White Paper: Challenge-Led Interdisciplinary Research Programs

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Abbreviations

ARC  Australian Research Council
DVC  Deputy Vice-Chancellor
ECR  Early Career Researcher
EMCR  Early / Mid-Career Research
FoR  Fields of Research
GCEC  Global Challenges Executive Committee
GCP  Global Challenges Program
GCPE  Global Challenges Program Evaluation
NHMRC  National Health and Medical Research Council
RSL  Research Strategy Leader
SME  Small Medium Enterprises
SMIG  Southern Manufacturing Innovation Group
UOW  University of Wollongong
Executive Summary

This white paper reports on challenge-led research programs as an innovative response to the need for a new approach to building interdisciplinary capacity. The context is the need to manage and fund research differently in order to harness expertise across multiple specialities.

Signals across the higher education sector increasingly point towards the need for such an approach—exemplified in the most recent revisions to Australia's national strategic research priorities, which have been framed around a small number of key 'practical research challenges'.

In this white paper, we contribute insights from an early experiment along such lines, conducted at the scale of an entire university.

Since 2013, the University of Wollongong (UOW) has invested in a major new strategic research program, Global Challenges: Transforming Lives and Regions\(^1\), which brings researchers together in novel combinations so as to develop ambitious projects that respond to identified research needs.

The Global Challenges Program (GCP) aims to foster ideas and frontier research from within specialist disciplines, but also address significant global problems in collaboration across fields of knowledge, and between researchers, communities and external organisations.

Truly transformative interdisciplinary research can be complex and difficult, but through substantive investment (underpinned by stable institutions) the desire to find a new approach can successfully align with a shared commitment to research excellence and passion to address major global challenges.

We have identified key features that contributed to a degree of success in this case:

- **Stable institutions** – researchers are prepared to embrace challenge-led projects where underlying employment conditions, basic research, funding mechanisms and institutional structures are stable and not threatened by short-term funding cycles and crises;
- **People and projects** – challenge-led research must engage with researchers and fund talented people to develop projects and partnerships;
- **Developing research leadership** – challenge-led research encourages identification of and investment in the next generation of research leaders;
- **Research excellence** – challenge-led research must ensure the research has both scholarly outcomes and real-world impacts;
- **Interdisciplinarity** – the 'magic happens' when truly novel combinations of researchers are brought together on projects;
- **Taking risks** – challenge-led programs should in the first instance encourage and fund riskier projects and teams who have never collaborated together before. Such nascent projects are critical to developing trust and collaboration across fields of research that yield later downstream results.

\(^1\) [http://globalchallenges.uow.edu.au](http://globalchallenges.uow.edu.au)
1. Nature of the Problem

In a world where specialist research reigns, what are we missing?

We are missing answers to the more profound questions (we may not even be asking the right ones); we are missing the channels of communication and debate between disciplines; we are eroding the impetus to collaborate in favour of the impetus to compile individual publications, citations and rewards. We are at risk of appearing aloof to funding agencies and taxpayers. Most of all we are failing to find solutions.

As research has evolved and the breadth and depth of knowledge has grown, the forefront of discovery has become increasingly specialised. Concurrently, the role of the generalist expert is less prevalent, and some would argue less valued, in the research sector. Gone are the times where one might be merely termed a ‘scientist’, or even known by a broad discipline heading such as a ‘biologist’. The identities and practices that researchers shape for themselves are often much more specialist, perhaps investigating a particular genetic aspect of an individual disease.

This foregrounding of deep specialisation is mirrored in funding bodies and universities that group researchers in like-minded disciplines together. Such structures develop deep teaching and research expertise that contribute to specific disciplines and makes good organisational sense for knowledge and resource sharing. Specialists focusing inwards on fine-grained research are constantly making great strides in knowledge at universities—indeed, their work is the core of what makes universities unique and irreplaceable.

However, structures are not perfect. The specialist focus of leading researchers has resulted in high barriers to entry for new researchers and also large opportunity costs for those not continuously narrowing down specialisations.

Beyond academic institutions, the challenges society is facing are increasingly complex and multifaceted. For example, earth systems scientists have developed sophisticated means to track atmospheric climate change, but the challenge of reacting to that change is equally political, social and economic. Our carbon-based economy needs massive reform, and that in turn will need philosophers and economists in conversation; accountants and lawyers to work out ways to track carbon credits and overcome regulatory hurdles; engineering, information technology, design as well as new materials to manipulate and create new technologies, and social scientists to analyse patterns of community vulnerability and adaptability.

The challenge-led approach discussed here proposes a new opportunity to bring together these diverse groups of specialists, stretching beyond disciplines towards a shared challenge. In this sometimes uncomfortable new space are new horizons of possibility and opportunity.

The true value of interdisciplinary research cannot be easily predicted; nor can effective research teams be easily conjured. The magic happens when unlikely collaborators find a shared focus for their passions and are supported by stable institutions and programs willing to take risks.

In the discussion that follows, we offer a reflection on two years of activity: a narrative describing the process of bringing researchers together, funding new projects and witnessing innovation unfold, aimed at opening discussion and debate about the prospects for challenge-led interdisciplinary research.

We identify key factors that have led to strong outcomes in the GCP at UOW (and the obstacles overcome) in the hope that our results can contribute to the conversation around and provide insights to building challenge-led interdisciplinary research initiatives.
2. The Research Landscape

A vanguard of Australian, British and American universities and research agencies are reorganising their efforts toward challenge-led (or "problem-led") research: a relatively new way of bringing together the disciplinary expertise needed to solve complex problems.

Examples of this include the research supported through the Bill and Melinda Gates Foundation\(^2\), University College London Grand Challenges\(^3\), Warwick University Global Research Priorities\(^4\), Delft University of Technology Research Initiatives Program\(^5\) and Princeton's Grand Challenges\(^6\). These programs work to bring researchers together under a common goal in order to address specific research issues.

Following the European Union’s lead, the Australian Federal Government in its report *Boosting Commercial Returns from Research* (2014) has signalled that challenge-led research will be increasingly important: "The Government is in a position to develop national research priorities and, for each priority, corresponding practical challenges to provide assurance that public research is addressing the most important questions for the nation".

Subsequently, Prof. Ian Chubb, in early 2015 led a process developing a new set of nine Science and Research Priorities, for each of which there are now three to four identified Practical Research Challenges, mapped against national capacity.

Much of the language surrounding the new Science and Research Priorities and Practical Research Challenges mirrors that of challenge-led schemes in Europe, North America and elsewhere. The identified challenges "will ensure that appropriate levels of public funding are allocated to research that addresses the most immediate problems facing the nation.

They are neither exclusive, nor are they exhaustive. Addressing the priorities and Practical Research Challenges will require effort from across the full spectrum of research disciplines" (Australian Government 2015, p. 1).

Given that challenge-led research is therefore likely to be increasingly prominent in Australia, it is timely to assess examples of where, and how, challenge-led research has flourished – and the factors that have been important.

2.1 Interdisciplinary Research: Tackling Global Challenges

Discussions of the need for, and the benefits of interdisciplinary research are not new (Grigg, 1999; Bammer 2012). Complex "wicked" problems cannot be solved by one discipline in isolation. Experts from diverse disciplines need to come together and work collaboratively in a whole-of-problem approach to help addresses societal challenges.

Instinctively researchers know that this is needed. However, it appears disparate to the way universities and governments largely reward and recognise high quality research. Bringing researchers together in a complex landscape fraught with challenges is high risk and can often fail. Nevertheless, when it works well, the rewards in terms of both funding scholarly and ‘real world’ outcomes can be substantial.

Discussion of the need for and benefits of interdisciplinary research often centres around two questions: *how do we define it; and how do we measure it?* In light of this problem, we must be cautious in approaching definitions of interdisciplinarity, especially as it pertains to challenge-led research.

Summarising previous discussions on how to build, conduct and describe research across more than one discipline would fill many volumes.
Among the varied buzzwords adopted by universities, funding agencies and government administrators are interdisciplinary, multidisciplinary, trans-disciplinary and post-disciplinary research (Bammer, 2013; Coles, Hall et al. 2006; Frodeman et al. 2010). None of these perfectly define interdependent research efforts across disciplines, nor eloquently counterbalance specialism with generality – though all certainly capture the zeitgeist.

One of the working definitions comes from the US National Science Foundation (NSF):  
"a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice." (Committee on Facilitating Interdisciplinary Research, 2004)

It is in applying a broad definition like this in practice—such as criteria around funding programs—that difficulties arise. For example in the Australian context, an interdisciplinary project could satisfy the above definition with reference to Australia’s formal Field of Research (FoR) codes (Australian Bureau of Statistics, 2008). However, with multiple FoR codes overlapping across high-level knowledge groups, too much scope exists for projects to be made to appear interdisciplinary when they have brought together researchers of similar epistemic persuasion.

Chemists, material scientists and environmental engineers frequently work together on single projects—as do human geographers, planners and demographers. In both cases the teams would qualify as ‘interdisciplinary’ if FoR codes were used as a proxy measure, but in neither case would the researchers concerned have to radically step outside their domains.

2.2 A Question of Measurement?

As research has become more specialised, so too have the measures used to gauge success. Funding agencies often struggle with the extra challenges of evaluating interdisciplinary research proposals (Frodeman, 2009; Lyall, Tait et al. 2011 and Mutz, Bornmann et al. 2015).

Correspondingly lower success rates for such proposals fuels a feedback loop that encourages researchers to stay safely within discipline boundaries (and the structures that support and insulate them).

So the overwhelming majority of the drivers in the systems remain set up to reward disciplinary expertise, and this system preserves a great deal of inertia. Dismantling it would be difficult if not impossible—and ultimately unwise, given the valuable specialist research it supports. Rather, it is important for the researchers involved in high quality interdisciplinary research to contribute back to their specific discipline areas and thus be captured in existing metrics and reporting.

Case Study: Protecting Oceans

Precarious: that was the overwhelming feeling of the Leader of Sustaining Coastal and Marine zones, Professor Clive Schofield when he visited Tarawa in Kiribati. It was a feeling that was particularly strong when he was standing on a causeway with ocean lapping either side of him and barely a scrap of land westwards to mainland Asia and eastwards to the Americas. “Pacific countries tend to be termed ‘small island states’ with the focus squarely on their limited territorial dimensions and problems associated with this and viewed from the perspective of Kiribati this is entirely understandable. That said, they are simultaneously ‘large ocean states’ with enormous maritime opportunities.” he said.

The desire of the Kiribati Fisheries project is to assist in delivering enhanced oceans governance and to help realise such opportunities. Managing this marine asset, and particularly its fisheries, which are key to life and identity in Kiribati, is a complex and ongoing challenge. It is also the focus of many conservation and development projects that GCP supports and represents a huge yet hugely worthwhile challenge.

Photo: Quentin Hanich

globalchallenges.uow.edu.au/sustaining/
UOW196573
3. Interdisciplinary Research Models

An initial wave of debate around interdisciplinary research in the 1990s delivered only modest successes. Two decades later, universities around the world (and increasingly government agencies) have embraced a new approach to framing research priorities in response to complex social, environmental or economic problems: “problem-led” or “challenge-led” research.

Interdisciplinary research is a necessary consequence of framing wicked problems. Often the problem is not convincing researchers to contemplate interdisciplinary research projects, but to find ways to integrate interdisciplinary projects onto existing proclivities and motivations, and to cultivate interdisciplinary engagement in a grass-roots, researcher-led fashion.

There have been various attempts to organise interdisciplinary research with varying levels of complexity, uptake and productivity.

3.1 Umbrella Approach

An umbrella approach occurs when a university or research organisation maps their existing research expertise under a common area or theme, and subsequently rebrands a grouping of collected researchers/projects in line with a stated societal goal. Existing research/projects are effectively white-labelled with the overarching goal. There is often no significant funding attached to this rebranding, or new research endeavours undertaken.

While under the umbrella, researchers from a number of disciplines contribute research to address the overarching goal, most often in isolation and in parallel within separate disciplines.

This approach stems from understandable desire to clearly and concisely package what is otherwise hugely diverse research, and to help market research or associated fundraising campaigns. This model, then, is more accurately described as a virtual coalition of single disciplinary teams. While expedient, this does not produce the kinds of truly synthetic research required to respond to major challenges: research outcomes that are greater than the sum of parts remain out of reach.

3.2 Organisational Restructure

Another approach is to realign research structures away from disciplinary specialisms into interdisciplinary groupings. An example of this approach was the formation of the Flagships at the CSIRO in 2003 (Australia National Audit Office, 2011). As part of this model, an entire workforce can be reorganised, with a change in line management responsibility of staff. New groupings and physical relocations effectively force researchers to work together. This model seemingly provides much more capacity than the umbrella approach to cultivate genuine interdisciplinary engagement. As the CSIRO case attests, it also potentially enables the identification of clear and ambitious goals for what will constitute success within a given timeframe.

One of the issues with this approach is that it structurally mimics the single-discipline ‘silos’ it is replacing. Over time it risks inheriting the weaknesses of the disciplinary structure (isolationism and non-cooperative positioning) while fragmenting and disrupting its greatest strength (deep expertise).

Moreover, in the university setting, where academic freedom is the core currency and lifeblood, researchers would rightly resist attempts to have their research agendas dictated to them from such institutional rearrangements. This academic freedom and institutional stability is a fundamental pre-condition of productive research from which more radical (interdisciplinary) challenge-led initiatives may spring.
MODELS

3.3 Interdisciplinary Research Institutes

In what could be described as a hybrid model, some universities maintain their discipline aligned faculty structure, and also create dedicated interdisciplinary research institutes. The research institute may have line management responsibility of staff, or it may be a coalescence of researchers from an array of home faculties that move in and out of the institutes as required. Notable successful models around Australia include RMIT’s Centre for Global Research and University of Sydney’s Charles Perkins Centre. Recently, the Vice-Chancellor of UNSW has indicated a likely move for that university in this direction. The degree of interdisciplinarity varies from institute to institute and we are interested here particularly in those groupings that bring together researchers without a ‘natural fit’ and who do not typically work together.

Advantages of this model are that it can bring researchers from different disciplines to work together daily, sharing responsibilities and meetings in an atmosphere of collegiality within a physical institute or building.

Critical in this model—and for any truly successful model of interdisciplinary research—is to demonstrate support and investment from the highest level of the university, and for a sense of ‘ownership’ to be cultivated across the entire institution. It is difficult to achieve these by establishing specific institutes to handle only some aspects of research. The risk is that, like with a whole of organisation restructure, developing individual interdisciplinary research centres and departments may over time compartmentalise interdisciplinary research, absolving the general university community from engaging more deeply beyond their specific disciplinary bases.

Case Study: Making Connections for Manufacturing Innovation

In addressing the barriers to collaboration between UOW and small and medium sized enterprises (SMEs), the GCP and the UOW’s Innovation and Commercial Research Unit have established the Southern Manufacturing Innovation Group (SMIG). The SMIG focuses on connecting researchers and businesses. SMIG members are all local SMEs involved in advanced manufacturing, and demonstrate real innovation in areas such as improving productivity, product development, novel management and marketing practices, and export successes.

As the conversation with SMIG members develops and potential areas of research collaboration emerge, a critical issue will be to match manufacturers with researchers. The GCP is uniquely positioned to assist in this ‘brokering’ role; a major benefit of the GCP is the knowledge generated about ‘who does what’ across the university, which is particularly important as areas of research expertise and interest are constantly evolving. The GCP leadership team spend a considerable amount of time in building and maintaining networks and databases of research activity. An additional benefit of this knowledge is the ability to connect researchers with each other and to external agencies – including the manufacturers in SMIG. Innovation often about ‘connecting the dots’, and the GCP is pivotal in this role.

[globalchallenges.uow.edu.au/manufacturing-innovation/UOW191273.html]
4. A Way Forward

The changing research landscape presents two problems: how society and academia frames problems (and hence research activity); and how we organise and bring together highly specialised researchers in interdisciplinary research.

By refocusing efforts onto wicked problems (against which we can measure incremental progress), we eliminate the rivalry implicit in arguments about how to organise and fund both single-discipline specialism and interdisciplinary collaboration—both efforts become valuable and interdependent in the shadow of a sufficiently complex problem. Challenge-led interdisciplinary research will remain fundamentally applied, and will continue to rely on successful blue-sky funding schema to provide fundamental insights and skilled specialist researchers.

With its GCP, UOW is at the forefront of Australian universities in implementing a challenge-led interdisciplinary research program. Here we look back over two years, on our mission, implementation strategy and lessons learned over the journey thus far.

Case Study: Dragging the Chain

When cycling to work, Leader of the Sustaining Coastal and Marine Zones challenge, Professor Clive Schofield regularly catches a glimpse of multiple large cargo ships that lie off our coast. Such ships of course are fundamental to our economy, given that over 99 per cent of our trade by volume is carried by sea, supporting an industry worth $200 billion annually.

Little did he think that he would become involved in a GCP project that brings together marine biologists, ports and logistics specialists, and legal scholars devoted to examining the impacts of anchors and anchor chains on the local marine environment, and looking at pathways towards designing sustainable anchoring practices.

The Dragging the Chain project aims to discover more about the impact on the marine environment where anchoring occurs, how ships impact upon the ocean floor, and to investigate the impacts of these activities on the environment and marine life in areas where ships ride at anchor. The project has implications for coastal zones around the world.

[globalchallenges.uow.edu.au/sustaining/UOW164772.html]
5. UOW Global Challenges Program: A Case Study of an Interdisciplinary Challenge-Led Research Program

In July 2013, after an extensive period of development and university-wide engagement, UOW launched an interdisciplinary challenge-led research program: the Global Challenges Program.

The GCP was born of the belief that interdisciplinary research is vital to address the truly significant problems the world faces. The integrated nature of major challenges of environment, economy, health and society will need researchers coming together from diverse backgrounds finding ways to transfer knowledge, methodologies and insights.

Currently at the start of its third year, this program has achieved success in building interdisciplinary research at UOW. In the period July 2013 – December 2014, the GCP had 40 active projects involving more than 240 researchers. The program has invested $1.3 million and has already catalysed an additional $7.8 million in matching external funding.

What factors lay behind this success, and what lessons have been learned?

5.1 Finding a Mutual Goal

UOW took a multilayer approach to identify a small number of challenges in which researchers were interested, where there was disciplinary expertise and genuine local and global need. We consulted UOW’s researchers to identify challenges that were important and that aligned with UOW’s existing strengths—which was consistent with our philosophy of making interdisciplinary research work within, around and beside existing structures.

The consultative process was led by a university-level working party with a breadth of disciplinary expertise and representation from all levels of academia. Draft challenges were then open to the full university community for feedback and review before endorsement by the university council, for an initial period of five years. From inception to launch, identifying and developing the GCP and its specific research challenges took approximately 18 months.

Initially, six challenges were proposed:
- Energy & Environment
- Health Futures
- Digital Cultures
- Manufacturing Innovation
- Transforming Lives and Regions
- Infrastructure

Through the course of debate and deliberations, it became clear that Transforming Lives and Regions captured the sentiment of the entire program and was therefore elevated to form an ‘overarching’ objective. After substantive input from across the research community, the remaining themes were revised to focus on three challenges:
- Living Well, Longer
- Manufacturing Innovation
- Sustaining Coastal and Marine Zones.

The challenges evolved through a balance between two conflicting desires: to include as many productive research disciplines as possible; and to keep the challenges focussed and meaningful. We operate in a region with a strong manufacturing heritage, in a delicate coastal zone and with an aging population. Ultimately, the challenges that emerged are globally significant problems, but all have a specific relevance to our region.

The time and effort devoted to developing meaningful challenges has paid off; they have greatly helped make progress towards GCP’s goals:
- Generate and apply knowledge to effect transformational change, both within our region and globally
- Build UOW’s capacity and reputation as an agent for change with tangible benefits to the community.
5.2 Program Leadership and Culture

The GCP is led by a team consisting of senior academic and professional staff. The program director and each challenge leader are active Professorial (Level E) researchers, and appointment to the GCP was made through a competitive internal process. It was not only important to appoint established Level E staff with strong track records (for credibility and experience within their disciplines); but also select leaders with disposition towards openness and collaboration as demonstrated in prior research experience.

The director and challenge leaders are highly successful researchers in their respective fields, and remain very active researchers (each retaining their substantive Professorship in their ‘home’ school/faculty). Additionally, the GCP leadership team also has a full-time Research Strategy Leader (RSL), a senior professional staff appointment (Level 10) (who also holds a PhD). The RSL has prior experience establishing major research initiatives, manages the program’s operations, and guides the strategic direction of the GCP.

From the outset, the GCP leadership team established the program to operate in a way that was viewed as owned by researchers. The vision was for researchers to guide the intellectual development of a program that would find and fund good people with good ideas and make it easy to undertake research – and to refrain from dictating what preferred projects should be.

5.3 Organisational Structure and Program Governance

Institutional stability and a strong commitment to the principles of basic research have been critical. Unlike other models of research funding outside of the university sector, the bulk of researchers who engage with the GCP are employed in continuing positions within faculties and schools. Like any university, UOW has its share of research-only staff funded on ‘soft money’, and many of these are active participants in the GCP.

Researchers across UOW remain line-managed within faculties, schools and centres, and continue to undertake basic disciplinary research. Meanwhile the GCP sits apart from faculties and schools as a comparatively free-floating program, reporting directly to the DVC (Research and Innovation).

Case study: 3D Printed Microtonal Flutes

Dr Terumi Narushima and PhD student Kraig Brady were becoming increasingly frustrated in the search for instruments that could play the music they were composing using microtonal scales.

GCP Manufacturing Innovation Leader Professor Geoffrey Spinks saw an opportunity to explore the application of 3D printing, so organised a workshop with Dr Narushima and acoustic engineer Dr. Christian Ritz. “Terumi came along to the workshop and I could immediately see the value in introducing her to our 3D printing engineers”.

The project’s success has been built on the team’s interdisciplinary expertise in music theory, composition, instrument design, modelling of acoustic vibrations, and advanced manufacturing technologies. The result has been the creation of one-of-a-kind flutes that allow for composition and performance of novel forms of music using a variety of microtonal scales. The project has challenged each of the individual disciplines and success has required continuous communication across the discipline boundaries. In a very short time, this talented team has generated outstanding progress in terms of research publications, and the door is open to kick-start a niche industry in design and manufacture of customised musical instruments.

[globalchallenges.uow.edu.au/manufacturing-innovation/UOW165117.html]
OUR RESPONSE

As a consequence of this structure, the success of the GCP rests with its ability to entice researchers to extend beyond their domains. The interdisciplinary research projects that the GCP supports do not compete with disciplinary based research structures, but build on these, providing a mechanism for projects to stretch outside of their disciplinary base.

A degree of funding stability has also been important. The GCP is centrally funded, initially for five years. Funding for the GCP has not been diverted from existing faculties, schools or centres—a point that was vital to be communicated to researchers very early in the process of the program’s establishment.

In addition to the five-strong leadership team, the GCP employs a small operational team providing administrative and media/communications support. This lean organisational structure allows the majority of program funds to flow to researchers, including research support for the challenge leaders. Research assistants and staff working on GCP supported project are primarily employed through school/faculty structures with GCP funds.

The GCP is governed by an executive committee (Global Challenges Executive Committee; GCEC) that consists of the GCP leadership team, the University’s research office director (or equivalent) and an early/mid-career researcher (EMCR) representative. The GCEC composition involves a spread of disciplinary expertise and also senior researcher and research administrators who are experienced in assessing research proposals.

Institutional oversight of the program is through the DVC (Research and Innovation) and the university executive group. In addition, each challenge has an external advisory group made up of academic, policy, and government experts in the field. The chairs of these advisory groups form a program-wide group.

The GCP continually seeks feedback and consequently reviews funding opportunities and implementation. At 18 months into the Program, UOW researchers were invited to respond to the first annual GCP evaluation (GCPE), with feedback guiding improvements. This has helped us quickly identify and work to address shortfalls: for example, 56 per cent indicated they were unaware of funding opportunities relating to travel support, a weakness we are addressing with improved internal communications.

5.4 Interdisciplinary Research

All projects supported through the GCP must be interdisciplinary—defined in terms of broad fields of knowledge. After its recent restructure, UOW is arranged into five faculties (Engineering and Information Sciences; Science, Medicine and Health; Social Sciences; Law, Humanities and the Arts; and Business). A minimum of three faculties must be represented in the researcher profile on all successful projects.

This is an imperfect criterion, and it has met resistance among UOW researchers. Yet in the 2014 feedback survey, the majority (70 per cent) of GCPE respondents said this condition did not prevent them from applying for funding. Indeed, to date, this tough interdisciplinary rule has been vital to the design and implementation of the program and has been an instrumental ingredient of success.

It has helped radically break down barriers to cooperation that exist between disciplinary silos. Researchers are actively encouraged to develop teams who have never worked together before, removing a problem that typically plagues attempts to promote interdisciplinary research via traditional funding mechanisms (where a proven track record of working together is vital). Markedly, many of the funded teams involve researchers who had never met before applying for GCP funds.

As a consequence, GCP projects have a typically wider range of disciplines present—in sometimes avant-garde combinations—than might be seen on purportedly interdisciplinary projects submitted to the ARC or NHMRC.

5.5 Program Funding Schemes and Research Support

The role of GCP is not to fund a larger number of large projects for a long period of time; rather we seed risky projects, practically-engaged researchers and novel teams, and then “wean” projects off a reliance on central funding as external funds flow. The timing and “plot arc” for this are different for each project.

GCP also nurtures and funds initiatives under the guidance of the challenge leaders, sometimes driving strategic university level initiatives that require a multi-faculty response.

The GCP is also well positioned to build teams and help develop larger-scale proposals in response to external opportunities.
There are three broad types of GCP funding: research, travel and PhD support. Within each of these there are a number of specific funding programs: for example, direct research grants have three bands of value, some occur via an annual funding round, and some through rolling applications. The GCP does not provide funding for capital purchases, research already funded from other sources or the indirect costs associated with fellowships and scholarships. The key principles were established in our approach to funding:

- **Make it easy to apply** and match any approval process to the value of the funding. Wherever possible we reduce administration and make submissions/reporting ‘low-doc’. Most funding schemes have 2-page applications, online/email only submission, and streamlined approvals process.

- **Don’t fund and forget**. GCP leaders often liaise with researchers prior to them submitting an application, and where possible they assist researchers to build project and teams, through for example brokering connections into unfamiliar faculties and/or disciplines. Once funded, we stay in contact with teams to guide the project team to help deliver outcomes and grow the project.

- **Be flexible and responsive**. Where possible, funding is available on a rolling basis to allow teams to respond in a timely manner to external opportunities to leverage and grow funding.

In addition to financial support, GCP projects and teams receive mentorship and development from the leadership team of the GCP. Researchers are also supported to develop skills around the communication and promotion of their project, enhancing and building expertise of researchers to communicate across disciplinary context and to the broader community.

Where researchers have unsuccessfully applied for GCP funding, we have worked to stop them from permanently disengaging with us (effectively a dead loss that limits the future potential and diversity of the Program).

One strategy was to summarise the achievements of the program to date in a visually arresting "passport" which was widely circulated. This engagement collateral served equally as a search piece engaging new prospects, and as a focus to reopen existing lines of communication.

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**Case Study: Tackling mental illness while training the next generation of health professionals**

Dr Lorna Moxham, Professor of Mental Health Nursing at UOW and the leader of the ‘Living Well, Longer’ challenge heads up a project that connects people with a lived experience of mental illness with nursing, psychology, dietetics, and exercise physiology students from UOW.

‘Recovery Camp’ is an Australian first that specifically addresses a fundamental key to health practitioner training: “It is about learning what’s not in the textbooks and dealing with real issues, fears and dreams. It develops essential life skills not only in training to become a health practitioner but to widen our views and perspectives towards mental health in general.”

The five-day therapeutic recreation camp has been so successful that other Australian universities have approached her to implement the program. It has also put mental health firmly on the radar of policy makers, educationalists and government agencies. Given almost half of the total population will experience a mental health illness at some point in their lifetime, mental health initiatives should be a priority and should be funded accordingly,” she said.

5.6 Assessment of Proposals

Key to building a challenge-led interdisciplinary research program is how research proposals are assessed. Funded projects must:

- Convincingly argue their research genuinely addresses one of these challenges; and
- Be truly interdisciplinary.

From our experience, it is not enough to assess projects on paper alone. Team interviews are incorporated into assessment, and reveal where possible ‘gaming’ of funding rounds may be taking place. Concordantly, interviews reveal the truly passionate and enthusiastic teams with real potential for growth. More detailed assessment criteria were developed in addition to our two core principles:

- **Research Program** – The quality of the proposal is assessed, including an assessment of the contribution of each of the researchers discipline expertise and how they will interact in novel ways.
- **Outcomes and Linkages** – The project is assessed on the proposed outcomes, linkages and partnerships, as well as how the project will grow and develop.
- **Participants** – The team is assessed on not only the interdisciplinary nature of the researcher composition, but also the inclusion of ECRs and postgraduate research students. Teams that have not worked together previously are supported.
- **Leadership/Mentoring** – Teams are assessed on leadership, with ECR leaders encouraged. Teams are also assessed on the ability of the project to build research capacity within the team and more broadly at UOW.

Assessment criteria and mechanisms, while not always onerous, must be rigorous so as to attract high quality interdisciplinary research. As with the application process, the assessment mechanisms were designed to correspond to the level of funding; for smaller travel or strategic grants, the relevant challenge leader makes the funding decisions.

Often a good mechanism to assess a team is to give them support and a small amount of funding and see what outcomes they can generate, putting the Program’s funding and assessment mechanisms into a continuous dialectic.

This enables GCP to support unproven teams and unconventional projects without unnecessarily pushing our (admittedly high) risk threshold.

Assessment for the annual seed funding round and larger project funding grants ($50k p.a., up to 3 years) is conducted by the GCEC. The GCEC then makes funding recommendations to the DVC (Research and Innovation), who has final approval over larger-scale projects.

Additionally, for projects that grow and progress through funding levels, they are accountable for achieving outcomes from any previous funding, ensuring publications and other expected research outcomes such as grant applications are delivered.

5.7 Developing the Next Generation of Research Leaders

A key objective of the GCP is to identify and mentor ECRs. Interdisciplinary projects can be a way for ECRs to step out of the shadows of more senior researchers.

In practice, as the GCP evolves, key researchers who have led projects are typically energetic ECRs, who as a consequence of working across faculties, and the publicity that accompanies GCP projects, become more highly visible. UOW has therefore benefited in terms of identifying future research leadership talent, while the ECRs concerned benefit from not only access to research income and enhanced traditional measures (grants, publications, citations, publicity), but the ability to highlight GCP project leadership in their individual applications for academic promotion to the next level of appointment in the university.

The GCP leadership team support ECR career development in their projects through close support and mentorship. ECRs receive specific advice on publishing strategies, funding strategies and how to build research teams and projects that are successful against well-accepted metrics.

The GCP has developed a program to attract and retain the highest quality PhD students through a PhD scholars program, a generous top-up offered to six of the best PhD applicants commencing each year.
The PhD scholars program adds an additional $10k p.a. on the candidate’s underlying competitive scholarship, combined with an annual research support budget for conference travel, field work and/or lab costs support ($5k p.a.). The PhD scholars program complements their discipline-based PhD research, but provides a mechanism for postgraduates to engage in interdisciplinary teams and build networks across the university (we host PhD Scholars mentoring sessions, workshops, lunches and get-togethers). These PhD scholars are also invited to key events hosted by the GCP to encourage networking opportunities.

Additionally, all of our interdisciplinary teams are strongly encouraged to include postgraduate students as chief investigators on their project applications, and this is captured in the assessment criteria. This cements the importance of looking outside disciplinary boundaries in the training of postgraduate students.

5.8 Measuring Success

At GCP it was understood from the outset that we had to balance assessing the success of our program, with the knowledge that any measure we put in place may drive behaviours. Based on many discussions among the GCP leaders, we now measure success against five KPIs, which are colloquially called the ‘five Ps’:

- **People** (engagement, involvement, participation)
- **Projects**
- **Publications and external funding**
- **Partnerships** (with external organisations and with researchers from other universities nationally and globally)
- **Promotion and reputation** (traditional and social media activity).

Data informing these five Ps is captured by a combination of quantitative and qualitative measures. For the quantitative our preference is to use data that is already captured within the university setting. Where appropriate we have worked within existing data capture systems to incorporate global challenges tags into metadata. This approach has also enabled funding allocations, and scholarly outcomes to be accessible and reportable within existing reporting structures, which add a layer of transparency to our program. Beyond quantifiable outcomes, the true impact of the program is captured in the stories of individual researchers or projects that have grown and developed within the GCP.

Case Study: How Can We Help People Live Well, Longer?

Australia has an ageing population—a quarter of the population is 55 and over and in the next 50 years this will rise to one third of the population. The "Enabilise" project examines key challenges and constraints experienced by those currently using mobility aids. In identifying manufacturing opportunities in the area of assistive technology (and importantly, guided by those using such technologies daily) the project aims to help improve quality of life by enhancing independence.

Professor Lorna Moxham, leader of the ‘Living Well, Longer’ challenge says she likes to be around passionate people; “Watching a group of researchers talk about solving problems is invigorating, especially when the problem they are working on has its genesis from end users or is grass roots driven.”

Professor Moxham believes a challenge-led approach that brings a group of researchers together from radically different disciplines, brings an edginess and energy to the discussion. “This stimulating collision of disparate realities with a desire to help people Live Well, Longer is why interdisciplinary research can really help make a difference.”

Enabilise is a truly collaborative research project, providing a forum for the region’s businesses and manufacturers to innovate solutions that meet real needs that can positively impact Australia’s aging population.

UOW Global Challenges: Key Insights

We have identified a number of key factors that have been crucial in the success of the GCP.

At the core these related to the way the program was established within the University, sitting outside of existing organisational structures whilst having support from the senior executive.

Having a separate funding pool and autonomy to allocate these funds in line with the principle that we established for the program, funding good people and projects and allowing them to take risks.

The establishment of the GCP, developing a new way of doing research at UOW was not without its difficulties. GCP was launched concurrently with a full faculty restructure of the university.

As such there was a heightened level of change that had both positive and negative impacts on the implementation of the program. As outlined in Table 2, one of the key challenges was the process of communicating to researchers about the program, engaging with them on the different ways we were approaching research, and gaining the trust of researchers.

Program Leadership and Culture

- The leadership team is composed of highly respected successful researchers drawn from a breadth of faculties, that can assist in overcoming school/faculty/research institute impediments to engaging in interdisciplinary research. The leadership team also plays a vital role in identifying and introducing researchers from across disciplines.
- The leadership team is also essential in identifying, assessing and building interdisciplinary projects, but also ensuring the teams produce world-class scholarly outcomes and real-world impacts.
- Building teams is not always easy. Often researchers are deeply connected with other researchers in their school, and have awareness at a faculty level, but when moving beyond that, simply do not know who the key people are and how to reach out to them. Challenge leaders have needed to adopt a facilitation role, acting as a ‘matchmaking service’, leveraging their knowledge of researchers in their home facilities to help build and grow teams.

Organisational Structure and Program Governance

- The project was the brainchild of, and retains strong support from, the senior executive of the university.
- Institutional stability is vital, with researchers’ employment not conditional or dependent upon GCP participation or funding.
- Important to GCP success was establishing a separate funding pool that can be leveraged with additional internal and external funding, but that is not sourced from schools/faculties/research institutes.
- GCP has not assumed line management responsibility for researchers who participate in the program. Thus there is no obligation for researchers to engage in interdisciplinary research, but there are attraction/benefits for them in so doing. Although this presents challenges, it enables the GCP to harness the passion and curiosity of researchers, which ultimately produces more creative and impactful research outcomes (‘carrots’ rather than ‘sticks’).
- Sitting outside of individual schools/faculties/research institutes has resulted in a smaller operational team to facilitate the research program. Essential to success, the core team needs to be well-connected and able to clear traditional administrative impediments to interdisciplinary research. For example collecting signatures, assessing and approving funding, spending funds across accounts, reporting across school/faculty/research institute boundaries.
- Governance from an executive committee and international advisory group for each challenge ensures the quality of and overall direction the challenges and the GCP.
- The GCP has only a small physical location, but critical is a neutral space for teams to meet and workshop ideas outside of the physical jurisdiction of any individual school/faculty/research institute.
Communication

- Messaging is essential. At the onset there was a perception about what the program was or wasn’t offering. It was important to refine the messaging of what our goals were under the program and each of the challenges so that we were attracting research projects and teams that were a good fit for the program. As the program enters its third year, the quality of applications has improved as more and more teams ‘get’ the logic and intentions of the program.
- There was some scepticism around the program. Some researchers decided that the GCP was not for them, either from the outset, or after an unsuccessful funding application. It is very hard to then re-engage with those researchers. High profile, well designed communications collateral helped promote the wins of the program and encouraged researchers to re-engage with us.
- Communication to an internal audience was a greater challenge than expected. For example of the GCPE respondents, 56 percent indicated they were unaware of funding opportunities relating to travel support.

Funding Schemes and Research Support

- To foster institutional level change, a long-term vision is required. Often interdisciplinary projects are initially higher risk, involving funding teams to work together for the first time. These can take a longer time to show a return on investment.
- Appropriate funding levels remain a challenge. Initially (in the program’s first 6 months) only a relatively small band of funding ($15K per project) was available via seed grants. A decision was made that it was important to allocate research funds while we were still developing the full suite of the funding offerings to engage researchers in the program.
- When allocating larger funds on a multi-year basis, it has been important to balance funding stability and program growth. Challenge leaders work with teams to identify other funding sources, applying for external grants or working with industry.

Assessment of Proposals

- Ensure that assessment criteria support the funding of the right projects. There is a balancing act between being flexible and open to being gamed. The leaders and executive committee of the GCP have been empowered to use their judgment around the assessment of whether a project is truly interdisciplinary and addresses one of the challenges. Importantly however, the process has been iterative, and unsuccessful teams that are committed to their projects are given support and the opportunity to further develop their proposal and come back, often in an open rolling timeframe.

Developing Interdisciplinary Culture, the Next Generation of Research Leaders

- Buy-in is needed from the school and faculty executive. They need to support engagement (or at least not hinder) their researchers undertaking interdisciplinary research.
- Even with buy-in from university executive, schools/faculties can hamper engagement. To circumvent roadblocks, both a bottom-up and top-down strategy was used. Once researchers were engaged and advocating for the benefits of the program, along with the university and faculty executive support, the school/faculty level management were more engaged and encouraging of active participation from their areas.
- We take risks on teams and projects knowing that some will fail, and that successes will return on their investment handsomely.
- Building teams is not always easy. Often researchers are deeply connected with other researchers in their school, and have awareness at a faculty level, but when moving beyond that, simply do not know who the key people are and how to reach out to them. Challenge leaders have needed to adopt a facilitation role, acting as a ‘matchmaking service’, leveraging their knowledge of researchers in their home facilities to help build and grow teams.
6. Conclusion: Redefining Success

At GCP we have developed an interdisciplinary focus combined with trust, academic freedom and ongoing support. This combination gives researchers greater flexibility to explore new ideas, to work on projects that do not already have their outcomes determined and that simply might not otherwise be funded.

By definition there are in GCP many riskier ventures, and projects do not always map neatly into a highly metric-driven management culture. But while this is precisely the point—to catalyse innovation rather than encourage clever ‘gaming’—the reality is that any funding, whether from internal or external sources, must have some measures around its effectiveness in achieving outcomes.

One of the biggest indicators of success is also one of the biggest hurdles—can projects secure funding from centralised government funding agencies such as the ARC and NHMRC in Australia? A few years into the GCP, it appears that projects are indeed able to achieve high-level scholarly outcomes within and across disciplines. One of the biggest challenges to be faced is how to develop projects once they have outgrown the level of available internal funding.

The ARC/NHMRC have programs directed at funding large multimillion dollar interdisciplinary research endeavours, through initiatives such as Centres of Excellence, Industrial Transformation Research Program or the Cooperative Research Centres. Yet such initiatives are much larger than those with which most budding researchers engage. The existing funding schemes for Discovery and Linkage projects continue to be assessed by discipline-focused Colleges of Experts, in a structure that results in self-identified interdisciplinary projects having extremely low success rates.

There is great potential for challenge-led research in Australia, and enormous willingness among researchers to team up with peers across unfamiliar fields of knowledge to address major societal challenges.

However, as with the broader landscape of research funding in Australia, the real challenge remains to find pathways from small successes towards larger scale, challenge-led research outcomes against the backdrop of inherited structures and research categories.
References


Global Challenges Program Leaders

**Professor Chris Gibson**

Professor Chris Gibson is the inaugural Director of the UOW Global Challenges Program. He joined UOW in 2005 after holding academic positions at the University of New South Wales and the University of Sydney. With Professor Lesley Head, Chris established the Australian Centre for Cultural Environmental Research (AUSCCER). From 2005 to 2010, Professor Gibson led Australia’s largest ever study of the contribution of festivals and events to regional development, covering 480 festivals over three states. From 2010 to 2013 he was an inaugural ARC Future Fellow, and in 2013 was an international expert contributor to the UN Creative Economy Report. He is currently editor of the academic journal, Australian Geographer.

Chris is a member of the Australian Council of Learned Academies (ACOLa) Expert Working Group: Securing Australia’s Future - Australia’s Comparative Advantage. He is also a member of the Chief Scientist’s expert working group tasked with revising National Science and Research Priorities, and undertaking national capability mapping for Environmental Change.

**Dr Tamantha Stutchbury**

Dr Tamantha Stutchbury, Research Strategy Leader, has extensive experience launching and running programs in the Higher Education sector. Prior to joining the leadership team of the Global Challenges Program, Tamantha worked as a Senior Innovation Development Manager leading innovative projects to develop the University’s engagement with industry and the wider community. Tamantha has also worked in IP management and commercialisation of University-led research.

Tamantha holds a BMedChem (Hons), a PhD in Biochemistry and a Master of Management. She has more than a decade of research experience into the pre-clinical assessment of novel cancer therapeutics, and during this time authored a number of peer reviewed publications. The pre-clinical success of technology stemming from this research is currently in human clinical trials, and has resulted in a number of Patents granted in the US, Europe, China.

**Professor Lorna Moxham**

Professor Lorna Moxham is the Global Challenges Leader for Living Well, Longer, and Professor of Mental Health Nursing in the School of Nursing and Midwifery, Faculty of Science, Medicine and Health. Lorna is a Fellow of the Australian College of Mental Health Nurses and also the Australian College of Nursing.

Initially qualified as a psychiatric nurse at Rozelle Hospital in Sydney, Lorna continued her passion for lifelong learning graduating from University of Western Sydney with a Diploma of Applied Science and Bachelor of Health Science. She then graduated from University of NSW with a Master of Education.

Lorna has held numerous university and community appointments including four at ministerial level. These include Chair of the Central Queensland Health Community Council, Mental Health Review Tribunal, Regional Planning Advisory Committee, and the QLD Priority Housing Committee. Additionally, Lorna was a Board Director for Central Queensland Mercy Health and Aged Care, and the Australian College of Mental Health Nurses. She was also a member of the Executive for the Australian and New Zealand Council of Deans of Nursing and Midwifery.

**Professor Clive Schofield**

Professor Clive Schofield is the Leader of the Sustaining Coastal and Marine Zones and Director of Research at the Australian Centre for Ocean Resource and Security (ANCORS). Professor Schofield is a former Australian Research Council Future Fellow and also a former ARC QEII Fellow.

Clive is a political geographer and international legal scholar whose research interests relate to international boundaries with a focus on maritime boundary delimitation and marine jurisdictional issues. He previously served as Director of Research at the International Boundaries Research Unit (IBRU), University of Durham, UK. He holds a PhD (Geography) from the University of Durham, UK and an LLM from the University of British Columbia, Canada. He is the author or co-author of over 200 scholarly publications including the book, *The Maritime Political Boundaries of the World* (Martinus Nijhoff Publishers, 2005) (with Professor J.R.V. Prescott).

**Professor Geoffrey Spinks**

Professor Geoffrey Spinks is the Global Challenges Leader for Manufacturing Innovation. He is an Australian Research Council Professorial Fellow. His research interests focus on new materials and nanotechnology and he specialises in the development and application of materials for artificial muscles.

Professor Spinks has published over 160 journal articles, including 4 co-authored articles in Science magazine. He is the co-recipient of in excess of $35m in grant funding and has supervised 22 PhD, 7 Masters and over 50 final year / honours students to completion.

Geoffrey has worked closely with industry including sabbatical leave with BHP Research and Allied Signal Inc. (USA) and collaborative projects funded through the ARC Linkage and CRC schemes. His current interests include new product development (such as the “Lymph Sleeve”) and new manufacturing methods (such as 3D printing) that utilise his artificial muscle materials.