality for each discipline. We also have the opportunity to develop new benchmarks against which to evaluate the impact and influence of our research in relation to societal engagement in both national and global contexts.
For citation-based disciplines, the process we will use draws on the Scopus data set and the Scopus-defined disciplines and subdisciplines. This is also the data used for the ERA collection (and QS rankings), though the ERA process defines disciplines in terms of Field of Research (FoR) codes at different levels of granularity.

This process will include:
- using the data to determine performance in the selected discipline across a range of indicators, including:
  - volume of research outputs
  - citations
  - relative citation index (identify individuals in the top 1 percent)
  - collaboration (identify percentage of external authors)
  - established versus emerging authors
  - discipline-specific characteristics.
- using the data to determine the high-performing institutions in the selected disciplines
- determining who the high-performing individuals are at the high-ranking institutions (from the data)
- determining whether the high-performers collaborate or work independently and the nature of those collaborations (institutional and/or publications network) in the selected discipline.

For disciplines in which citation-based analysis is incomplete or inappropriate, citation-based measures will need to be supplemented with other information, including:
- those publications and research outputs – journals, books, creative works etc – that standard data sets ignore, or only partially cover\(^\text{12}\)
- the contribution of relevant humanities, arts and social sciences disciplines and subdisciplines to the top 30 percent of field of research (FoR) submissions to the ERA
- percentage of publications in highly ranked journals and books with leading publishers, as determined by peer review;
- external research income (benchmarked against relevant Go8 and global competitors)
- awards / honours (including membership of learned academies)
- editorial prestige (editorships of top ranked journals, book series etc.)
- quality of institutional affiliation over career
- activity on the Australian Research Council or equivalent international research council
- leadership of research centres or networks.

For both the citation and peer-review disciplines, this analysis would then allow us to:
- evaluate how much new capacity would be needed to make the University of Sydney top-ranked in (a) Australia (b) the region/world, in the selected discipline by these measures
- estimate the size of the gap to the leading institution that can be used to compare the level of investment required in these select disciplines.

This process will, of course, only provide information based on recent and historical performance data. However, research capacity and success is unavoidably path-dependent and although past performance is no guarantee of future success, it provides a very strong indicator of the likelihood of success.

On the other hand, to determine emerging excellence will require identifying significant upward trends in the data identified above, as well as growing scale, such that further investment would provide a likely “tipping point” either to pre-eminence in the field and/or the ability to contribute substantially to our multidisciplinary activities. While there is an inevitable dimension of risk in identifying emergent areas for investment, there is also a need to be flexible and respond quickly to opportunities that emerge.

Next, we turn to how we should evaluate the potential for our research to have meaningful societal impact.

\(^{12}\) Scopus has substantial gaps in its data set with regard to some of the leading journals and publishers in the humanities and social sciences. The University’s Research portfolio will work closely with the relevant disciplines and faculties to ensure these gaps are identified.
Societal impact: understanding and measuring
The quality and value of our research will also be measured by its influence and impact in the world around us. Our researchers will not only be recognised for their innovation and creativity, but also for influencing public debate, shaping public policy and contributing to the improvement of people’s lives, both locally and globally.

How do we measure impact? The federal government is likely to focus on impact in future ERA processes, and various groups propose potential measures for impact – most recently the Australian Academy of Technology, Science and Engineering, which sought to develop an “Impact and Engagement for Australia” metric.13

Some indicators of impact can be measured by proxy – for example: influential publications; commissioned research; policy engagement and influence; recognised expertise; creation of intellectual property and successful new businesses; keynote addresses; performances; exhibitions; awards; prestigious prizes; and recognition from the leading societies and academies. We will need to capture impact and influence in ways that governments, funding agencies and our supporters can understand.

In 2015, the federal government also announced new national priorities for science research: food, soil and water, transport, cybersecurity, energy, resources, manufacturing, environmental change and health.14 Within the health sphere, there are already more specific priorities identified by the Australian Institute for Health and Welfare.15 Further, various global organisations, particularly the United Nations, have outlined important international priorities and goals, such as the UN Millennium Development Goals.16

How does our research contribute to addressing these national and global priorities? How should we recognise and prioritise our research activities to take account of them? Combining these various priorities with our own strengths, are there opportunities for further investment in activities that tackle, for example, not only the new government priorities, but the challenges of inequality, the future of democracy, global cities, sustainable development, and “big data”, to name a few?

One priority to which Sydney has already committed itself, already mentioned above, is leading in Aboriginal and Torres Strait Islander research. Excellence and impact in research concerning the wellbeing and place of Aboriginal and Torres Strait Islander peoples in Australia and the world will feature prominently in our new Strategic Plan. We cannot be a truly Australian university without engaging deeply with our Aboriginal and Torres Strait Islander past and future. The initiatives at the University of Sydney will also engage critically with other major universities that have developed Aboriginal and Torres Strait Islander research initiatives.

Thus, for the purposes of societal impact, strategic investment should be considered in relation to the following elements:
- the opportunity to lead and influence genuinely in areas of research with clear societal impact and the capacity to make a difference in addressing these challenges
- scale and capacity for producing high-impact research
- the capacity for researchers in existing and emergent disciplinary strengths to collaborate to address important national and global challenges
- the presence of, or our ability to attract, researchers and disciplinary leaders who are likely to make substantial contributions to our multidisciplinary activities and who are willing to engage and work with the relevant communities who have most at stake in our research.

Reputational impact: understanding and measuring
The quality and visibility of our work shapes our overall reputation, although this correlation is difficult to measure. However, our ability to achieve a position of leadership in a particular area and to differentiate ourselves from our peers will undoubtedly have benefits for our overall reputation.

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13 atse.org.au/atse/content/publications/reports/industry-innovation/developing-impact-engagement-australia-metric.aspx
14 pm.gov.au/media/2015-05-26national-science-and-research-priorities
15 aihw.gov.au/national-health-priority-areas/
16 un.org/millenniumgoals/
At the same time, many of the strategies for improving our disciplinary and multidisciplinary research outcomes will also have positive consequences for our rankings in the various league tables, which in turn will generate additional reputational gains. Improvements to our reputation and in the rankings will undoubtedly have positive effects for undergraduate and postgraduate student recruitment, for attracting new staff and for the opportunity to build or develop new relationships with quality partners and collaborators.

When we look at all the variables in the rankings measures, we see that those with the most influence are the academic reputation surveys done by QS and Times Higher Education. These indicators, however, are essentially subjective and very difficult to influence, other than speculating that if we increase our overall academic performance, our reputation will likewise improve. The variables with the next greatest influence are citations, publication output and staff-student ratio, which offer greater opportunities for influence in terms of what we can actually do to improve.

Thus, rankings and other measures of reputation are important and should feature in our decision making about strategic investment, but they shouldn’t dominate it.

Resources: capability and availability
In addition to the criteria already discussed, we will need to evaluate other aspects of our existing capabilities – and in the context of the external and competitor landscape. Considerations such as the degree and nature of existing collaboration; the depth and strength of disciplinary and research leadership; and the overall staff profile will be important for benchmarking our current position and to understand the potential requirements for and impact of new investment.

Subsequent considerations will include the likelihood of being able to attract the resources and capabilities we identify as being necessary to grow in the particular area. Can we recruit the high-quality research staff and students we think we need? And what are the opportunities for generating future external research income, such that our investment is sustainable over the long run?

The strength of our existing partnerships, and the opportunity to develop new collaborations with high-quality partners, is another crucial factor. Deep engagement with important government, industry and community partners can provide the means for translating our research into the world and help those organisations solve problems and challenges. But they can also open up new opportunities for support for basic research and the chance for researchers to work with community and industry partners to forge new paradigms and approaches in ways not possible before.

3.2 Proposed criteria for strategic investment in research

Bringing together our discussion of these three elements – research excellence, societal impact, reputational impact – we arrive at a set of criteria that should guide our decision-making process for new investment in research excellence. However, at the same time, these criteria will need to be weighted differently in relation to each of our strategic aims.

We propose that the core criteria for strategic investment should be the following (table 2):

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<th>Attribute</th>
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<td>Reputational impact</td>
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<td>potential to attract quality partners</td>
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<td>Resources</td>
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<td>expenditure required to be number one</td>
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<td>opportunity to diversify funding</td>
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Table 2. Proposed attributes and criteria for strategic investment in research
3.3 Criteria for strategic investment in disciplinary excellence

We will need to identify those disciplines in which we have the greatest opportunity and capacity to achieve national and/or global pre-eminence, as well as having positive multiplier effects on our other disciplinary and multidisciplinary capabilities across the University.

Breakthrough disciplinary research attracts external research funding, high citation rates (where relevant), outstanding young researchers (higher degree research students and post-doctorals) and reputational benefits to the institution as a whole. The evidence also demonstrates that the likelihood of such research is higher when there is research concentration and scale. We see this, for example, in the teams that form around our NHMRC Australia Fellows and ARC Laureate Fellows (who often are the leaders of successful Centres of Excellence proposals and other external funding sources).

We need to ensure that strategic investment in particular disciplines is also sustainable, such that we steadily and sequentially invest in a number of disciplines by identifying new and emerging strengths and not simply investing in the same areas without rigorous and regular evaluation of performance and opportunity. This is critical. It is important that we have criteria that take into account the opportunities for ongoing external funding in what is a challenging context for research funding more generally.

However, in deciding how best to invest in particular disciplines, we need to weigh the criteria that we feel are most important for achieving these aims. Thus, we need to weigh investment in disciplinary excellence strongly towards existing and potential research excellence, and the likelihood that further investment would lead to pre-eminence in the relevant fields. In particular, such decisions would need to be informed by analysis that makes clear what kind of investment is required to move us from third or fourth place nationally and/or globally, to first or second.

Ideally, investment in disciplinary excellence would also have positive spillover effects onto our ERA performance, our societal and reputational impact, and our ability to attract future funding and recruit outstanding students and staff. These additional reputational factors might not be weighted as strongly as research excellence, but should still feature in our considerations.

Other important considerations include:
- the level of scale of a discipline (for example, whether we would consider “physics” or “quantum physics”, “history” or “international history”)
- whether the disciplines also generate high student loads and thus the potential synergies between education and research, as well as help support “flagship” degrees and program
- the extent to which our investments in disciplines contribute to supporting multidisciplinary ambitions
- whether we consider clusters of disciplines, such that investments in a series of interconnected disciplines might contribute to a greater whole and genuinely innovative research. One example of this might be in the broad area of social science, which could comprise areas such as public policy, public health, political science, economics, sociology, psychology, neuroscience and business, encompassing both quantitative and qualitative methodologies
- the types of organisational structures or changes in structure that would best enable greater disciplinary coherence and visibility; for example, as we discussed above, in relation to biomedical research that spans biochemistry, molecular biology, systems biology etc. Another example of a discipline area spanning multiple administrative units is data science; here there are groups in computer science, mathematics, economics and the Business School all working, from different perspectives and technical capabilities, on similar types of data problems.

17 The disciplinary definitions used nationally (as per the ERA Field of Research Definitions) and internationally (as per Elsevier/Scopus or Thomson Reuters definitions) and the discipline-specific divisions considered by researchers, collaborators and prospective students. To demonstrate visible leadership in a discipline, an operational definition between each of these complementary approaches to disciplines needs to be considered.
There is no simple algorithm for our decision making here. But we should aim to agree on a set of clear criteria, weightings and transparent processes to guide our considerations. In table 2.1 (marked in bold), we propose criteria we feel are most relevant for investment in disciplinary excellence.

**Proposition 1**  
**Criteria for strategic investment in research**  
That the University adopt the proposed criteria for strategic investment in research.

**Proposition 2**  
**Criteria and weightings for investment in disciplinary excellence**  
That the University develop a detailed and agreed process to select a small number of disciplines and cross-disciplinary areas for additional investment.

How might this investment occur? We propose consideration be given to creating a new strategic fund for research excellence, to be used for the purposes of achieving the aims outlined above and informed by the criteria we are developing. This may take the form of funding new teaching and research positions, international PhD scholarships, infrastructure, or innovative modes of community and industry engagement.

Sustainability would also be a key factor. We would need to ensure any new posts, for example, were sustainable beyond a period of central funding, and were focused as much on attracting younger and mid-career academics as senior colleagues.

The key questions for strategic investment would thus be: Given our agreed strategic criteria, what would enable your discipline(s) to become genuinely pre-eminent in Australia and beyond? And how would this benefit the University more broadly?

Of course, it’s also important to continue investing in supporting and developing outstanding researchers already at the University. We propose developing new initiatives that enable our outstanding younger and mid-career researchers in particular to receive the support they need to pursue the highest quality research. This could include opportunities for further professional development, research “incubator” support, targeted teaching relief and equipment and infrastructure. Details of these initiatives will be provided in our second paper, “Building a culture of research excellence”.

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Table 2.1. Proposed weighted criteria (blue) for determining strategic investments in disciplines.
Proposition 3

New investment in disciplinary excellence

That the University establish a strategic fund for investment in research excellence, focused on enabling disciplines, in accordance with our agreed criteria, to become nationally and globally pre-eminent in their fields and support the aims of our research strategy more generally.

This proposal would, in turn, sit alongside other new initiatives to help develop and support outstanding researchers already at Sydney.

How would decisions be made about investment in disciplinary excellence? Faculties, schools and even cross-cutting clusters of disciplines, working closely with the Research portfolio, would have the opportunity to work together to develop a detailed strategic case for investment – informed by the analysis and criteria proposed above. The final decisions would be subject to approval by the Senior Executive Group (SEG).

3.4 Investing in multidisciplinary excellence

The 2011-15 Strategic Plan inaugurated a strategic shift for the University towards a small number of large-scale, collaborative, multidisciplinary centres that aimed to take advantage of both our breadth and concentrated expertise to tackle issues of national and global concern. These initiatives focus on addressing important societal problems, but also deliver greater academic visibility and impact for our work. We need to build on this important development for the University in the next Strategic Plan.

Large-scale collaboration aimed at problems of high social impact have also begun to attract additional sources of funding as governments, industry and philanthropists are motivated to invest in programs of work designed to solve large and complex problems (for example, from the NSW government for translational cancer research; from Rio Tinto and Qantas for innovation in autonomous systems; and the Bushell Foundation for research in areas ranging from medicine to agriculture).

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Table 2.2. Proposed weighted criteria (blue) for determining strategic investments in multidisciplinary activities.
Our next strategy must continue to develop and implement these initiatives, along with the means to support them. And even though the early signs are positive, it will be vital to monitor and review their performance to ensure they are delivering the research outcomes upon which our investment was premised. As we contemplate additional areas of focus, including the continuing implementation of the recommendations of the Health and Medical Strategic Research Review, we will need to determine how many such new initiatives make sense for the University and can be delivered and managed successfully over time.

Ultimately, we want to frame a distinct, clearly articulated set of high-level areas of focus for the University of Sydney. These will encompass, in the first instance, those we already have – the pressing health challenges of our time (diabetes, obesity and cardiovascular disease); understanding and engaging our region (China and Southeast Asia); and nanoscience – as well as those we develop additionally through this strategy.

We propose that the set of basic criteria described in table 2.2 are appropriate for consideration of investment in new problem-focused, multidisciplinary activities. However, the weightings applied to each of the elements will differ from investment in disciplinary excellence, with greatest emphasis on societal impact and possibilities for engagement, among other factors. This doesn’t mean existing or emergent research excellence isn’t important, just that it is not as dominant as in the case of disciplinary excellence.

While undoubtedly still focusing on people, the kinds of potential investments in these initiatives may also be more multifaceted and at larger scales. Thus it will be even more critical to consider investments holistically and in alignment with the other University initiatives, including the decadal plan for research infrastructure and also leveraging the valuable lessons learned through the implementation of the Health and Medical Research Strategic Review.

Here too there will be complexities and nuances that need to be considered. For example:

- To what extent should additional investments in such large scale multidisciplinary activities be complementary and aligned with the existing centres and institutes, such that we effectively leverage a greater amount of the University’s capability?
- To what extent should there be collaborations already?
- What sort of time frame should we consider for the development and establishment of new initiatives?
- How much should we consider the educational opportunities in making a determination?
- What is the right number of such large-scale multidisciplinary activities?

Proposition 4
Criteria and weightings for multidisciplinary initiatives

Applying our agreed criteria, that we call for expressions of interest for the next set of multidisciplinary initiatives aimed at tackling national and global challenges in which the University would make additional strategic investments over the life of our Strategic Plan.
4 Conclusion

In this paper we have proposed a new way of thinking about how we should invest for research excellence at the University of Sydney. Although we can take pride in the achievements of our researchers over the past five years, we cannot afford to be complacent about the future.

Our aim is to conduct research of the highest quality that serves the public good. In order to realise our aspirations, we need a renewed investment in our research activities to build a culture of excellence befitting our ambition to be the leading university in Australia and the region. With excellence comes opportunity:

− to do truly innovative work as we deepen and push our disciplinary expertise in new directions
− to recruit outstanding students and staff
− to attract new resources to support our work
− to lift our national and global reputation that creates new ways for us to help shape public debate and improve people’s lives.

4.1 Your contribution

We encourage you to take the time to consider the important proposals within this discussion paper, engage in the strategic discussion about them and contribute your feedback.

If you would like to respond to the propositions set out in this discussion paper, please do so by 7 August via the online form available through sydney.edu.au/strategy

Should you require further time to submit feedback, please inform us via university.strategy@sydney.edu.au

In addition to a written submission, there are many other ways to contribute your thoughts and ideas on these proposals. The University will also facilitate focus groups with staff and students. We welcome your participation and will invite you to these events as they are scheduled.

4.2 Complete list of proposals for discussion

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Contact us
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