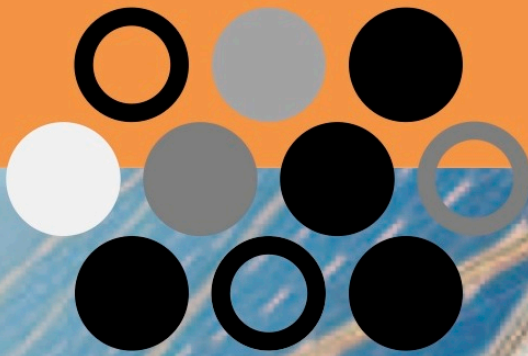# MELBOURNE INTERDISCIPLINARY COLLABORATION EXPLORATION (MICE)

FINAL REPORT – PHASE 1

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MELBOURNE INTERDISCIPLINARY COLLABORATION EXPLORATION (MICE)

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A study of researchers' perceptions and experiences of collaborative interdisciplinary research at the University of Melbourne.

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Executive Summary

Collaborative and interdisciplinary research (CIDR) is simultaneously well-known and poorly understood. Around the world, both approaches have long been touted as emerging and ideal research types in academia and have received recent renewed interest in response to pressures on academia to improve its performance most particularly its contribution to the broader community. Yet, further work is needed to understand what these approaches to research offer and entail.

This report describes work-to-date on the Melbourne Interdisciplinary Collaboration Exploration (MICE) research project, which was established in mid-2010 to provide feedback and reflection on a funding initiative at the University of Melbourne. The Interdisciplinary Seed Grant (ISG) scheme was started in late 2009 to fund highly innovative small- to medium-scale interdisciplinary research projects that show significant potential for future funding by granting bodies; and catalyse the drawing together of academic staff from across disciplines to work on interdisciplinary problems consistent with the broad research objectives of one or more of the Melbourne Research Institutes or designated emerging areas of focus.

The aim of the MICE project is to identify what those involved in the program expect and perceive the main outcomes of the ISG projects to be, and to explore what influences these expectations, perceptions and outcomes. Taking an ethnographic approach centred on the researcher-participants, it uses the ISG scheme, and associated institute-funded projects, as a window onto interdisciplinary research at the University of Melbourne and beyond. There are two phases involved. Reported here, the first phase (2010 until mid 2011) provides an introductory analysis of the ISG program across the two years it has been running. The second phase (Oct 2011-April 2012) adds a longitudinal component by following up with 2010/11 researchers at the completion of their ISG projects and tracking longer-term project outcomes among the 2009/10 cohort that may be associated with the projects.

For this report, researchers on projects funded in 2009/10 and 2010/11 were surveyed and 22 researchers were interviewed (4 project groups and 9 other individuals). Directors of all but one of the eight research institutes were also interviewed. The mixed methods also included social network analysis (to be reported in phase two) and document analysis of successful project applications. These methods together capture information at different scales, providing a combination of general trends and context-specific detail.

Key findings include the following:

1. Institute Directors primarily value CIDR for the way it helps them address the societal issues their Institutes are focused on.
2. Most institute directors are looking to fund a portfolio of highly innovative projects that as a whole provide a return on investment in the long term. Most researchers were strongly focused on the potential academic outcomes of their projects.
3. Different disciplines have different norms and cultures of research practice, including whether they are accustomed to grants such as the ISG.
4. Most researchers had some level of experience in CIDR and had enjoyed it to a degree.

5. Most researchers were familiar with or experienced in the topic of their project but very few had worked on it extensively.
6. Most projects were initiated by one or two individuals who, on the basis of their conception of the project and their networks, then invited others to be involved.
7. In some cases, the collaborative and interdisciplinary characters of projects co-evolved as group membership shaped the research topic, and vice versa.
8. The ISG research funding catalysed the formation of most projects, especially in Round 1.
9. Researchers appreciated the low transaction costs of the application process and would like more clarity on some aspects.
10. The modest size and duration of the grants introduced both advantages and disadvantages for researchers.
11. Collaboration was a relatively strong point of the projects, although some researchers engaged on the projects more than others, causing difficulties for some groups.
12. Groups divided the project work between individuals along seniority, task and/or disciplinary lines, as pragmatic and epistemological goals intersected.
13. Performing interdisciplinarity required researchers to consciously share perspectives, with this intellectual collaboration itself viewed differently among alternative research traditions.
14. Producing interdisciplinary publications is a particularly challenging intellectual and interpersonal exercise that again exposes differences between research traditions.
15. Virtually all researchers in the sample rated their projects as moderately or highly successful but for diverse reasons.
16. Most researchers were strongly focused on producing academic publications and grant applications from their projects.
17. Researchers reported a wide range of positive informal outcomes, including new insights into their professional identity and context.
18. Researchers reported a high level of interest in doing further CIDR, and on the same topic and with members of their project group in particular.
19. The main barrier to researchers doing more CIDR is a lack of time to invest in slow and risky research.
20. Researchers underlined that CIDR requires that one is reflective about the process and conscious of the tradeoffs.

Overall, the researcher feedback suggests that the ISG scheme is successful at many levels, seeding new projects, but also new relationships, ideas and perspectives. While projects are diverse and ongoing in formal and informal ways, the researchers involved have generally found the experience valuable and products of significant academic and societal worth have started to emerge. In this way, the scheme is helping to address academia's modern need to be innovative, productive, and accountable and useful to society. In addition to fulfilling these logics of interdisciplinarity, a few projects have successfully been working toward critically engaging with and seeking to improve aspects of the *status quo,* including conventional academic practice.

Researchers also reported diverse personal benefits such as meeting like-minded others. In a sense, researchers benefit from simply knowing that others in the University are interested in CIDR, including the institute directors who have supported their ISG projects. By providing for researchers not only opportunities for fruitful research but a window on to the University that they are part of,

the ISG scheme strengthens researchers' institutional identity at a time when this is being stressed by other developments. Concurrently, small aspects of the ISG scheme (namely a low level of institute involvement) inadvertently obfuscate researchers' understanding of how CIDR, institutes, and thus the researchers themselves are positioned within the University, creating for some a sense of confusion, and missing an opportunity to deepen researchers' sense of professional community.

In a similar way, the mundane, incremental decisions researchers make about how their projects are organised - from the moment of application and team formation, through to the details of how to write together - can have strong epistemological and interpersonal implications, shaping the type of interdisciplinarity that is consciously or unconsciously performed by individuals and projects groups. More than actual disciplinary differences, systemic differences between research "traditions" (namely positivist and interpretivist traditions) emerge in the ways different researchers approach research practice, including its interpersonal aspects. The project structure provided by the ISG scheme offers both advantages and disadvantages and familiar and unfamiliar aspects for different researchers. Limitations are introduced by the modest size of the grant but so too are welcome containment, accessibility and accountability. While the timeline of funding does not capture the full extent of work done on many projects, the low transaction costs and trustfulness of the application process are appreciated by researchers.

The timeframe of this MICE project similarly does not capture the full extent of the outcomes of the ISG projects. Researcher interest in pursuing avenues opened up by their ISG projects indicates that outcomes are likely to be prolific and diverse, if not always traceable. It is an open question how the innovative content and refreshing researcher experience of CIDR (of different modes and orientations) is altered as it is translated into the more risk-averse but high-status sphere of ARC-type funding, or even by the expectation that it will ultimately lead to research in such a sphere. It is also an open question how this sphere itself may be altered by CIDR over time.

A strength and weakness of CIDR is that it is risky. Interdisciplinary research in particular promises new and innovative insights and experiences but only on the proviso that considerable intellectual, interpersonal and personal challenges are successfully negotiated. Researchers as well as research funders carry this risk. It is important to recognise that the time pressures they are under are not only the predominant barrier to CIDR but a systemic consequence of the productivity push that collaborative research is a direct response to, exposing tensions within the trajectories and logics of modern research institutions.

Collaboration and interdisciplinarity are approaches to research that prompt us individually and collectively to ask what sort of research we value and why. As such they prompt us to consider the context in which research is being conducted, both within and beyond institutes, departments and the University. Reflexivity of the sort needed for successful CIDR is needed more broadly to address the question of how individuals and the academy are adapting to the diverse societal demands upon them, as well as how they in turn can contribute to changing that societal context as needed. Various pointers are provided for the ISG scheme and the institutes and University more broadly.

1 Background

1.1 Introduction

Collaborative and interdisciplinary research (CIDR) is simultaneously well-known and poorly understood. Around the world, both approaches have long been presented as emerging and often idealised practices in academia. Yet, further work is needed to understand what they offer and entail, including the pros and cons they pose for the researchers encouraged to practice them. As Strober (2011) notes, despite 'growing enthusiasm' for such research 'our collective understanding of the dynamics, rewards, and challenges' of conversations across disciplines 'remains murky' (p.i).

Collaborative research refers to research in which two or more people cooperate, not only to share the workload (as in outsourcing field work to a commercial company) but to jointly contribute to the intellectual development of the project. Interdisciplinarity is defined in various ways, in part because it is perceived from numerous discipline-based angles (e.g., Committee on Facilitating Interdisciplinary Research 2004; Rhoten 2004; Frodeman and Mitcham 2007; see Davies and Devlin 2007 for a useful overview). As van Rijnsoever and Hessels (2010) note, however, 'they all point in the same direction' (p. 2), which is the bringing together of perspectives and ideas from different disciplines. How intensively they are brought together can be imagined as a spectrum, with disciplinarity at one end, multidisciplinarity ('interaction', Hunt and Shackley 1999) in the middle, and interdisciplinary ('integration', Hunt and Shackley 1999) at the other end (Petts *et al.* 2008). Combined with other axes of research types discussed further below, like collaboration, interdisciplinarity (and disciplinarity) is usefully considered not as a neatly bounded "type" of research as much as an "orientation" or "approach" that can manifest in many forms and modes.

> **Collaborative research is about two or more individuals collectively contributing to the intellectual development of a piece of research. Interdisciplinary research is about integrating different disciplinary perspectives. Both are more usefully considered an approach to research than a discrete type of research.**

This report examines the functioning, context and outcomes of an initiative at the University of Melbourne that has been designed to help overcome a recognised obstacle to CIDR: a lack of accessible funding. The Interdisciplinary Seed Grant (ISG) scheme was started in late 2009 to fund highly innovative small- to medium- scale interdisciplinary research projects that show significant potential for future funding by granting bodies; and catalyse the drawing together of academic staff from across disciplines to work on interdisciplinary problems consistent with the broad research objectives of one or more of the Melbourne Research Institutes or designated emerging areas of focus.

Like the interdisciplinary virtual Melbourne Research Institutes through which the ISG scheme is administered, the scheme is funded out of the University's $30 million Major Research Projects Fund, which aims to build interdisciplinary capability and cross-faculty collaboration on large public questions (OVC 2009). Combined with the move towards interdisciplinarity in undergraduate

teaching through the Melbourne Model, this Fund suggests a serious commitment to interdisciplinarity by the University; one that deserves and necessitates serious reflection.

This document reports on the Melbourne Interdisciplinary Collaboration Exploration (MICE) research project established in mid-2010 to provide feedback and reflection on the ISG scheme in the context of the University's (and academy's) incorporation of CIDR to date. Taking an ethnographic approach centred on researcher-participants, it follows and complements a number of previous reports on interdisciplinarity conducted at the University of Melbourne: three on interdisciplinary in teaching and learning (Davies and Devlin 2007, Golding 2009, McCalman *et al.* 2008); and one on interdisciplinary research (Bolitho and McDonnell 2010). While, as will be discussed, it is similar in some respects to the latter report, it builds on it with a much larger empirical study with researchers and a more explicit focus on the ISG scheme. Moreover, it responds to the call in the latter for an evaluation of the ISG scheme in order to better understand perceptions of and influences and limitations on success in interdisciplinary research.

1.2 The Interdisciplinary Seed Grant Scheme

Funded for three years in 2009, the ISG scheme annually provides modest financial support to approximately 25 projects conducted by University researchers from across different faculties (and other partners as appropriate) and linked to the thematic interests of one or more of the eight mainly virtual interdisciplinary Research Institutes. Based roughly on the academic year, it provides approximately $30-60k to project teams for 12 month interdisciplinary projects that show promise of catalysing further research activity in accordance with the objectives stated in the previous section.

The application procedure for the ISG scheme is minimal and is administered by the institutes. Applicants submit a short, generic paper application to an institute chosen for its connection to their topic area. In each institute, an initial assessment is then made by a small committee who construct a short list of the top applications, based on the following assessment criteria:

> **The Interdisciplinary Seed Grant scheme is a pilot program supporting relatively small 12 month interdisciplinary research projects at the University of Melbourne. Administered through the Research Institutes, it is the focus of this report.**

- demonstrably innovative interdisciplinary research
- consistent with the broad research objectives of one or more of the Melbourne Research Institutes or designated emerging areas of focus
- involves a team of academic staff from across disciplines with appropriate and complementary expertise for the proposed research
- shows significant potential for future funding by granting bodies
- budget expenditure is aligned with claimed outcomes.

Notably, experience with the proposed area of study is not prioritised nor is academic rank more generally. Each Institute Director takes the institute's resultant short list to a cross-institute meeting where the best projects are selected from across all the institutes for a total of approximately $1

million funding (with no formal criteria for weighting of projects across the institutes). In some cases, applications unsuccessful in this 'open' round are subsequently funded internally by the related institute.

1.3 Researching interdisciplinary and collaborative research

This section discusses some of the elements involved in thinking critically about interdisciplinary and collaborative research, and presents some existing research on the topic. Reflecting the social science tradition from which the MICE project has been conducted, it introduces some terms and ideas that may be unfamiliar to those from other disciplinary backgrounds. While helpful context and hopefully illuminating, this section is not essential reading and readers should feel free to skip straight to Section 1.4 on the MICE project or Section 2 on the key findings.

1.3.1 A catalyst for research reflexivity[1]

Collaborative interdisciplinary research is increasingly popular. As discussed below and throughout the findings, there are many good reasons for this. But to fully understand these approaches to research, and researchers' experiences of them, it is important *not* to start from a blinkered or normative position that assumes these approaches to research are inherently superior. While the emergence of CIDR within a competitive research

> In considering collaborative and interdisciplinary approaches to research, we are encouraged to ask what sort of research we and others value and why.

environment means that its presence is often accompanied by criticisms of its implied "other" – that is, of solo and disciplinary research – CIDR is a complement rather than substitute for such alternative approaches. The appropriate balance between such approaches in any one context or at any one point in time is a matter for discussion. It may be decided that in a certain context, such as the University of Melbourne, the balance could usefully be adjusted and incentives such as the ISG scheme are needed to facilitate this shift. Most importantly, however, all such decisions need to be accompanied by consideration of what we now expect and want of research of all forms. As something different from the existing norm, CIDR usefully encourages us to be reflexive (that is, deeply and critically reflective) about what valuable research looks like and how it can best be produced and supported.

In this light, the following exploration of the ISG program is not just about "how to facilitate CIDR". It takes a step back and asks what such research does and does not offer and involve. As Jacobs and Frickel (2009) argue, given the importance of academic knowledge production to researchers and society alike, interrogating how this occurs is critical. This includes carefully scrutinising what is expected, presumed and experienced in efforts to increase collaborative and interdisciplinary research. In contrast to projects that uncritically uses the existence or degree of interdisciplinarity or

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[1] To be 'reflexive' is to engage in a particularly deep and critical form of reflection, encompassing the practices one is engaged in as a target for reflection as much as the knowledge content that one has produced. Reflexivity involves not only carefully interrogating empirical material or experiences, but also being aware of how one is interpreting and representing them, why and to what effect. For more detail, see Alvesson, M. and K. Skoldberg (2000). Reflexive Methodology: New vistas for qualitative research London, Sage.

collaboration as a proxy for desired research characteristics (e.g., Reisinger 2011), this project considers what the experience of participating in these particular modes of research tells us about the aim, practices and context of knowledge production in contemporary academia.

1.3.2 Collaborative and interdisciplinary research: a macro perspective

CIDR has long existed. Yet, it is also now seen as deserving of and in need of further encouragement, reflecting a shift in how knowledge production is viewed and positioned in society. Why is it being prioritised in this way? Certain assumptions about CIDR demand interrogation. This section presents some of the arguments put forward for why CIDR is needed.

Contemporary calls for more CIDR are based on the belief that these forms of research exhibit certain desirable characteristics, including what Barry *et al.* (2008) refer to as accountability, innovation and ontological (that is, real world) change. The perceived desirability of these characteristics – or 'logics' as Barry *et al.* (2008) call them – reflect in part characteristics of academia's current operating context. In particular, CIDR is gaining prominence as a core part of the academy's response to ongoing queries from government, business and others about the value and role of academic research in society, and in particular how academia can more effectively help society address the complex problems it faces.

> **Interdisciplinary research is motivated by different rationales or 'logics', some of which try to counteract criticisms of conventional academic knowledge production.**

CIDR is often touted as a response to certain negative stereotypes (that is, myths) about academics. First, in counterpoint to the stereotype of the lone, anti-social academic working slowly and indulgently on an esoteric passion, collaboration is encouraged as a more collegial and strategic mode of producing knowledge. It is pursued as both an antidote to, and advantageous response to, the competitiveness of the modern research environment. Collaborative research is valued for its presumed association with enhanced research productivity, efficiency, innovativeness and breadth (see for example, Fox and Faver 1984). To the extent that collaboration integrates 'peer review' into the research production process, it is also considered by some to be associated with higher quality research.

Collaboration could and does of course occur within a single academic discipline, perhaps dominantly so. As such, it does not counter (indeed, may reinforce) a second disparaging stereotype of academia: that of a group of like-minded, pedantic academics obsessively debating a narrow component of their canon. While this stereotype does not necessarily imply that the researchers are from the one discipline, disciplinarity if often associated with this sense of confinement and interdisciplinary research, rightly or wrongly, is posed as a solution. Here, interdisciplinarity connotes (implies) a sense of openness, freshness and relevance. The latter points to the way that interdisciplinary research is also often presented as inherently problem-solving (Barry *et al.* 2008) for the way in which it seems to shape research according to the messy contours of societal issues rather than the historical divides between research traditions, thus providing a more synthetic ready-to-use answer for any "research user". Yet interdisciplinary research can also be driven purely by intellectual interest. In terms of physical science, Rhoten and Parker (2004) suggest, for example:

Interdisciplinarity has become synonymous with all things progressive about research and education, not because of some simple philosophic belief in heterogeneity but because of the scientific complexity of problems currently under study. In many fields, it is argued, the easy work is finished as scholars are confronted with questions that defy easy categorization in or solution by traditional disciplinary frameworks (p. 2046).

Overall, CIDR presents an image of researchers working together in a more cooperative and open-minded way, helping academia to fulfil its knowledge production mission by lifting its innovativeness, salience and productivity.

Moves towards collaboration and interdisciplinarity are valuable for all of the reasons described above. However, CIDR projects are also far more heterogeneous than this depiction makes out. They encompass other values that extend beyond enhancing academia's standing within society. They also encompass many limitations and challenges. These include not only barriers to or failures in realising the true potential of these research forms, but difficulties more inherent to these approaches.

On the one hand, for example, regardless of the quality of a piece of interdisciplinary research or the societal relevance of its topic area, in an applied setting it is liable to being devalued if its conditions and location of production are seen to be limited only to academia. In the terminology of Cash *et al.* (2003), research needs to be not only topically 'salient' and academically 'credible', but also socially and politically 'legitimate'. Research that explicitly extends beyond what academia can know to practice settings is referred to as 'transdisciplinary', representing another variant of the broader category of 'cross disciplinary' research (Davies and Devlin 2007). On the other hand, CIDR can also be viewed negatively because of the less clear cut criteria about how to assess its quality (Huutoniemi 2010).

1.3.3 The disciplinary and institutional context of interdisciplinarity

This research focuses on the position of CIDR research in researchers' lives and professional and institutional context. We are interested in the perceived and relative value of CIDR both in terms of discourses and organisational feedback. A range of existing research describes some of the epistemic, epistemological, organisational and personal issues researchers face in practising both collaborative and interdisciplinary research (see Bolitho and McDonnell 2010 for a useful overview)[2].

A key element of the context that researchers work within is that it is generally structured along disciplinary lines. Discipline based units remain the central organising framework for the structure of the University of Melbourne, and most other universities. In most universities, interdisciplinarity is institutionalised as a second, complementary and minimally disruptive layer of research organisation. At the University of Melbourne, this role is played by the mostly-virtual theme-based research institutes.

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[2] Epistemic refers to areas of knowledge. Epistemological refers to ideas about what counts as true or valid knowledge.

Within such a context CIDR can be viewed as a threat. To the extent that it signifies the academy's growing responsiveness to society, it can inadvertently (or deliberately) position disciplinary research as isolationist, irrelevant, rigid and static (Guggenheim 2006; Barry *et al.* 2008)[3]. Thus, engaging with CIDR involves researchers not only "going against the grain" but also in some cases being resented for it (Bolitho and McDonnell 2010). It is therefore not surprising that, despite widespread positive rhetoric about interdisciplinary research, past studies suggest that systematic obstacles to its realisation remain within the academic system (Petts *et al.* 2008). Past research at the University of Melbourne suggests, for example, that the value of interdisciplinary research is often poorly captured in conventional mechanisms for measuring and rewarding professional success (Bolitho and McDonnell 2010).

Realisation of the considerable obstacles that researchers may have to overcome to engage in CIDR, there has been rising interest in the role of external incentives, such as grant money (e.g., Sa 2008) and the relationship of these incentive schemes to the institutional position and view of CIDR (e.g., Miller 2010).

While institutionally, disciplinary and interdisciplinary research remain relatively separate – involving different organisational units, drawing on separate funding sources, responding to different research questions, and guided by different research criteria – for researchers the division is likely to be a lot messier. While some researchers elect to stay within their disciplinary "home", many researchers are likely to be involved in both at some stage. How they experience, combine and negotiate these different research tracks or spheres is conceptually and institutionally consequential. But being highly varied, dynamic and private, these research experiences are not often visible in higher level discussions about the characteristics or value of different research modes. These "on the ground" perspectives of research in practice are a key focus in the current project.

> **Interdisciplinary research is commonly institutionalised as a parallel and complementary approach to existing disciplinary based research.**

These issues need to be understood in the professional context of academics' working lives more generally. A recent Australian wide survey of over 5,500 academic across 20 universities concluded that 'Australian academics are highly intrinsically motivated and most find their careers rewarding'. It found that the most prized aspects of academic life are 'the opportunity for intellectually stimulating work, a genuine passion for a field of study and the opportunity to contribute to new knowledge' (p. xi). At the same time, however, it concluded there has been an 'unmanaged growth in the expectations on academic staff' and:

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[3] Such a representation is unhelpful in three ways. First of all, it presumes that disciplinary knowledge is more unitary than it is. Instead, across and within the disciplines, knowledge characteristics are highly heterogeneous. Second, within the variation inherent to disciplinary knowledge is much that does not conform to the above representation and is instead highly dynamic and socially engaged. Third, such criticism is not contained to disciplinary knowledge. Interdisciplinary knowledge can also be isolationist, irrelevant, rigid and static. As argued above, it is the ultimate characteristics of research that are of importance, not research approach. Quality, fit-for-purpose research is not only the domain of interdisciplinary collaborative research, nor an inevitable or easy outcome of it. Rather, producing and facilitating such research is a challenge and achievement.

Many academics in mainstream teaching and research positions are overwhelmed by their workloads and the range of their responsibilities, and are concerned that the opportunities for creativity, innovation and originality are being eroded [within Australian higher education] (Bexley *et al.* 2011, p. 49).

These findings suggest that researchers are likely to be drawn to CIDR to the extent that such work is perceived as an opportunity for 'creativity, innovation and originality'. However, the opposite is likely if they instead perceive CIDR to be part of a negative commercialisation and managerialist turn in higher education that threatens intellectual autonomy and research quality (see for example, Behrens and Gray 2001; Gill 2006; Jamison 2008 for discussion of these issues). Only 17% of academics agreed that "Generally, the Australian higher education sector is heading in the right direction" and even fewer agreed that there is strong government support for the sector. Even if academics do see CIDR as offering an opportunity for passion, intellectual stimulation and new knowledge, academics' abilities to engage in such research may be limited by other pressures. How CIDR is positioned within the extrinsic and intrinsic motivations for researchers' professional lives is something this project explores by considering the role of the ISG grant.

Much research into researchers' experiences of CIDR tends to look at the issues in isolation and focus on micro-level challenges of group process or disciplinary interaction. While this literature provides some important insights and is drawn on as relevant in the following sections, a contextual approach is needed to understand why CIDR is perceived and experienced the way it is. An example is provided by Petts, Owens *et al.* (2008) who report on UK researchers' experiences with interdisciplinarity in the area of urban sustainability. Invoking a common metaphor in geography (reflecting their own disciplinary background), they suggest that some of the main 'border troubles' researchers tend to encounter are:

> **Research is needed into the way collaborative interdisciplinary research is shaped by both individual and structural level factors.**

- the association between interdisciplinarity and applied research (which some academics view as lower status)
- disciplinary differences in how research problems and questions are framed and investigated
- the challenge of achieving both 'cognate' interdisciplinarity (between disciplines within one domain such as the social sciences) and 'radical' interdisciplinarity (between different research domains, namely the physical and social sciences)[4]
- the way that the 'hard wiring' of the research support and assessment systems in many academic contexts is not conducive to interdisciplinarity.

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[4] Other 'radical' divides exist between some disciplines on the basis of different epistemological assumptions rather than different objects of study. For example, both economics and anthropology study systems of exchange, but economics is generally conducted within a positivist tradition where facts are considered to exist independently of their context, and anthropology is part of an interpretivist tradition where facts are considered to be irremovable from (meaningless without) their context (see Morgan, M. S. (2010). Travelling Facts. How Well Do Facts Travel? The Dissemination of Reliable Knowledge. P. Howlett and M. S. Morgan. Cambridge, Cambridge University Press**:** 3-40.)

The authors report that:

> ...participants argued for interdisciplinarity to be seen not as a grand project, routinely advocated but rarely delivered, but as a series of negotiations and recursive interactions between disciplinary perspectives (p. 600).

This useful idea of interdisciplinarity as an emergent property of individual and group decisions is explored in this report. Ideals and realities about disciplinary interaction merge to shape the eventual project outcomes. It is a messy and, as researchers in this MICE report emphasise, a risky undertaking. However, success comes in many forms. The main contributors to this project are those who perceive their projects to be successful in one or more ways. This sampling approach itself is a blend of ideal and reality: ideal because 'success cases' are rich sources of information; and reality because it is those who successfully applied for ISG funding and generally felt positively about their ISG projects, who voluntarily participated in this study. Academics in the work by Petts *et al.* (2008) identified a number of conditions for successful interdisciplinary collaboration:

- Mutual trust amongst participants in interdisciplinary work
- Robust disciplinary knowledge and practice
- Individuals' confidence in their own disciplines
- Mutual respect for others' disciplines (plus humility and sense of humour)
- Space and time for sharing knowledge and exploring differing constructions of problems and methods
- Planned opportunities to negotiate at the borders
- Agreement that 'the problem' can be framed in different ways.

Research on CIDR is often focused only on (often essentialised) characteristics of individual researchers (e.g., Brew 2008) or the macro structures that researchers are part of. What is instead needed is reflexivity about *collective* endeavours, including the creation of research settings, structures, norms and categories. As Bourdieu and Wacquant (1992) argue about social science, reflexivity is needed about the 'epistemological unconscious', about what is assumed and accepted as good practice and how the field is organised. Bourdieu and Wacquant (1992) focus this work on their own discipline of sociology. Their work is designed to 'buttress the epistemological security of sociology' (p. 6) and 'strengthen its epistemological moorings' (p. 46). In contrast, this project encompasses the category of "discipline" (and, so, "inter-discipline") within its reflexive gaze. In doing so, it hopes to encourage such reflexivity among those involved in conducting and supporting collaborative interdisciplinary endeavours.

> **Interdisciplinarity is an emergent property of individual and group decisions made in the process of establishing and managing a project.**

1.3.4 Performing interdisciplinary collaboration

Finally, seemingly mundane details of doing or "performing" interdisciplinary collaboration are a rich site for analysis. In particular, small decisions and practices made in the process of research shed light on the profound communication challenges that research involves. A useful way of exploring research practices is by considering the 'boundary objects' that are developed and used. 'Boundary objects' (e.g., methodologies, standards, collective research products such as journal articles, models, graphs) are material or metaphoric 'things' that serve as a site on which shared understanding between different knowledge actors can be built and negotiated in cooperative work arrangements (Star and Griesemer 1989; Guston 2001; Star 2010)[5]. That is, they are something on which different members of research teams need to collectively focus, thus serving as a basis for discussion in which disciplinary differences can be debated and incorporated.

Since the development of the idea of boundary objects by Star and Griesemer (1989), it has been often used to consider work conducted across disciplines (though not exclusively). Related concepts of heterogeneity, negotiation and cooperation are of clear relevance to understanding the practises of collaborative and interdisciplinary knowledge production. The boundary object idea has subsequently been taken up in diverse disciplines and in numerous studies of interdisciplinarity. The latter includes Rhoten's (2004) study of interdisciplinary centres in the US, where she highlighted the important focusing role of boundary objects, concluding that an:

> absence of explicit, discrete targets of work – otherwise known as "boundary objects" – appears to complicate rather than catalyse communication and collaboration between disciplines (p. 9).

The role of boundary objects, notably academic publications, is something we discuss further in this report. Representing another aspect of 'boundedness', we will also consider how institutional technologies such as "projects" are simultaneously stimulating and *containing,* empowering research while also constraining it in helpful or unhelpful ways.

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[5] Boundary objects are inherently flexible in terms of how people interpret them. They are necessarily vaguely defined and are always understood slightly differently and 'locally tailored' by individuals in different settings. Individuals then 'tack back and forth' between their personal form of the object and the group form of the object in performing their individual and collective tasks. Researchers' acceptance of the validity of a shared boundary object is voluntary and if consent is not given or withdrawn, the boundary object ceases to perform its bridging function and so too may the collaboration. Boundary objects help to manage the central tension in all shared/group knowledge work between the twin goals of heterogeneity and cooperation. Rather than searching for a total overlap or alignment of views, developing and using boundary objects is about finding a pragmatic intersection of understanding that enables cooperation (Guston, D. H. (2001). "Boundary Organizations in Environmental Policy and Science: An Introduction." Science, Technology & Human Values **26**(4): 399-408, Star, S. L. (2010). "This is Not a Boundary Object: Reflections on the Origin of a Concept." Science, Technology & Human Values **35**: 17.)

1.4 The MICE project

1.4.1 Aim and research questions

The overarching aim of MICE is to identify what those involved in the program expect and perceive the main outcomes of the ISG projects to be, and to explore what influences these expectations, perceptions and outcomes. The project has inter-related practical and academic motivations. From a practical perspective, it is designed to provide feedback on the ISG scheme. From an academic perspective, it is designed to contribute to knowledge about CIDR by providing a valuable broad and longitudinal exploration of researchers' lived experiences and perceptions of such work over time. In particular, this project considers:

> The aim of the MICE project is to identify what those involved in the program expect and perceive the main outcomes of the ISG projects to be, and to explore what influences these expectations, perceptions and outcomes.

1. What do those involved in the program (institute directors and researchers successfully funded under the ISG scheme (and related internal institute funding) in 2009/10 and 2010/11) consider to have emerged from it and why?
2. What are researchers' experiences and perceptions of the program? How are these influenced by:
   a. The collaborative, interdisciplinary and institute-based character of the projects?
   b. Researchers' professional and institutional context?
3. How is success understood, represented, pursued and/or recognised by those involved in the program?
   a. To what extent do these responses reflect conventional academic criteria for success versus newer ideas about societal relevance?
   b. How are conceptions of success influenced by actual experiences with the ISG projects?

1.4.2 Project Design and Methods

The project is designed to provide rich insights into researchers' experiences and perceptions of CIDR and to trace the formal and informal outcomes that emerge over time. To capture this temporal element, MICE has two main phases. The first (2010 until end of 2011) provides an introductory analysis of the ISG program across the two years it has been running. This is the basis of the current report. The second (March 2012-December 2013) will add a further longitudinal component by tracking longer-term project outcomes using social network analysis.

Mixed methods were used to capture information at different scales, providing a combination of general trends and context-specific detail. The mixed methods used are: social network analysis (SNA), surveys, interviews, document analysis of successful project applications (Table 1).

The SNA work will use publication data to look at change over time in co-authorship patterns among ISG researchers as a means of providing further information about possible direct and indirect outcomes of the projects (eg project publications, new collaborations), noting that attribution to the ISG projects cannot be assumed. Two examples of using SNA to envisage initial co-authorship patterns between researchers in ISG project groups are provided in the Appendix. Such analyses will not be repeated until 2013 to allow time for publications to be produced.

In the survey of Round 1 researchers, individuals were asked to indicate whether they would be willing to be interviewed. Those who did were interviewed as individuals or with their project groups. All findings about specific researchers or groups are treated as confidential and their input is represented as anonymous. The project gained ethics approval from the University (Ethics ID 1034771).

1.4.3 ISG Scheme Researchers

The project considers the first two rounds of the ISG scheme. Round 1 research projects had been going for about one year when this research commenced, while Round 2 researchers had only recently commenced. The surveys directed at the two groups varied to account for this difference.

In Round 1, 24 projects were funded out of 107 applications. Most projects (19/24) involved people from 2-3 faculties. Of the 97 individuals involved, 12 were members of more than one funded project. 64% of the researchers were male and 36% female. Most were early to mid-career, with over 50% having received their PhD within the last 10 years and 26% having Professorships.

In Round 2, 28 projects were funded out of 93 applications. More than half (15/28) of the projects involved 3 faculties, 5 projects combined 4 or more faculties, the remaining 8 projects combined 1-2 faculties. Of the 141 individuals involved, 11 were members of more than one funded project. 72% of the researchers were male and 28% female. Approximately 40% of the researchers have received their PhD within the last 10 years and 24% have Professorships. Across the two years, there were 11 researchers who were part of projects in both rounds.

Table 1. Types and details of methods used in MICE

Method	Description	Objective	Theoretical sample	Actual sample	Timing
Social network analysis	Co-authorship network analysis for successful projects	To gain insight into possible direct and indirect effects of the ISG projects on researchers' co-authorship patterns	All ISG successful applicants	All ISG applicants employed at UM	Phase 2: March 2012-December 2013
Surveys	In-depth online surveys to collect a mix of qualitative and	To gain broad input from researchers about their	All successful applicants based at UoM in Round 1 (95	Round 1 End-of-Project survey ("R1"): 36 respondents	The R1 and R2A surveys conducted simultaneously

	quantitative data. Repeated at start and end of projects and for Round 1 and Round 2	experiences and perceptions with both CIDR and to explore how this changes over the duration of the ISG projects and between the two years of the scheme.	researchers) and Round 2 (119 researchers)	(38% response rate, covers at least 50% of projects) Round 2 Start-of-Project survey ("R2A"): 37 respondents (26% response rate, covering at least 50% of projects) Round 2 End-of-Project survey ("R2B"): 28 responses (23% response rate, covering at least 55% of projects)	Nov-Dec 2010 R2B survey conducted Nov-Dec 2011.
Interviews	30-60 minute in-person, semi-structured, recorded and transcribed interviews (all but 2 interviews recorded)	To complement survey with more in-depth information from researchers To explore institute directors experiences and perceptions of the ISG scheme from their institute's perspective	Individual institute directors Willing project groups or individual researchers associated with Round 1 projects that were identified by the researchers or institute directors as 'successful' in some way	7 institute director interviews conducted; Interviews conducted on 12 out of 24 projects from Round 1 (46% coverage). 22 researchers interviewed in total: 4 project groups totalling 13 researchers; 9 individual researchers associated with projects other than those covered by the group interviews.	Interviews conducted, recorded and transcribed Nov 2010- Mar 2011 Interviews analysed thematically using cross-referencing between researchers

Document analysis	Discourse analysis of successful applications in the ISG scheme	To explore how success is perceived in the applications to gain insight into expectations and to compare these to constructions of success by institute directors and completing researchers	All successful Round 1 and Round 2 ISG applications	All successful Round 1 and Round 2 ISG applications	May 2011
Participant observation	Observation of presentations and posters by researchers and institute directors at the annual Interact forum	To gain further insight into how research associated with the ISG is represented, perceived and valued	All participants at the 2011 annual Interact Forum	All participants at the 2011 annual Interact Forum	July 22, 2011

2 Key findings

2.1 Introduction

This section provides insight into key findings around four broad topic areas: people's motivations and experiences, outcomes that have emerged and implications arising. While the focus is on the ISG scheme, the discussion necessarily encompasses the broader academic and University context. Perspectives from researchers are mainly presented, with some comments drawn from Institute Director comments when especially pertinent.

2.2 Motivations and routes to involvement

2.2.1 Views on collaborative interdisciplinary research

The characteristics of the MICE research participant sample naturally means that all of them were generally positive about CIDR. That said, participants presented a diverse range of perspectives on what they most value about it. Discussed further in the following section, some people primarily value CIDR as a means to the end of tackling research questions of intellectual and/or societal interest. Reflecting the fact that the Melbourne Research Institutes are focused on research areas rather than research modes, this emphasis on CIDR as an appropriate response to problem-driven research questions characterised the responses of most Institute Directors. As two described, for example, they believe the research problem needs to drive the selection of a collaborative interdisciplinary approach:

> **Institute Directors primarily value collaborative interdisciplinary research for the way it helps them address the societal issues on which their Institutes are focused on.**

> *I don't see any value in interdisciplinary research for the sake of interdisciplinary research. [...] I see the value of research for the sake of producing new understanding and making that applicable to real world. And the mechanisms by which you do it are varied (Institute Director 5).*

> *The essence of multi-disciplinarity for me is people joining together to attack a problem. The juices are almost always generated when people meet and say to other people what the longstanding interesting problem is [...] [rather than] say "let's do an interdisciplinary thing about water" [...] [My] real passion is to form these linkages with people that bring problems that we can address, because it's fun to address them and it's important to address them. So the mantra is we should move from saying "What we can do research in?" to "What should we be doing research in?" (Institute Director 3).*

As the comment about fun illustrates, directors also perceive CIDR as having intrinsic appeal, providing an intellectual and interpersonal challenge and opportunity in their own right, as well as a new perspective on what research questions to ask.

For most researchers, collaborative research is seen as normal, while interdisciplinary research is seen as more unusual and, as a consequence, as more difficult. As one researcher put it:

> I guess everyone does collaborative research. I mean there's not many people, maybe some people in Maths, but there's not many people who don't work with other people. But cross-disciplinary is quite a different beast and a lot more difficult (Researcher C, Group Interview 4).

The reference above to cross-disciplinary illustrates the way that most researchers defined interdisciplinarity in very general terms, referring to any research that involves more than one discipline. As some wrote for example, interdisciplinarity is:

- *Simply a range of research disciplines (Survey R2A-33)*
- *Incorporating different disciplines (Survey R1-33)*
- *Multi-field (Survey R1-29)*
- *Collaboration between very different disciplines (Survey R1-25)*
- *People from many disciplines (Survey R1-17)*
- *Connections between other disciplines (Survey R1-16)*
- *Working across traditional discipline boundaries (Survey R2A-5)*
- *An interdisciplinary field crosses traditional boundaries between academic disciplines (Survey R2A-4).*

Such succinct answers may be an artefact of the survey instrument (i.e., a desire to limit time spent writing detailed answers into the survey). They may also reflect researchers' lack of concern about what approach is adopted, or a deliberate commitment to a broad non-prescriptive definition of interdisciplinarity. One of the institute directors noted that the latter approach was embodied by the ISG scheme:

> I think the message, although we're struggling to actually have a holistic perspective to the message, I think it's fine for there to be a bit of wobble there because I don't think we should be prescriptive (Institute Director 4).

The most commonly discussed characteristic of interdisciplinarity was its quantum or 'degree'. Most people seemed to support the idea of Petts *et al.* (2008) that it is a knowledge spectrum, with inter-disciplinary distance increasing along the axis, however distance is measured. Challenging the spectrum idea, however, was a concurrent sense that below a certain disciplinary distance, the validity of claims to interdisciplinarity is questionable, with differences being defined more and more specifically in terms of domains, disciplines, sub-disciplines and fields, down to the level of individuals. No one specified precisely where the minimum disciplinary distance for meaningful or authentic interdisciplinarity lies, and as illustrated by the quote above, some argued explicitly against getting caught up in such discussions. This suggests that maintaining a degree of vagueness in the concept of interdisciplinarity in itself fosters interdisciplinary collaboration, housing a diversity of approaches united by a common intent. In this sense the concept of interdisciplinarity may itself act as a kind of 'boundary object' (Star and Griesemer 1989). Star (2010) argues that vague shared representations facilitate cooperation between different actors.

That said, a number of critical remarks were made by Institute directors and researchers about the narrowness and thus apparent authenticity of some others' claimed interdisciplinary efforts. As one researcher remarked:

> It's one of the things I find about the University of Melbourne generally: it's a very academic place and people dig fairly deep. Like a biochemist, for example, would consider working with somebody in the chemistry department [to be] interdisciplinary (Individual Researcher Interview 6).

People in general were very careful not to criticise disciplinary research, reflecting its ongoing centrality in their own and their peers' professional and institutional existence. Nevertheless, perhaps in reaction to conservative criticism of interdisciplinary research and/or a desire for the difficulty of interdisciplinarity to be recognised, there was a sense among many interviewees that "real" (more radical) interdisciplinarity is more desirable or laudable than "pretend" (more cognate) interdisciplinarity. Both raising and obstructing the question of how to define what does or does not count as "real" interdisciplinarity is the way that the axis of disciplinary difference seems to be simultaneously interpreted as a measure of value. The act of specifying what counts as interdisciplinarity thus becomes not only descriptive but judgemental, with true interdisciplinarity accorded higher worth than "false" or narrow interdisciplinarity.

Some researchers did provide quite specific definitions of interdisciplinarity, not in terms of disciplinary distance but in terms of how it is performed and what it is motivated by. In doing so, they collectively pointed to some of the many options involved in how interdisciplinarity is approached and demonstrated some strong commonalities in understanding.

First of all, there was a strong emphasis on one of three 'modes' of interdisciplinarity distinguished by Barry *et al.* (2008): **Integrative-Synthesis mode**. Representing the mode of interdisciplinarity favoured in policy and practice and expressed also by Institute Directors, this mode of interdisciplinarity is the most "democratic" of the models. This sense of egalitarianism and expansion was evident in some researcher statements about what interdisciplinarity means to them. For example:

> Linking epistemological perspectives in order to get a fuller view of a particular issue of phenomenon (Survey R1-21)

> Bring expertises together to resolve higher degree problems and to generate a full detailed answer otherwise not possible (Survey R1-6).

> The synthesis of different disciplinary methods, knowledge and theory (Survey R2B-11).

In this version of interdisciplinarity, two or more disciplines are envisaged as contributing relatively equally to the development of a new more expansive perspective. This new perspective is envisaged as sitting in an apolitical space between disciplines, stretching equally in all directions rather than sitting within one and drawing on others. One of the motivations for such a model of research is likely to be the sort of cooperative, harmonious group processes and relationships that are implied to be involved for researchers.

As also found among institute directors, many researchers also expressed support for a **'problem-based orientation'** to interdisciplinary research (Barry *et al.* 2008). Many presented the driver for such research as addressing 'important topics' (Survey R1-22), 'common goals' (Survey R2A-34), or to 'form something that has greater depth and breadth and therefore contributes more extensively to society' (Survey R2A-12). One scientist suggested that one of the benefits of taking an interdisciplinary approach to problem-based research is that there is a greater tendency for it to then become *solution*-focused. He explained:

> It's just a personal opinion but, I reckon, when you work with people who are in your field a lot of the time when you have discussions people see problems - people see hurdles or technical difficulties that need to be overcome. And when you're talking with people outside your discipline they see possibilities and [...] the way forward seems more positive. They're not aware of the technical difficulties. They don't know that if you're going to grow a microorganism it has these requirements that are bloody hard to meet. If you're talking to another microbiologist they know that, and they're going to say "How are you going to control the oxygen concentration in the fermenter?" and they'll see a problem. If you're talking to a chemical engineer it's "Great! We could do this, or we could do that". And they leave you with the problems to sort out. So when you're having those discussions there's always that part in the back of my mind thinking "Oh Christ, how am I going to make this work?" But it's fun, because it is a more positive conversation. I feel more positive about what comes out I suppose (Individual Researcher Interview 6).

In addition to a focus on societal problems, some researchers also indicated a complementary interpretation of interdisciplinarity as practice. This **'practice-based orientation'**, described also by Barry *et al.* (2008), draws attention to the collaborative element of interdisciplinarity and the implications of epistemological decisions about interdisciplinarity for research practice and group dynamics. Support for this view is implied by the way numerous researchers expressed interdisciplinarity in terms of a process rather than outcome and represented the flow of influence as two-way, both between project and disciplines, and between disciplines. As some wrote, for example, interdisciplinarity is:

> That each discipline will be informed by the other and that a new and innovative joint approach will be generated (Survey R1-32).

> Learning with, and from and about each others' disciplines – so expanding the knowledge of a particular phenomenon (Survey RB-14).

Under a problem-based orientation, the relative mix of disciplinary input involved is not a matter of evenly balancing the contributions of different researchers but is a pragmatic question of what a problem requires. This has implications for the relationship between the different disciplines (and thus researchers) involved. Although not discussed by Barry *et al.* (2008), it underpins the second more instrumental mode of interdisciplinarity they define: the **'Subordination-Service mode'**. Here, rather than aiming for a balanced contribution from different disciplines, one or more disciplines provide some form of "input" to another on an as-needed basis. A few researchers reflected this model in their comments. As one wrote, for example:

Interdisciplinary research crosses disciplines. e.g., biology at the molecular level requires knowledge across physics and chemistry. There is a need to use physical techniques to study biological molecules (Survey R1-9).

The researcher above is a physical scientist. This is notable because some characteristics of the physical sciences – namely a foundationalist view of knowledge, Cartesian scale differences between disciplines, traditions of specialisation and commercialisation, and reliance on complicated techniques and capital resources - mean that they are more likely to be comfortable with the idea of pragmatically "using" some disciplines to support work in others. That said, an institute director (a scientist) commented that he personally does not like this way of interacting, reflecting the way that the epistemological framing of projects has personal and inter-personal implications for researcher experiences:

The paradigm in the past has been matching your interests to our capabilities. But that is not rewarding for a [scientist] because 'we're being used' so to speak. [...] [Instead] I enjoy [...] working on a problem with people who clearly had come from a different culture, but we're both working on the same problem (Institute Director 3).

At a higher level, a compartmentalised and instrumental view of disciplinary input reflects the instrumental view many have of academic knowledge in general – and interdisciplinary research in particular - where academics provide a service to society by providing expert "input" on externally-identified problems.

Although many researchers indicated broad support for a problem-based rationale for interdisciplinarity, most also indicated sensitivity to the practice-based and inter-personal consequences of how collaboration between disciplines is played out, presenting not a service relationship between disciplines but a more egalitarian 'Integrative-Synthesis' ideal. For one project group, this combination of approaches was a deliberate effort to counteract the perceived subordination of social science "input" in the dominant problem based 'Subordination-Service mode' interdisciplinary research that already exists on their topic. As two geographers explained:

There's also a politics to the research: we saw that the way research around X [their topic] had traditionally been done within the University tended to bring in social perspectives as not on an equal footing, more as an add-on [...] (Researcher A).

[...] A few of us come into this from a number of different issues. One is a concern about X [their topic] in Melbourne - so problem-based if you want to put it in those terms. The other is that we saw that there's a real bias in the kind of X research that the University does, and that's connected to the sort of X policy that eventuates [...] - that being very focussed on the technical, infrastructural, physical sciences. [...] And we saw that amongst us as a group, we had a lot to offer to complement and challenge that kind of perspective and hopefully, through that, connect with policy and practice (Researcher B, Group Interview 2).

As discussed further below, this project is envisaged by those involved as bringing together perspectives that are otherwise excluded in other dominant interdisciplinary efforts on the same topic. It highlights the way that the question of the relative priority given to different disciplinary

perspectives within an interdisciplinary project merges into the question of what perspectives are included within the project at all.

Power issues are also central to the third mode of interdisciplinarity discussed by Barry *et al.* (2008): the **'Agonistic-Antagonistic' mode**[6]. In this mode, interdisciplinarity is a deliberately political effort to examine and question the divisions between forms of knowledge in general. Related to transdisciplinarity, in this mode interdisciplinarity is:

> *conceived neither as a synthesis nor in terms of a disciplinary division of labour, but as driven by an agonistic or antagonistic relation to existing forms of disciplinary knowledge and practice. Here, interdisciplinarity springs from a self-conscious dialogue with, criticism of or opposition to the intellectual, ethical or political limits of established disciplines or the status of academic research in general... (p. 29).*

Some interviewees indicated support for this critical mode of CIDR. For example, in the project discussed in the previous paragraph, interdisciplinarity was performed not only within the project but in conscious relation to an alternative disciplinary perspective on its topic of interest. Representing a range of social science and humanities disciplines, the project critically examined the implications of the existing dominance of engineering and economics in policy and practice on its core issue. In this sense, it staged an interdisciplinary conversation not only between the members of the research team (who represented a form of social-science based 'cognate' interdisciplinarity (Evans and Martin 2004)) but with the more distant disciplines that were the focus of their critique. The aim was not to transcend the boundary between the two domains but to draw attention to its existence and therefore the privileging of one form of knowledge over another. By critically examining the implications of the division, the project in fact served to reinforce it for the researchers in some ways. As one of the researchers discussed:

> *I guess we're up front about acknowledging the limitations of the interdisciplinarity of this effort, which has been that it's more from a social sciences and humanity perspective [...] I would like to particularly collaborate with people from the natural sciences [...] I guess this is my bias and my narrow-mindedness, but I wouldn't be so open to collaborating with people from an engineering perspective and an economic perspective because I see those perspectives in the domain of X [their topic] as so dominant already that I... Just to provide a critique and alternative, I feel that we need to give greater space and power to these other perspectives. And I would be concerned that that would just be coopted or lost (Researcher A, Group Interview 2).*

A second researcher on the same project posed future engagement with physical scientists on their chosen issue as a next possible step in a more 'radical interdisciplinary' (*cf.* Evans and Martin 2004) effort. Altogether, the ISG project is positioned as necessary social science groundwork. As she put it, *'we need to do that building up of the social perspectives before we engage'* (Researcher B, Group Interview 2). Interdisciplinarity in this sense becomes a process over time, starting with the seed grant and progressing through further projects to increasingly radical forms of interdisciplinarity.

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[6] Agonism is committed to the potential for positive change to emerge out of criticism of existing structures.

In another project with Agonistic-Antagonistic leanings and a similar commitment to societal change, there was a strong focus on not only bringing diverse disciplines and their practices together, but on overcoming conventional divides between academic researchers and community members. As an anthropologist involved asked:

> *What is the value of interdisciplinary research if it's not to change the process of doing research, or the relationship between the research academy and the community? (Researcher C, Group Interview 1).*

Here, interdisciplinarity is associated with an alternative approach to academic knowledge in which disruption of disciplinary boundaries symbolises and facilitates a disruption of the boundary between academic and lay knowledges.

All of these variants are included under broad definitions of interdisciplinarity. As indicated above, the ambiguity that broad definitions house can be a strength, allowing for creativity and novelty. However, as discussed further below, ambiguity can also be a weakness if researchers begin a project with contrasting understandings of the approach or rationale involved in their collective interdisciplinary endeavour. At the same time, achieving clarity by imposing one view of the project in a hierarchical manner is unlikely to facilitate productive interdisciplinary interaction. As Petts *et al.* (2008) note: 'if frames are imposed rather than negotiated, this will lead at best to misunderstanding, and at worst to antagonism from disciplines that are marginalised as a result' (p. 598).

2.2.2 Aims and expectations for the projects

Institute directors generally expressed a strongly entrepreneurial attitude to the ISG scheme. Stressing that their aim was to support exciting, highly innovative projects and novel collaborations, they made clear that they accept that some such projects have a relatively high chance of failure (in the sense of the research not leading to the desired outcomes). Focused on 'upside risk' (the potential gains of taking a risk), they highlighted the opportunities rather than threats involved. As a couple stated:

> *The money is best spent in risky nascent projects which genuinely provide new opportunity which otherwise wouldn't be there (Institute Director 4).*

> *The nature of them is, perhaps, you know, to try and do some different things. Some of [the projects] are expected to work, some of them... There's a casualty rate, as you'd expect [...] Some of them are tough new areas to work in, and knowing how to work in the areas is challenging, so the results haven't been startling. But, you know, there's a breeding time in that. Learning by doing is one of the issues (Institute Director 3).*

This approach stands in contrast to the focus on 'downside risk' (the potential losses of taking a risk) in conventional meritocratic approaches to assessing research, underlining that the scheme itself is novel. At the same time, many directors indicated that their desired outcome for projects includes a significant proportion of them eventually securing large external grants, representing a familiar interest in return on investment figures and grants as a symbol of academic credibility.

That said, most directors indicated that they also value the intangible benefits such as new ideas, networks, and researcher experiences that are generated by the scheme. As one commented, success to him is that researchers develop:

> *A sense of value in doing this stuff - that they're, you know, that there's a context in which they do their research and a value for it [...] I'd hope it would lead on to productive lives as researchers, whichever trajectory they go in (Institute Director 5).*

This director also expressed a desire that the novelty of the projects' outcomes changes others' perception of what the University is capable of:

> *Eventually, perhaps not immediately, eventually, [I hope it will lead to] something that makes groups outside the University stand up and open their eyes and say "We didn't expect that from old University" [...] Impact beyond our traditional spheres of impact, but building on our strength in those traditional spheres (Institute Director 5).*

As illustrated by the quote above, many directors expressed awareness that the successes of ISG projects may emerge over relatively long time frames. They also indicated that the scheme is designed to get research going quickly. In further contrast to the slow and laborious nature of large external grant programs, the scheme aims to make money available relatively quickly and easily, thus speeding up the formation and implementation of potential collaborations. As one director stated:

> *There is a limit to what you can do when you're all physically isolated from one another and you have to work really hard to get people together and you have to find methods and means to put them together. So the interdisciplinary grants are a great pot of honey that academics are attracted to, particularly early career researchers. They see an opportunity here for a sizable sum of money at a very low opportunity cost because the grant application is really very shortened. And the reporting requirements - they don't have to put in a very complicated budget. They can have their money and they can have a go (Institute Director 3).*

The focus on early career researchers was frequently mentioned by directors. An implicit goal of the scheme and part of its 'seeding' intent is to get in 'new blood', as one director put it (Institute Director 2). As another commented, 'we are after seed funding new people' as much as projects (Institute Director 3). This support of early career researchers is not simply altruistic. As indicated above, it allows the scheme to attract researchers with relatively modest funding, enabling funding to be spread over numerous projects and increasing the chance that the funding will meaningfully "add value" to what an individual is working on rather than being absorbed as 'chump change', as one director phrased it, into a large research portfolio. To the extent that it involves bringing in new people, supporting early career researchers also adds to the novelty of the collaborations involved. Further, it was related by a few directors to the quality of the projects:

> *I think probably, you know, this is a scheme which is best suited to having young energetic people, perhaps with a mentor of some, you know, serious heavyweight involved, but light-handedly [...] I mean, I think they're more interested in (a) slightly*

revolutionary type approach to stuff - making a difference stuff, you know, changing the status quo stuff (Institute Director 5).

The way the support is implemented is by deliberately turning away from the conventional focus on track records. Not only do project groups not have to have a track record in their proposed area of study, but individual researchers do not have to have a track record in that area or even have a long track record in general. One director reflected on how the selection process focused on the quality of ideas rather than track records:

> **Most institute directors are looking to fund a portfolio of highly innovative projects that as a whole provide a return on investment in the long term. Most researchers were strongly focused on the potential academic outcomes of their projects.**

> *Around the table when people are evaluating proposals there's a very interesting dynamic, which is that people genuinely are looking at the project. And in fact the track record of the people involved - which is usually the main ammunition that you have in a regular grant - is in fact a detriment. So people like grants from people they don't know [...] Very often when we are talking about grants, its "Oh this person has 50 publications, clearly a wonderful researcher, we can be assured of a good outcome". But that wasn't the case. People said "that's a really interesting idea" and one of the things that was so valuable about us all sitting around the table is that your idea had to capture the imagination of people that know nothing about your area [...] I read an awful lot of proposals and it's very hard to distinguish between them. And when someone comes up with something that's really new and different and invigorating, it stands out (Institute Director 3).*

Numerous directors were reflective about this element of the selection process because they had collectively discussed it in order to overturn an initial selection criterion that inadvertently privileged more senior researchers. As one explained:

> *Part of the reason that some of the people, some of the very senior people, appeared on some of these grants is because of the rule that we had that demanded that at least one person on the grant had a two-year tenure. And that actually was a big limitation that we've now dropped. In other words, one of the chief investigators would have to have a guaranteed position till the end of 2012 for the current round. Now we've relaxed that and they just have to have a position for 2011 (Institute Director 3).*

So how do these aims and expectations match with those of the researchers involved? Like most directors, many researchers were strongly focused on the societal benefits their research offered *and* strongly focused on academic outputs, namely papers and grant applications. While not all project applications report academic publications under their expected outcomes (something discussed further in Section 2.4.2), there was a consistently strong focus on subsequent large grants: on using projects to 'prepare the ground', as one researcher put it. The majority of projects were framed as a means to the end of further research funding, reflecting the 'seeding' intention and

labelling of the grant and the associated application criteria. While this could stem from researchers presenting appropriate answers rather than expressing what they actually want to achieve, interview data suggests that most researchers genuinely want to secure further funding in order to achieve continuity, momentum and impact in their research. Part of the popularity of further grants (namely from the ARC or NHMRC) is that they count as success regardless of whether one is motivated primarily by societal or academic interests, simultaneously enabling further practical gains and legitimising the academic credibility of the work.

In project applications, "expected outcomes" were variously expressed in a spectrum from a sole focus on the societal impacts of the research (e.g., improved renewable energy production in Victoria, progress on developing a vaccine), to an additional emphasis on the strategic institutional or academic benefits also offered by the projects (e.g., new research clusters, new industry linkages, new commercialisation opportunities), to a sole or additional focus on academic outputs (e.g., data, literature reviews, workshops, journal articles, books). The extent to which the collaboration versus research content was emphasised also varied. While all proposals included elements of all these factors, the balance between them varied strongly, reflecting differences in researcher motivations, perceptions of the purpose of the ISG scheme, and how close projects are to the academy/society interface (those working at the conceptual stage are necessarily limited in what societal benefits they can claim).

The intended academic outcomes of the projects especially overlapped with what many researchers reported they expected to get out of their project personally, suggesting that for many researchers their professional identity and success is a deeply established part of their self. Some people reported detailed aspects of the projects as their personal motivation, such as 'interest in new technology' (Survey R1-10), 'learning new techniques' (Survey R2B-7) or 'chance to get some useful equipment' (Survey R1-11). Alternatively, others listed intangible benefits such as excitement, stimulation, understanding, opportunities and contacts as their main personal motivation for being involved.

Collaboration was generally viewed as a critical enabling factor in the projects. Supporting the strategic view of collaboration (discussed in Section 1.3.2), researcher responses indicate that they often value co-researchers as a source of:

- labour;
- knowledge, skills and ideas; and
- contacts (including with industry and target populations).

These benefits are tempered by the costs and risks that researchers also expect collaboration to introduce, including difficulties in meeting everyone's goals and expectation, combining perspectives and paradigms, and coordinating people's schedules. Some researchers embarking on their projects in Round 2 noted that they were unsure how their group collaboration would play out and. As some said, they expected the challenges to be:

- *For everyone to understand the goals clearly and for everyone to share them (Survey R2A 34)*
- *Communication/cross disciplinary understanding (Survey R1 19)*

- *Confusion over the same concepts with different meanings (Survey R1 16)*
- *Uncertainty as to how we decide on anything (Survey R1 7)*
- *Getting all the personnel involved and understanding each others' aspect of the research and what problems can be solved (Survey R1 1).*

Some of these issues highlight the particular challenges of practising interdisciplinarity. While all projects needed to develop a degree of shared understanding for the application, it seems from researchers' comments at the end of projects that there was often still a long way to go in establishing more detailed areas of intellectual and practical overlap when the project commenced. As one researcher explained:

> *I think very often it's very easy to link research at a conceptual level. So I could probably go to the agricultural faculty and [...] over coffee, find an idea that is... You know, the conception level is very different from the actual practical. So then [the question is] can we actually investigate, is there an overlap in the methods or in, like, a meeting point somehow in the methods we use, in the questions we ask? (Interviewee B, Group interview 4).*

The above ground work is time intensive, which is why many projects only take it to a certain level when putting together their applications. Whether they would then have time to devote to such work once they commenced their ISG project was a concern mentioned by numerous Round 2 researchers as they embarked on their projects. Reflecting the time pressures academics in general are under (Bexley *et al.* 2011), time management was the most the common topic across all researcher comments. Critically, this was not only as an expected contextual challenge (given the relative brevity of the projects and busyness of people's schedules), but as a proposed solution within the projects for the intellectual and inter-personal challenges they expected to face (that is, using regular contact as a core strategy for maintaining engagement and developing understanding). This paradox – that the context and character of the ISG projects means researcher time is both in short supply and especially necessary – is discussed further below.

2.2.3 Prior experience with short term, grant based research

The ISG projects have a range of specific characteristics that researchers may or may not have had experience in. This experiential base represents an important influence on researchers' motivations and expectations about ISG funded research. One of these is simply whether they are familiar with grant based research. While research grants are a way of life for most researchers, this is not the case in all disciplines. Pointing to one of the many cultural differences that accompany topical, philosophical and methodological divides between the disciplines, some disciplines and associated faculties rely more heavily on external grants than others.

This was emphasised by a researcher on a project that brought together a specialised area of science within his field. He noted that research in the scientific field is consistently funded by external grant money and this is tightly tagged to specific projects. In contrast, in his faculty, numerous research projects utilise commonly owned databases and specifically funded grant-based research is uncommon. As he explained:

What's very difficult, what's totally unusual in X [his discipline], is the idea of having large expenses for one particular study, for one particular paper, like you would do in [...] science [where] you would spend $20 - $30,000 just on [...] analysis. That, in our area, is unheard of. [...] So [our ISG research group was] at a position where we wanted to do [...] a project that required significant - a five-digit amount - of money. But Y [his scientific co-researcher] didn't have a grant in this area. And we couldn't go to my faculty to ask for it. So it was very helpful that the University enabled us financially to do a seed project in the area [...] It allowed us to do maybe what we could call a feasibility study or more like an initial project in which we could trial, during which we could trial, whether we could work together in the first place [...] I don't think we would have done this without support by the University (Researcher B, Group Interview 4).

Thus, the ISG funding in this case filled a gap not only between disciplines but between the limitations of different disciplines' funding structures and norms. Disciplines in which research typically involves low start up costs may be less accustomed to research being tied to specific grants.

> **Different disciplines have different norms and cultures of research practice, including whether they are accustomed to grants such as the ISG.**

Besides funding, grant based research has other characteristics that expose differences between disciplines' customary ways of working. Another researcher in the project discussed above explained how they encountered different expectations about the speed of work. Compared to research based on an existing readily available database, getting new grant based research up and running can be time consuming, especially if there are new equipment, techniques or ethics applications involved. As this scientist explained:

Another aspect of doing interdisciplinary work […] is that the timelines are often understood very differently by different disciplines. So, just as X [his co-researcher] was saying, if you already have an infrastructure like a database and you're doing research on it - I don't know what the timelines are, but compared to [his own area of work] - well our normal experimental timeline is about a year. That's really as fast as possible, and it's more like 18 months typically. Meaning that when you get a grant, to when you get an ethics approval, to when you do the [experiment], and then you do the analysis, and then you do the write up... All of that takes time… (Researcher A, Group Interview 4).

Timescales for operation may differ not only between disciplines but between academic and non-academic groups if the latter are involved. Discussing the division of labour within her project group, one researcher working with a charitable organisation noted that it was up to the academics 'to do the conceptual work' while 'the industry partners just sort of hope they get on with it and be a bit quicker' (Individual Researcher Interview 5).

Besides difference in normal practice, unforeseen issues can also slow progress. Numerous researchers in the sciences, for example, mentioned having to wait for equipment to arrive,

experiments to be repeated, and data produced. Such differences in normal research practices and procedures between disciplines can be exacerbated when an interdisciplinary project has to start from scratch, as with most grant based research.

2.2.4 Prior experience with collaborative research

Virtually all sampled researchers were drawn to the ISG on the basis of a positive conceptualisation of collaborative research. For many, this was informed by previous positive experiences with collaborative research, with about half reporting that they had a high or very high level of experience and nearly 90% rating it as strongly or slightly positive.

> **Most researchers had some level of experience in collaborative and interdisciplinary research and had enjoyed it to a degree.**

The breadth of experience with collaborative research reflects the normalisation of this way of working in academia, as discussed in Section 1.1. This is particularly the case in the sciences, where 'team science' is of functional importance in the context of increasing individual specialisation. As one scientist put it:

> *Science [...] cannot be conducted without collaboration. It's like you have your own field but you always need expertise from someone else. We are probably specialists in one domain or one technique, so it's not enough to get the full picture of what we try to resolve (Individual Researcher Interview 7).*

As discussed above, collaboration also has strategic importance within the competitive academic environment as competition between individuals is replaced by competition between teams. The existence of this attitude to collaboration is supported by comments by another scientist who remarked that many teams in science consist simply of a senior person and their cohort of staff and students, leading to 'vertical' collaboration rather than 'horizontal':

> *Some people just tend to do "up and down collaboration" sort of thing, rather than network, rather than actually spread across different fields (Individual Researcher Interview 2).*

To the extent that this is the case, it suggests that collaborating in an *interdisciplinary* way is a new challenge. The extent to which people recognise and accommodate the novel aspects of interdisciplinary collaboration as opposed to intra-disciplinary collaboration is an open question, as discussed below.

2.2.5 Prior experience with interdisciplinary research

Across the two rounds of the ISG scheme about 80-90% of respondents had had prior experience with interdisciplinary research. Within this group, all rated their experience as "OK" or better, with

nearly 70% rating it as "strongly positive"[7]. That no one reported having prior negative experience of interdisciplinary highlights the role of positive feedback in motivating involvement in further interdisciplinary research. It also shines a light on the role of interdisciplinary research in the University. That no one seems to have "forced" themselves to be involved in the ISG scheme for extrinsic reasons underlines the self-selected nature of participating in CIDR within the University. Those who have not enjoyed such activities in the past (presuming there are some) are free to choose not to be involved in it further. This reflects the fact that, in contrast to disciplinary work, interdisciplinary research is not seen as a prerequisite for career advancement.

The level of experience with interdisciplinary research dropped across the two rounds of the ISG funding, with more of those in Round 2 (20%) having never engaged in interdisciplinary research than in Round 1 (7%), and less having a high level of experience (defined as involvement in 6-10 projects) (13% in Round 2 versus 30% in Round 1). This suggests that the scheme has begun to draw in more than those already familiar with interdisciplinary research and is encouraging a new "audience" to engage. This expansion into the University mainstream may be because: it has become more widely known by interested researchers; others are increasingly convinced to try such research after hearing about the positive experiences of those involved in Round 1; and/or extrinsic drivers of CIDR (e.g., greater availability of funding and/or focus on grants obtained) are having an influence.

About 60% of respondents indicated that they identify with and work in more than one discipline. As one researcher commented about his own involvement in two disciplines, for example:

> *There are people who do see very, very firm lines, the boundaries of their discipline [...] And I'm aware in my own work - when I'm doing sociology and when I'm doing political economy and when they're not really gelling with each other. So, yeah, I'm really aware of disciplinary boundaries (Individual Researcher Interview 3).*

These references to "doing" one discipline or another highlight the important difference between the cross-disciplinarity of individual pieces of research versus that represented by the whole of a researcher's research activities. It suggests that disciplinary boundaries may be performed through the conduct of research projects as much as the coherence of individual researchers' identities. An image is created of a population of mobile researchers flying between disciplinary islands and congregating on their chosen one to engage in relatively "immobile" disciplinary research with others, sustaining the discipline with their visit before leaving again to do the same elsewhere[8].

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[7] It is important to note that the sample is likely to be biased towards those with positive perspectives on collaborative and interdisciplinary research and the ISG scheme in particular, as those with more negative perspectives are likely to have opted not to participate in either the ISG scheme or this research on it.

[8] If researchers are already comfortable with crossing disciplinary boundaries but tend to position any one piece of their research within one or another discipline rather than at the interface, we have to consider why it is that research is positioned in this way. Is it because it sets a common language and mode of operating for a project that makes it easier to progress with? Is it a function of administrative requirements? Or is it a way of playing the dual track game – achieving disciplinary expertise but also conducting reconnaissance trips into other disciplines to satisfy personal interest?

Such sequential disciplinary performance may create a working life that is "multidisciplinary" but not necessarily "interdisciplinary". Yet it is likely that being "bilingual" in more than one discipline increases sensitivity to cross-disciplinary differences in a way that is valuable for subsequent interdisciplinary work, as well as possibly building understanding of another specific discipline involved in an interdisciplinary endeavour. 96% of those in Round 1 and 74% of those in Round 2A who identify with more than one discipline reported that they thought their experience with other disciplines would help them with the interdisciplinarity of their ISG project. Interestingly, 11% of Round 1 respondents (and 3% in Round 2A) reported that the discipline they are most associated with in their ISG projects is not the main discipline with which they identify, pointing to a doubled practice of cross-disciplinarity by these researchers in their ISG projects.

2.2.6 Prior experience with the research topic

Projects pursued under the ISG scheme sit along a continuum of researchers' prior involvement in the topic (and in some cases, prior involvement with the research group). Across all Round 1 projects, 4% had worked on the topic area of their ISG project extensively while another 4% had never heard of it. 39% had worked on the topic to an extent and about half knew something about the topic but had not had worked on it. The proportions were very similar in the Round 2 surveys.

The resultant projects can broadly be classified as three ideal types - seeds, seedlings and branches – which represent a continuum in how new the research topic is for those involved. "Seed projects" are those based on largely new ideas, topics and groups, often catalysed by the opportunity to put a project together. While of course no idea emerges out of a vacuum or is disconnected from researchers' existing interests, these projects are those that represent the greatest degree of departure in research direction for those involved, and perhaps for any researcher. One respondent for example stated that their project originated because:

Most researchers were familiar with or experienced in the topic of their project but very few had worked on it extensively.

> *'I considered a "space" not apparently dealt with and sought appropriate collaborators' (Survey R2A-7).*

Although not necessarily reflective of a low level of research experience in the area, numerous interviewees also described their project as emerging out of conversation with others, who in some cases they did not previously know.

Closely related, "seedling projects" are those projects motivated by a desire to pursue an often quite specific and long-standing problem of concern or potential area of work. Often driven initially by the ideas of an individual, the ISG scheme in these cases provided an opportunity to explore a pre-existing research interest for the first time and/or work with a potential colleague in a more sustained way. As a sociologist explained, for example, the central issue of her topic was something she had been already thinking about. It was also, crucially, a topic she was already in conversation about with potential project partners:

I'd been talking for some years to different people about that. But in particular, I'd been over to [an NGO] and spoken to them about it. And they were very interested and concerned and it was very relevant to a lot of things that they were doing. And I've done a seminar there and other things, so when this seed grant opportunity came up, we had a talk about whether this would be a good project to see if, to get going, to get some research going in the area. So it came out of that, which I think bode well, because it was already there. We didn't have to think of something. We'd already been talking about something and so this became a vehicle to actually develop the ideas further (Researcher A, Group Interview 1).

A chemist, education researcher and atmospheric scientist also found the ISG project allowed them to pursue long held interests, as they described in turn:

It's sort of something I've always been very keen to try and do [...] But [...] like I don't have at the moment a program [on it] [...] I'd always wanted to go into that and this is a great opportunity for me to have done that and I'm pushing that. So from, like, a senior researcher's point of view, it aids you going into areas where you couldn't go before - where you wanted to, but you've not had sort of the weight to roll into that area. And I think this has definitely aided me getting a bit closer to working into [the area] (Individual Researcher Interview 2).

I've always been interested in [this topic] [...] But even when I did my PhD, I didn't really think about [the new aspect she is now looking at]. [...] It was still working within the confines. And so to have been able to work on projects like this with [...] other people who are used to thinking about [the topic in this way] has been very enriching and a really nice capping to what I've been researching and thinking about for a long time (Researcher A, Research Interview 3).

I've been thinking about this project for a while and I'd played around with little toy models of my own but was never able to do it properly. So [with the grant] it went from being something I did in my spare time to something I actually committed a significant amount of time to do (Individual Researcher Interview 4).

Some survey respondents similarly noted that their projects stemmed from long standing interests, or as one put it, from 'an idea that had been floating around my head' (Survey R1-1). Besides bringing ideas to the surface, the ISG helped coalesce 'hallway conversation' into formal collaboration:

One of the things that's come out of it which has been really good is there's been people that we've talked to in the hallway for example and it's just "Oh, we're doing kind of similar things, we should work together" [...] But it never happens unless you've got a formal process to actually go through and give you a little bit of money or a little bit of I guess even responsibility [...] It is always just the hallway conversation and saying "Yeah, yeah, one day we'll do that", but you never do (Individual Researcher Interview 6).

When asked about who from his subsequent research group had the initial idea for their project, this chemist further emphasised that the idea was "sitting there":

> I'm not sure that anybody actually had the idea. I think the idea was just sitting there waiting for somebody to actually write it down (Individual Researcher Interview 6).

Although a relatively informal grant in many ways, the ISG nevertheless has provided enough formality, structure and encouragement to help numerous projects transition from vague idea to active focus.

The third type of projects are the "branch projects": those that were new research projects but stemmed from pre-existing research efforts and relationships, with the aim of continuing, extending, updating or gap filling such work. One interviewee, for example, used the grant to build on some influential work conducted on an ARC project 15 years ago:

Most projects were initiated by one or two individuals who, on the basis of their conception of the project and their networks, then invited others to be involved.

> I had had some discussions with X [his co-researcher] prior to this initiative and we had been looking at ways in which we could regenerate the work. So when this came along, it was absolutely the best opportunity that we could have asked for [...] So it's come in the context of work that we've done before, which has been influential and I think it would not be immodest to say that we are seen as people who are innovators in the area [...] I'm doing a whole lot of other things now, so [...] it's enabled me to get back into something that I always was interested in the past (Individual Researcher Interview 3).

Similarly, some survey respondents noted that their projects stemmed from:

- 'Development of a larger Linkage Project application' (Survey R1-30)
- 'Extension of existing collaborations' (Survey R1-12).
- 'It was a topic that interested me but was peripheral to our current funding' (Survey R1-12)
- 'Discussion about the reviews received for an NHMRC grant application' (Survey R2A-32),
- 'From previous research results. We wanted to make our evidence-based interventions available to everyone' (Survey R2A-34)
- 'A lot of intense thinking about my current project' (Survey R1-18).
- 'We had previously worked on a similar idea that needed developing further' (Survey R2A-28)
- 'Project idea arose as part of another study' (Survey R2A-22)
- 'The team was already involved in similar collaborative research in the last ten years. This project builds on this track record' (Survey R1-14).

The mention of track record in the last quote above reflects the high value attributed to this form of "academic capital" in conventional research grant assessments. Researchers' emphasis on their experience in the topic area they pursued through the ISG scheme may reflect their expectation that, whether explicitly asked for or not, such assessment criteria shape decisions in the ISG scheme application process as well. Alternatively, this emphasis on prior experience may be less about image management and more about the fact that individuals' research trajectories reflect incremental change in current interests and the pragmatic need to draw on existing resources. Extending extant research projects and collaborations represents a low risk avenue not only for funding agencies but for the researchers involved. In a pressurised professional context, the likelihood of achieving tangible outputs is no doubt an important consideration for many researchers.

A variant of the "branch project" are those ISG projects that form part of a portfolio of research projects conducted by one or more teams. One interviewed project team for example were simultaneously investigating three aspects of a central issue, of which the ISG was one. Here, the ISG project "added value" to the other projects and also leveraged off them, providing a broad platform of work on which two ARC Linkage Grants are now based. Another project team discussed the fact that the ISG project served to not only "fill a gap" between their diverse disciplines but between projects, allowing them to do a technical piece of work that supported other projects.

2.2.7 Prior experience with their collaborators

Related to the question of researchers' familiarity with CIDR and their research topics are the questions of the social origins of the research topic and researchers' relationship with other project members. Only about 3% of the projects sampled from each round were reported to be pre-existing groups (noting that there may be variation in whether people interpreted this to mean active research collaborations or past ones). In these few cases, a positive pre-existing relationship is likely to have accelerated progress on the projects. One media communications researcher whose ISG project was conducted with a past collaborator (and two newer ones) noted that 'one of the distinctive factors' that made their project 'so successful':

> *was that the participants did know each other and had worked with each other [...]*
> *The present project was a way of revisiting and yes, basically updating work that X*
> *[his co-researcher] had done with me all that time ago [...] It meant that we, we*
> *knew each other, and we knew what each other represented and brought to the*
> *project [...] There was this history of working that we'd done in the past, but that*
> *really needed to be revisited. So it was pretty clear what it was that we should do.*
> *So it's all been very coherent, really. (Individual Researcher Interview 3).*

Like the project above, 40-50% of project topics were the idea of a single individual and a further 30% or so were initiated by two group members. These individuals then put together an interdisciplinary team in an attempt to embody their mental image of the project's disciplinary components. In this situation, the interpersonal collaboration followed the imagined interdisciplinary character of the research problem. As an atmospheric scientist explained, in his project:

I brought the original idea to the table and so I had a vision that I wanted to turn into a reality, into a research project. So I had to recruit people and convince them that it was a good idea and get them involved. That was my main role [...] We kind of made the links to the other people in the group by what we perceived as being the necessary partners to make the project work. But we didn't know them - we hadn't worked with them before. [...] We took a bit of a risk bringing together people who hadn't worked together, who maybe didn't understand what each other was talking about and tried to make it work (Individual Researcher Interview 4).

The eventual make up of such "hand picked" projects reflects the way that different individuals prioritise the risk of collaborating with people they do not know versus the risk of not getting the "right" people to help enact their envisaged project. Tempering both risks is how well connected individuals are with others in appropriate fields.

About 20% of projects were constructed through a cascade of contacts, with each group member inviting another in a sequential fashion ('snowballing'). In contrast, in situations controlled by one or two research leaders, the strongest (initial) connection is likely to be between them and those they pick, rather than between the other group members, even if the leader is bringing in people they do not know. These different patterns of group formation have consequences for how the different disciplines come to be represented in the project, and thus for: the mode of interdisciplinarity enacted; the methodological shape of the results; and individuals' research experience. Researchers "brought in" to a project already in development are likely to be disadvantaged by being more unfamiliar with both the project idea and other team members. While most survey respondents were – as could be expected – the official or unofficial research leaders on the project (indicating that filling out the survey was seen to be something done "on behalf of" their project team), others reported that they had become involved "by invitation". Some were also clear that they were included in the project to provide a discrete kind of "service" for the project's intellectual leaders, reflecting a Subordination-Service mode of interdisciplinarity. While some noted that they expected to contribute generic skills like creativity, project management or facilitation skills, many referred to a specific area of discipline-based expertise. As they commented when asked why they got involved in their project:

- *I was asked to do the economic components of the project (Survey R1-19)*
- *I'm a technique specialist (Survey R1-25)*
- *I was approached because my background strengthened the application (Survey R2A-6)*
- *I have a biological preparation suitable for the project (Survey R2A-24)*
- *My expertise in the instrumentation and in my field are complementary for this project. I will establish the methodology and train a postdoc to use the technique (Survey R2A-3).*
- *The requirement for mathematical optimisation in the project (Survey R1-29)*
- *The two primary people wanted to use techniques that I have expertise in so they approached me to be involved. I thought is sounded like a good idea so I agreed (Survey R1-28).*

The mention of "agreeing" to be involved underlines that while invitations for involvement may be extended, they may not always be accepted. The atmospheric scientist quoted above, for example, found that while overall he was 'pleasantly surprised at how easy it was to get people on board' with his strongly problem-driven project, he did encounter difficulty in finding anyone from a particular desired discipline who would agree to take on the role he needed them to play. Those he spoke to perceived the expertise being asked of them as not too minor within the project, but as too unsophisticated. Although the group had recently found a graduate student who was considering helping them, earlier efforts had been unsuccessful:

> *We really wanted to get a [person from discipline X] involved as well and that was one thing which we failed at miserably. The reason was because what we wanted to do was more just an application of X than X research. And so the X researchers we spoke to were just like "That's like third year and we're not interested" (Individual Researcher Interview 4).*

To the extent that researchers want to engage in projects in which they can have substantial intellectual input, the Subordination-Service mode of research can be unappealing if the small size of their input is combined with a low level of sophistication (and thus interest and status), even if this project design is driven by a very legitimate problem-based rationale.

It is not surprising that, in many of the project groups interviewed, the collaborative and interdisciplinary character of the projects – that is, group membership and project topics - co-evolved iteratively. For example, the following interview excerpt reflects the iteration between project leadership and the evolution of the project as a new member's art-based interests were incorporated:

Artist:
> *[The project leader and I] just had a cup of coffee and I ranted about all of my interests at the time and it just sort of made sense [for me to become involved]. So I think the actual job description was very much revised because I brought a particular area of skill [...] (Researcher B).*

Sociologist:
> *I think that when I had that coffee with [her subsequent RA] [...] I saw a great potential [...] and just thought "Ah, that's what we need. That's what it needs" [...] It is that opportunity to have a different kind of idea and want to do the research in a different kind of way (Researcher A, Group Interview 1).*

Here, the limitations of the initial project as conceived by the project leader were recognised by her in the process of interacting with someone who brought a different perspective and skill set. She then took on board the quite profound implications of this different approach by adjusting the project to accommodate a new methodology, which then became one of the most innovative elements of the project. Depending on when the research process is considered to begin, the group-based origin of project topics in this way means that CIDR preceded the identification of specific research questions rather than followed as a necessary tool.

As mentioned above, across all projects, eventual group membership reflects not only the imagined or actual needs of the project but people's social networks. The latter is shaped in part by who people already know, work with and "bump into". Given that very few ISG projects emerged out of pre-existing groups, broader networks are also likely to have been called upon in order to fulfil a perceived role on the project. These networks reflect the broader circle of who those they know further know, and who researchers can access via their membership of formal networks such as the research institutes. Researchers described meeting collaborators at formal networking events, workshops, and group meetings, as

> In some cases, the collaborative and interdisciplinary characters of projects co-evolved as group membership shaped the research topic, and vice versa.

well as in the form of informal discussions, including 'bumping into people in the hall' (Survey R1-31), and 'discussions in the AGB cafe' (Survey R1-8). One noted that industry events hosted by her faculty were 'powerful places to start these kinds of conversations' (Researcher A, Group Interview 3) and a couple mentioned the Interact Forum as the origin of their project groups. A neuroscientist discussed the catalytic role played by a mutual colleague:

> [A mutual colleague and I] started working together probably 2 and a half years ago [...] So I was familiar with [his] general area. But I mean, it's a fairly big stretch from [my own discipline] [...] And whenever we would chat, it would take a lot of effort to get something happening - which would be of value to both of us and potentially competitive. So it was always just a chat [...] But then when [the mutual colleague] came back to me and said he'd met with [his subsequent co-researcher] [...] it became, I think, probably the right mix of people [...] So it was clear to me that there was an exciting new hot area. But on my own it would be just impossible. So then this meeting took place and the opportunity of putting a grant application together for the seed grant came up and that just seemed like it could fit at the right time, really (Researcher A, Group Interview 4).

A sense of things "coming together" with the right people at the right time was frequently expressed by researchers in describing the origin of their projects. The role of such serendipity, as one researcher phrased it, points to the fact that in any given year the ISG funding round may catch some people at the "wrong" time. For, while the application itself is simple, finding the right topic and mix of people is not. As more people become aware of the ISG scheme and so are able to anticipate and plan for the opportunity to submit a proposal, this sense of being "caught", ready or not, is likely to be lessened.

2.2.8 Role of the ISG funding in project formation

While the "pieces" of an interdisciplinary research project may exist, they may not "come together" until catalysed to do so. It seems the ISG funding provides such a catalyst. Reflecting similar proportions in Round 1, 84% of projects sampled in Round 2 stated that the ISG funding was of moderate or greater importance to their project's formation. Indeed, within this, 32% rated the funding as 'essential'. As one researcher explained: 'I initiated [the project] as a result of seeing the funding round' (Survey R2A-7).

At one level, this emphasis on the importance of the ISG funding underlines the importance of funding in general for any projects' formation. Given the uncommon nature of CIDR, it is likely the availability of funding was especially important for those projects subsequently funded by the ISG scheme, not only practically, but symbolically and culturally. This is supported by the fact that even more researchers in Round 1 – when interdisciplinary research was less well known or supported in the University - rated the funding as 'essential' for their

> **The ISG research funding catalysed the formation of most projects, especially in Round 1.**

project's initiation (45%). The Institutes also seemed to have indirectly played a stronger role in initiating the projects in the first year. In 2009, all researchers already knew or were involved in the Institute their project became attached to, while in 2010 over a quarter did not previously know of the Institute's existence, and the proportion of those funded who had a formal role in the Institute dropped from 21% to 7%. This suggests that since the first round of funding awareness of the ISG scheme has extended beyond the immediate networks of the Institutes into the broader University population. This is made more significant by the fact that researcher awareness of the institutes is also likely to have increased over the period. It should also be noted that many researchers' knowledge and understanding of the Institutes remains vague. One interviewee from the Round 1 projects for example did not even know that the institutes were involved in the ISG scheme.

2.3 Experiences and reflections on process

2.3.1 The application and set up process

Some researchers commented in interview about the application process for the ISG scheme. There was strongly positive feedback about the low transaction costs involved, given how much time and effort many other grant applications demand. Because it was different to the norm and does not come with a lot of explanation, some researchers also felt unsure about what the ISG scheme is and who was assessing them. As one interviewee commented:

> *Actually it was a very – quite a small application and I wasn't quite sure who you were actually writing it to. It was a little bit different like that... (Researcher A, Group Interview 1).*

While the simplicity of the process was appreciated, it did also introduce some ambiguity about how the grant – and interdisciplinary research in general – fits within the broader academic landscape, leaving questions in researchers' minds about what the motivation, context and process of the grant scheme was. Some researchers also indicated that they would have liked more information and transparency about the application selection process, with one researcher in particular very suspicious about how decisions were made and convinced that only well-established and well-connected researchers got funded in the institute he applied to.

A lack of understanding of the ISG scheme reflects in part a generally low level of interaction between researchers and their relevant institutes (noting this varies between institutes). Before the applications were submitted, some researchers (usually project leaders) met with their relevant Institute Director, in some cases in accordance with some institutes' requirement to do so. Directors

noted that they appreciated it when researchers made this effort. However, despite these initial inquiries, many researchers gave a sense of feeling that they needed to be invited "in" to the institutes and this may have hindered them initiating further discussions both before and after the application process despite this being what they would have liked.

As discussed further below, some researchers expected that through the projects they would become closely involved in the relevant institute(s) and were disappointed when this was not the case. One interviewee, for example, was surprised by the fact that she merely received an email from her nominated Institute saying that she had got the grant, and then did not hear from the Institute again. This and other examples signal that some researchers expect and want their ISG project to help embed them into the University and into a community of interdisciplinary scholars in particular. To the extent that the appreciated simplicity of the application process is followed with a minimal intervention approach by the institutes, opportunities for connecting with researchers and building a sense of belonging, intellectual engagement and momentum are being overlooked. As the researcher above commented:

> *I think X [the Institute] is missing opportunities. [...] They've got some plans I know for workshops and things this year [...] But I just don't know why they aren't more actively working with their teams of researchers around the place to promote the research. Isn't that their job? [...] We've had no contact with them [...] I reckon it would have been nice to have had a letter at some point from them [...] They could formalise their process a little more and say "You're part of the research team. Here's all the other ones that are working under the X [their topic] theme right now". Or, you know, just something. [...] I guess what we would have liked is greater recognition that this work was going on from the Institute and maybe an opportunity, not to just attend one of these meetings -"Oh, who's doing what?" - but rather a substantive discussion about the content of the work in a structured way (Researcher A, Group Interview 2).*

The idea of "formalising the process a little more" is not a call for unnecessary administration. It is about the important symbolic and social value that formal – that is considered, authoritative and possibly public - gestures of recognition can convey. More than a pat on the head, what is wanted is respectful peer-to-peer intellectual engagement: a recognition of and contribution to the academic and societal worth of the research endeavours that the ISG projects represent.

Early serious intellectual engagement with the research represented by ISG applications could help to manage an unintended consequence of the simple application process, which is "off the cuff" applications. While some groups emphasised that they did a large amount of collective ground work in preparation for the application, other collaborations seemed to exist only in abstract at the time of the application, and the form was simply completed by one or two instigators. For example, a couple of researchers contacted for the MICE survey were not aware that they had been listed as collaborators on projects. While minimum ground work is a rational way of reducing the

> **Researchers appreciated the low transaction costs of the application process and would like more clarity on some aspects.**

opportunity costs of the application process given that the project may not be funded, it does mean that if they are subsequently funded they require a lot of intellectual and group work to get going effectively. It also potentially means that researchers listed on applications, but not directly involved until the funding is granted, may commence a project relatively unfamiliar with their proposed project and the ISG program rationale, aims and criteria. Not only does this increase the amount of work required to get up to speed if their project is funded, it may more permanently reduce their sensitivity to the interdisciplinary character of what they are embarking on and its position within their institutional context. It also potentially sets up a dynamic where they have little sense of ownership of or responsibility to their particular project, which was an issue encountered by numerous projects (discussed below). One researcher who had problems with this in her group suggested that the application form should require input from each discipline in order to symbolise and initiate the interdisciplinary collaboration involved (Individual Researcher Interview 5).

A number of comments were also made by researchers about the financial management of the scheme: that it took a long time for the money to arrive once granted; that it was unclear how the money was to be managed or by whom; and that it was surprising that there was not more accountability. The last two points exacerbated power issues in some projects. As one researcher commented, there was a lack of transparency on who had control over the funding and how it could be spent:

> It's very unclear I think how the money is spent. Because there's been a few discussions in our [...] project about how and on what is the money being spent? And could it assist with research assistance for some members of the group? And by and large it goes to the person who put the submission in, and it's a bit of a mystery I'd say (Individual Researcher Interview 5).

This researcher went on to comment that some basic financial accountability would have assisted her group in not only planning and managing the project overall but in clarifying the amount and type of work each member was expected to and actually did dedicate to the project, allowing those who had worked hard to be recognised. Another commented that she also thought financial reporting would assist with this element of group management, with dollars acting as an indicator of expected researcher contribution (Researcher A, Group Interview 2). Such reports could provide a practical 'boundary object' for a group to collectively focus on and envisage the progression of their project.

More broadly, a number of researchers suggested that progress and final reports be required of ISG groups. Although this extra formality would add to the administrative burden of the project, they noted that it would serve as a focal point and mirror for groups, assisting those involved to periodically assess how their work and collaboration is going, and providing some leverage over recalcitrant group members. Similarly, someone suggested that the scheme should be more prescriptive from the start to help avoid recalcitrance and different expectations. They suggested the scheme should 'state the expected outcomes from the project (publication, successful grant, etc) to enable the researchers from different disciplines to have a clearer shared outcome objective' (Survey R2A 8). Others were not so sure, with some interviewees explicitly stating that no more administration should be involved and one survey respondent asking for 'less reporting, less meeting about things that are not to do with the actual research' (Survey R2A 17).

2.3.2 Managing time and budget constraints

As acknowledged by institute directors, the timeframe and quantum of the ISG grant is perceived by most researchers to be quite modest and short, although this depended on their other opportunities. But, even if perceived as limited in quantum and timeframe, this was not necessarily seen as a negative. Despite some people's impression that "a small grant is good, a big grant is better", researchers highlighted that the consequent 'smallness' of the grants introduces both advantages and disadvantages. These are discussed in turn below.

> **The modest size and duration of the grants introduced both advantages and disadvantages for researchers.**

By bounding the ISG projects to a degree, the twelve month timeframe and associated budget of the ISG funding (if not actual research activity) has the advantage of fencing off a manageable corner of the broad expanse opened up by interdisciplinary research. In this sense, it helps compensate for the removal of disciplinary boundaries and the lost focusing effect that disciplines usually provide. As Bruce *et al.* (2004) argue:

> ...disciplines have survived for so long in the academic world because they serve a very useful function of constraining what the academic has to think about (p. 467).

Numerous researchers commented that they liked that the projects were not too big or onerous. As one put it:

> *In some ways, I liked the limited money, because it was enough money to employ some really good RAs, and yet you had a year program and you knew that you were doing it as a start for something bigger. And so you didn't worry about it too much - you just jumped in and did it. I reckon it was great (Researcher A, Group Interview 3).*

A common way in which the modest size of the grants was used to benefit the project process was by managing expectations. As another researcher put it, his group thought of the ISG as an 'enabling sort of grant' and this helped them to focus and get going.

> *It's true the fact that you've only got so much money to work with creates a knowable limit on what you're able to achieve. But it was enough for us to hire a part time research assistant and also somebody to help him with interviews. So there was just enough money for that. Like I said, we didn't have enough money to bring [an interstate collaborator] down [...] In terms of being able to travel and do those sorts of things, you've got very little scope. And so we more or less said at the outset that we would conduct a pilot survey, which would give us enough data to write a paper [...] that we could use to leverage an ARC large grant. So we did see it as an enabling kind of grant and obviously we're glad to have it (Individual Researcher Interview 3).*

Another researcher commented positively about having to select what to work on in the project, pointing to the breadth of ideas generated in the process which may become part of later research efforts.

Clearly we had to pitch it to the amount of funding that we understood to be available. But yeah, it was a very nice process of trying to work through what we would or wouldn't do. And I guess we've always had a sense of "There's potential for a big grant down the track, so what can we do now that sets us up in order to apply for something bigger?" So it's a bit like when you're writing your thesis: when you can't put it in the thesis, you can't put it in a chapter, so you put it in the pile of the papers you're going to write afterwards (Researcher A, Group Interview 2).

Among the many researchers who approached the ISG project as a precursor to 'something bigger', there seemed to be two general ways of handling the containment, shaped in part by how familiar researchers were with their ISG research topic and in part by different disciplinary perspectives on what "preliminary work" should involve. One approach was to frame the project as an early stage exploration and scoping piece, emphasising the need for creative and conceptual thinking. This approach was also associated with a serious concern with interdisciplinary integration. Two of the groups interviewed emphasised that they had, as a result of the budgeting and time constraints, focused on conceptual work in this way, with empirical work mentioned as something that would hopefully come later. Another researcher mentioned that the focus of her group's work to date had been 'joining literatures that haven't been joined before' (Individual Researcher Interview 5).

The other main approach was to frame the project as a small carefully targeted sub-project, tightly focused on a strategic activity, such as the collection of particular data set or the piloting of a technique, in support of a broader imagined program. As an atmospheric scientist commented, while he and his collaborators had previously spent their own time doing basic conceptual work in their topic area, once they were modestly funded their activities were:

... much more focused. Because there was a budget and a timeline involved it actually made us focus more carefully on what we had to do (Individual Researcher Interview 4).

Besides approaching the ISG as (simply) the first step in a longer research voyage, another way that the contained size of the project was used as an advantage was to emphasise the relative shortness of the commitment required of researchers and the immediateness of outputs they would/could achieve. Most projects set out to achieve something within the one year time frame that would be a substantive contribution of some sort, irrespective of whether further possible research was pursued or successfully funded. Not only did this offer a welcome sense of short term achievement, but it reduced the commitment demanded of those not sure from the outset that they wanted to work on the topic or with their collaborators longer term. By requiring only 12 months involvement, the funding helps to manage the risk that the collaboration or research process may prove unsuccessful or unsatisfying in some ways for those involved (risks that are heightened in the case of CIDR by the novelty and challenges often involved). It also makes the grants more accessible to those who only have one year of involvement available. Furthermore, the shortness of the projects reduces the opportunity costs for researchers (foregone alternative activities), which is likely to be especially appealing to those not wanting to identify themselves too strongly with either interdisciplinary research or their particular ISG research topic at the expense of their other (disciplinary) research. In addition, containing the project to the foreseeable future decreases the

risk to the project group that members will leave part way through the project to take up other opportunities.

While advantageous in these ways, the time frame and budget size of the ISG projects were also mentioned as a serious stressor by numerous researchers. Some groups found the 12 month period too short for what they wanted or needed to do. As one researcher commented, it was 'such a quick grant'. In some cases the sense of the funding period passing rapidly by was caused by a project taking considerable time to gain a sense of direction and momentum for some of the reasons discussed above. Many respondents commented on the large amount of time required to build initial understanding of the project among a diverse project team and complained that this was not properly accommodated within the grant period. As some survey respondents noted, they did not enjoy or were concerned about:

- *The time take to arrive at an agreement on the way forward (Survey R1-36)*
- *Trying to fit a time-intensive process into limited time (Survey R1-21)*
- *Lack of time to really devote to it (Survey R1-10)*
- *The slowness of the process for sharpening the research questions (Survey R1-22)*
- *Not enough time to explore ID [interdisciplinarity] (Survey R2A-2)*
- *The virtual nature of the group and the time requirement to make progress happen (Survey R2B-12).*

An interviewee emphasised that the main thing that both characterised and limited their group's progress was the issue of time:

> *...In the reality of lives where academics are doing far too much admin, as well as everything else that they've got to do, do they get time to actually do what I think academic, interdisciplinary work requires? Which is major work around the conceptual understandings that each person in a team that is interdisciplinary is bringing to the table. We did that. We made that happen - whether it was in our own time or not, it happened and it took time to do that [...] It's time: I don't know how else to put it (Researcher B, Group Interview 2).*

Discussed further in Section 2.3.5 below, some other groups got going quickly but sacrificed later interdisciplinary integration. One scientist in this camp commented:

> *It was basically a two stage thing. There was a finality to it, like "We've got one year to do something" and that type of thing. So it was sort of like "Well, okay, these are our set goals that we've got to meet here. You guys - here's this material that you need to make the particles, or here's a bit that we can provide you to do your bit with. You then give us that, then we go off into that". So in that type of sense it's very much - although we have meetings and I met with X [a co-researcher] and everybody else there - there's sort of like – it wasn't as well meshed as it could've been, because of that timeframe constraint (Individual Researcher Interview 2).*

Some encountered management issues that contributed to their struggle to complete the project within the designated period. As one interviewee commented, while she thought her project would

pay off in the longer term, initial progress had been poor due to leadership and engagement issues, meaning that the project hadn't 'started enough with a bang' (Individual Researcher Interview 5). In some cases, time management issues were exacerbated by a clash between the envisaged project "work plan" (however informal) and various unforeseen delays. With only twelve months to play with, projects did not have a lot of capacity to absorb such disturbances. Some also experienced clashes between their initially envisaged work plan and that which was funded. A number of researchers mentioned in the survey that one of the difficulties they faced with their ISG projects was managing with only a proportion of the funding that they had asked for.

Overall, the bounded window and size of the funding was perceived by researchers as both advantageous and disadvantageous (Table 2), reducing some risks for them personally but also limiting what the projects were able to achieve.

Table 2. Advantages and disadvantages for researchers of the relative smallness of the ISG projects indicated by researcher feedback

Advantages	Disadvantages
• Reduces the commitment risk and opportunity costs • Reduces the transaction costs • Can make it more simple and manageable • Can encourage a focused, "just do it" attitude • Can encourage a willingness to experiment and sense of fun • Allows "low profile" experimentation with interdisciplinarity, the research topic and/or new collaborators • Reduces the risk of losing colleagues part way through a longer process	• Project may be afforded low priority by co-researchers and others • Can require a difficult and unsatisfactory downsizing of the ideal project • Can limit the quality of the research and research experience, notably time spent on developing interdisciplinary understanding and group cohesion • Can increase the stressfulness of research • Can lead to exploitation of individuals' own time • By not having provision for a 2nd year, does not accommodate unforeseen but likely delays

2.3.3 Interacting as a group

Collaborative research is strongly dependent on how well those involved function as a group. Survey results suggest that this was a strength for over half the Round 1 groups. 27% reported that they functioned 'extremely well' as a group and a further 35% reported that they functioned 'moderately well'[9] (Figure 1). Figures for Round 2 were virtually identical.

How well did you function as a group? We functioned ..

- .. extremely badly as a group 0%
- .. quite poorly as a group 8%
- .. quite well as a group 27%
- .. moderately well as a group 35%
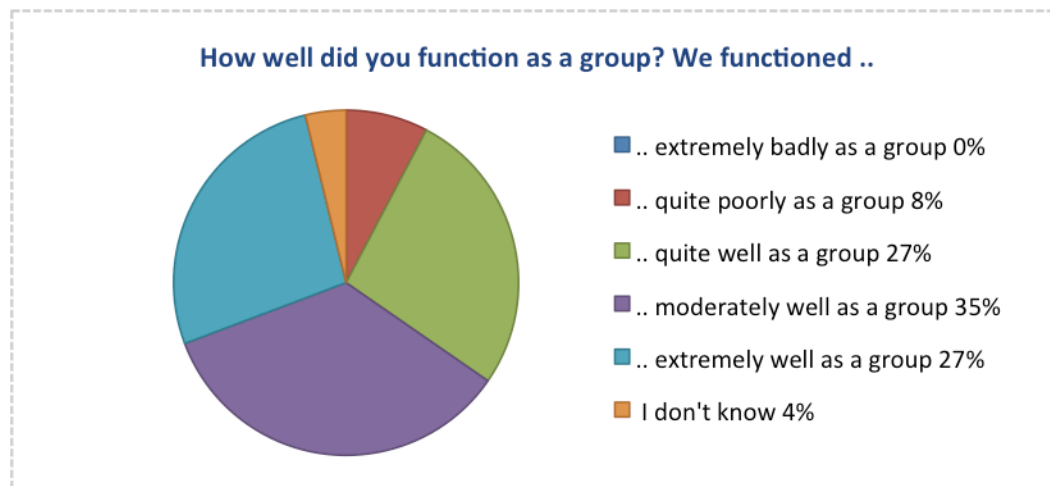- .. extremely well as a group 27%
- I don't know 4%

Figure 1. How well project groups functioned according to self-report by survey respondents from Round 1 projects (n=26).

As discussed further in Section 2.4.3, many researchers also noted that their collaborations were not only functional but enjoyable. This underlines the idea that researchers' satisfaction with a research experience stems not only from the procedural or intellectual characteristics of research but the interpersonal environment in which such investigation occurs. In the presence of disciplinary differences and little institutional pressure to undertake interdisciplinary research, the research topic in CIDR seems to play an especially important role in attracting and affiliating the researchers involved. While management issues also shape people's research experience, subjective assessments of group function such as those reported above are shaped in large part by how much members like each other. A shared interest in the project topic seems to play a strong social function from the outset, transcending some intellectual differences. Some researchers, for example, represented their projects as above all bringing together 'like-minded' people. The associated sense of camaraderie helped to colour their perceptions of research experience as voluntary, passionate and fun.

A further quarter of groups (27% of Round 1, 26% of Round 2) reported that they functioned only 'quite well' as a group, and another 8% of Round 1 researchers and 4% of Round 2 researchers said 'quite poorly'. While not large percentages, this overall proportion is still notable, especially given the positive bias likely to be affecting the sample. As discussed further below, it underlines the difficulties that can be encountered, not only in collaborating

> **Collaboration was a relatively strong point of the projects in general.**

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[9] As noted earlier, keep in mind that the research sample is likely to be strongly skewed towards those with positive ISG project experiences.

with others *per se*, but with those from other disciplines in particular.

One source of poor group function is unhelpful behaviour by individuals in a group context. While virtually no such issues were reported in this study, some researchers did indicate that they had encountered some inter-personal difficulties within their groups.

> *[The main challenge was] to come to a consensus without knowing each other, especially when some pretty tough characters are involved (Survey R1-18).*

> *Group facilitation was an issue given diverse perspectives (Survey R1-32).*

One project group referred to some specific personality issues, but also pointed out that they had been able to manage and learn from this:

> *There's a few times when - oh, there was one woman in the group who's quite intellect – you know, she's quite challenging or confronting in style, but we worked through that. And maybe people might have thought [...] "What do you mean by that?" or [...] they might feel quite uncomfortable [...] I mean, because you're trying to explain this complex thing. But actually we actually worked through that quite well and I think the team is now much stronger (Researcher A).*

> *[...] I think we've all had a very strong ability, I guess, the confidence in where we're coming from. So when there has been [...] I mean, I think we can think of a meeting where it just felt like there was a bit of "we're not all on the same team". But we were able to talk that through in a very straightforward manner and were able to defend what we were saying in intellectual terms or ethical terms or whatever [...] I think that's just par for the course in terms of knowledge or community work... intellectual teamwork (Researcher C, Group Interview 1).*

As discussed further below, we see here that 'intellectual teamwork' requires not only academic intelligence but emotional and social intelligence, including the ability to present one's own perspective in a non-aggressive manner. While the low level of explicit group conflict reported suggests that people were relatively sensitive to and skilled in such performance, it also seems that some researchers chose to informally retreat from group participation rather than invest time and energy in debating and contributing to the group's direction. As discussed in the following section, their passivity within the group was then a source of considerable tension for some of the more actively engaged researchers.

2.3.4 Managing different levels of engagement

Collaborative research requires dedicating time and effort to group communication. As an institute director remarked:

> *...A lot of the development of good interdisciplinary teams is the work that you do upfront: the regular meetings, the cups of coffee, the understanding of different languages and the different value systems (Institute Director 2).*

Researchers emphasised regular communication in their reported plans for facilitating collaboration within their groups. Similarly, at the end of projects some researchers reported regular communication within their groups as a factor contributing to their group's relative success. Some survey respondents indicated that they used combinations of 'face to face meetings, emails, phone calls, document sharing and sending' (Survey R1-22) to keep their group operating and on track. Others also ran intensive workshops, worked together in the laboratory, swapped written pieces, and held regular working groups with key partners.

Groups varied in how closely they worked together. There was also strong variation within some groups. Numerous researchers reported that patchy engagement across their project group was a significant challenge. As some described, for example:

- *This project brought together 3 research groups and 2 of the 3 groups worked extremely well together and the third had other priorities [...] I did not enjoy having to treat one group of collaborators with care because they had other priorities (Survey R1-9).*

- *We were the lead partner and found one group very helpful collaborators whilst the other had to be reminded of our needs (Survey R1-17).*

- *[I did not enjoy] the frustrating reality of managing different teams that did not give enough care to the project (Survey R1-6).*

- *It was sometimes difficult to get colleagues to commit time (Survey R1-1).*

- *As a minor project, it was difficult to find opportunities for all parties to meet (Survey R1-12).*

- *Some people in the group aren't very committed to a joint conceptualisation. And others are just keeping on with their own focus, so that's another issue. And yet the idea of this was to really try and bring different perspectives to the one problem and then try and break new territory (Individual Researcher Interview 5).*

As indicated in the comments above, numerous attitudinal, stochastic and systematic factors are likely to affect why some individuals engaged with their projects more than others, and the extent to which they perceive their low engagement as an active choice or as the unfortunate result of external forces. One group of researchers compelled to engage in their projects are those significantly employed on the projects. The role of contractual relationships was emphasised by an interviewee who noted that an advantage of having funds to pursue his group's research topic was that it took the research from voluntary and altruistic to professional and commissioned:

> *Because we had resources, we could actually ask people to do something, offer them money and insist that they do it. Whereas previously it had always been if people can find a little bit of spare time to help out (Individual Researcher Interview 4).*

Even if a fraction of their time is paid for by the ISG project, and even if they are attracted to participating in an ISG project, for some researchers it seems more difficult or unusual to devote effort to such research. Seniority was mentioned by a number of researchers as a limitation on participation. How academic rank interacts with CIDR is an ongoing debate in the literature, with seniority generally seen to facilitate researchers' ability to envisage and participate in such comparably risky work, but to concomitantly reduce their inclination to be involved and erode the

> **Some researchers engaged on the projects more than others, which caused difficulties for some groups.**

time they have available. From a funding perspective, seniority is also presumed to be associated with less need for small grants such as the ISG, as some institute directors emphasised above (Section 2.2.2).

Comments by some respondents in this project suggest that a proportion of more senior researchers were not as actively involved in their projects as their co-researchers (and possibly they themselves) expected or would have liked. One researcher stated that they were frustrated by 'how time poor senior researchers are' (Survey R1-18). Another described how the small scale of the ISG projects relative to higher status ARC-type ones seems to encourage some researchers to put the ISG project to one side:

> *In our [project] group, we're bringing together some quite high flyers who have their own agendas and some of whom have not contributed at all. They've just been passengers and they're very good researchers. But they haven't come to meetings, they haven't delivered anything - but they wanted their name on the original application. And so it's been left to a sort of core clump to actually do the maintenance. And, you know, their excuse has been, "Well I have to put my Discovery in, I have to do this other stuff, so I haven't got time to do this...". So, now, that's fair enough. They are busy and productive people in their own right. But I think some accountability... [These ISG projects] haven't got the same status as, which is as you would expect, as an ARC Linkage or Discovery or an NHMRC [...] And some people have been disengaged from the beginning. You know, you can't tell senior academics "Well you're a free ride" [...] [But] people are not regarding this [...] not quite regarding it like an ARC or NHMRC, in terms of "You're accountable [...] if you've put in for one of these grants" (Individual Researcher Interview 5).*

To the extent that there was low engagement among some senior academics, it may reflect various personal and stochastic factors or, as indicated in a comment above, be a function of more systematic factors. For example, it may indicate that many are accustomed to taking a hands-off advisory or key expert role. Nearly half of Round 1 survey respondents phrased their contribution to their project group in terms such as 'initiating', 'team formation', 'guidance', 'advice' and 'leadership', suggesting a degree of distance from the "coal face" of research[10]. The question is how

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[10] To the extent that this shapes the subsequent role of each discipline within the project, it suggests that a variant of Barry, A. *et al.* (2008). "Logics of interdisciplinarity." Economy and Society **37**: 20-49.'s Subordination-Service mode of interdisciplinarity may exist: an "Advisor-Expert" mode where a discipline may only have a "small" role in terms of input but nevertheless be privileged rather than subordinated into a service role. This parallels the situation in consulting firms, where the higher charge-out rates of senior members on projects mean their relatively expensive input is reduced on an hourly basis, often to only strategic input (Guggenheim, M. (2006). "Undisciplined research: the proceduralisation of quality control in transdisciplinary projects." Science and Public Policy **33**(6): 411-421.). Likewise it may reflect the fact that senior researchers are increasingly asked to take on the role of expert in 'Scientific Advisory Board' type groups as such a quality control mechanism becomes more common within Australia's accountability culture.

intentional, well communicated and widely accepted their adoption of such a position was. While many of the survey comments would suggest that taking on the role of expert guidance was intentional, time poorness may also have exacerbated the distance involved in this role. In the recent Australian wide survey of academics mentioned earlier, only 16-17% of mid and late career academics agreed that "I have enough time for research" and only 24-28% agreed "My overall workload is reasonable and manageable"[11] (Bexley *et al.* 2011).

> Groups divided the project work between individuals along seniority, task and/or disciplinary lines, as pragmatic and epistemological goals intersected.

Competing priorities are not, of course, exclusively the domain of senior academics. Comments by other researchers emphasised the time pressures upon earlier career researchers. Time pressure is influenced not only by stage of career but stage of life and associated gender differences. One project for example had four of six members go on maternity leave during the two year period they have been thinking about and working on their ISG project. They have also had to negotiate researchers' subsequent part time work hours. As the project leader said '...between the maternity leaves and the part-timeness, and all this sort of stuff, it's been quite a challenge...' (Researcher A, Group Interview 2). While challenging, those involved emphasised how much they appreciated the sense of understanding and support they received from the group given the commonality of their experiences.

Sectoral context may also influence the level of priority able to be afforded the ISG project. For some industry partners, for example, doing any research may be unusual. As another respondent commented:

> It was hard to get people to deliver on certain tasks when you know that they are really busy and not supported to do research in their workplace (Survey R1-36).

Finally, physical proximity was also mentioned by quite a few researchers as a limitation on participation and collaboration. If co-researchers have to travel a considerable way (even on foot) it seems to reduce the frequency of formal face-to-face get togethers and reduce the likelihood of chance meetings.

2.3.5 Distributing the project workload

Research groups differed in how they divided their project work between them. Across the groups, work was variously distributed along seniority lines, task lines (e.g., data collection versus writing papers) and/or disciplinary lines.

Some level of hierarchical division of labour seems to have existed in virtually all projects. The most commonly noted budget expense in the successful research applications was employment of a part-time or casual post-doctoral fellow or research assistant. Typically, this person was brought into the

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[11] Figures among early career academics were higher, but are still concerning, with 29.7% reporting they have enough time for research, and 40% agreeing their workload is reasonable and manageable.

project once it was funded (as opposed to being involved prior to the application) and was more junior than most other members of the group. They tended to be employed to do the main data collection and analysis tasks. In some cases, they also seem to have become, informally at least, the project manager, with other group members adopting an advisory role. For example, one interviewee described how because he was the one engaged in the "actual work" of the project, he was the only one who knew what was going on and, in the absence of group meetings, spent a lot of time individually keeping the other more senior members informed. He described his role as:

> *Translator in a lot of ways. I go around and talk to all of them and explain where we're at and what the other ideas are. And because I do fall between the cracks of disciplines in a lot of ways, I can speak the language so to speak (Individual Researcher Interview 6).*

In other groups, a less hierarchical structure was used, with many group members involved in the "grunt work" of the project, with or without the assistance of an employed staff member. Motivated in part by a commitment to contributing their disciplinary perspective throughout, this model required distributed communication throughout the group rather than a reliance on a central translator.

Other projects were neither strongly nor weakly distributed vertically. Some Chief Investigators for example were mid-career researchers who took on an active research management role, liaising with both research assistants and more senior academic colleagues in the group. As one such senior member commented about the mid-career CI on his project:

> *X has been very much the research manager. She has been the one who has kept an eye on things and kept everything moving along, and reminding us of our responsibilities [...] In terms of being a researcher, I guess, I've learned another way of doing research where it's collaborative, but not particularly hands on [...] I've been involved in different projects in lots of different ways, but not quite like that (Individual Researcher Interview 3).*

The reference to being 'collaborative but not particularly hands on' points to the existence of the 'Advisor-Expert' mode of interdisciplinarity suggested above. Likewise, the reference to 'reminding us of our responsibilities' highlights both a shared understanding of what the project requires of people, as well as the way that for those people not spending a large amount of time on the mechanics of the research project, the project could slip down their list of priorities, with varying consequences according to how crucial their contribution was viewed to be.

Comments suggest that active group involvement swelled at the start and end of the projects, creating an inverted bell-curve of engagement for some researchers. What constitutes the "end" of the projects is of course blurry, extending in virtually all cases beyond the official budget period as the article and/or grant writing continue. As one researcher explained:

> *...The main thing was to expend the money by the end of the financial year, and we've pretty much done that, at the end of the calendar year. And the collaboration, well the writing, is just ongoing (Researcher A, Group Interview 2).*

The professor quoted above about being collaborative but not particularly hands on commented that his involvement had increased in the 'aftermath of the project':

> It's really in the aftermath of the project or the intermediate stage between the seed funding and going for the ARC large grant, as we used to call them, that there's more involvement being asked of me. [...] I now have to be more involved than I've been, because I'm getting emails saying, "Okay, you said you were going to write a certain number of words about [a certain topic]"... So yes, I'm being drawn in a way that I haven't had really up to this point (Individual Researcher Interview 3).

Overlaying the sequential pattern of work created by different research tasks was, in some cases, a division between disciplinary based activities. This multidisciplinary approach was the most commonly nominated way by which groups would or had combined their disciplinary perspectives. 56% of Round 1 project respondents reported that they had operationalised interdisciplinarity by using different disciplines to address different parts of the research question, and 46% of those in Round 2 reported that they planned on taking the same approach (a figure that may grow as projects progress and compromise is needed). For some in Round 1, taking such a multidisciplinary approach represented a compromise relative to the higher level of interdisciplinary integration and group work that they would have liked to have achieved. For example, one project group found that they ended up running two parallel "sub-projects", initiated in part by the needs of an industry partner who was more interested in one component of the project than the other (and more interested in addressing his identified policy need than achieving any ideal of academic integration). A researcher involved reported:

> One surprising thing was that we needed to fall into two teams that worked somewhat separately to each other. And so there was a group that were looking at X [one topic] [...] But then was another team that was looking at Y [another topic] [...] Monthly we were meeting as an entire team, but we ended up having our own research assistants. We had two research assistants with different expertise and they almost worked like little silos. And interestingly enough, it's looking like it's going to turn into two Linkage Grant applications now rather than one. We had anticipated it would be one, but then we went and spoke with the Z [government] department, who was our loose partner, and he was quite keen that there was a lot of work that was done on [the Y aspect of the project] (Researcher A, Group Interview 3).

In this project, the whole team met monthly. Nevertheless, this researcher noted that the reliance on formal meetings between the two teams was limiting, with important informal discussions being missed:

> I think it was the discussions as well, where we [in one of the teams] would meet afterwards and have a talk. And maybe I don't think we've had the informal discussions across the two silos as much as perhaps we could have (Researcher A, Group Interview 3).

Although data collection may have been conducted in disciplinary spheres, some projects such as the one just discussed also viewed such a division as a temporary divide to be overcome at the data analysis or write up stage. In the project above, the whole team was planning to reconvene more

seriously during the post-funding writing phase of the project, as discussed in more detail in Section 2.3.7 below. This and other cases illustrates how the conflict between the time-consuming nature of interdisciplinary integration and the short timeframe of the ISG projects was managed by some groups by shifting the major integration work into the "post project" phase.

2.3.6 Learning and teaching different perspectives

Regardless of what level of intellectual integration a particular project group aimed to achieve, collaboration required that they considered and shared their different perspectives, especially given that different disciplines were involved. Developing a new understanding of others', and one's own, knowledge and ideas was frequently mentioned as the most challenging but rewarding aspect of the ISG projects. 'Learning new skills' (Survey R1-12) and 'learning from others' (Survey R1-3) were nominated in the survey, for example, as what people enjoyed most about the research experience.

Some individuals and groups were more consciously focused on learning and on negotiating and integrating epistemological differences (that is, differences in what is and is not considered valid knowledge) than others. This in itself reflects different disciplinary cultures and interests. In interpretive social sciences (those that focus on how meaning is constructed), discussions about different people's "standpoints" are a routine part of research. Three researchers from a particularly reflexive social science/humanities project, for example, described how they faced the challenge of working together from different disciplinary perspectives. As seen in the extended excerpt below, they emphasised that their deliberate openness to each other's views complemented the topic of their research, which included exploring ways in which differences between academics and their research sites and participants are constructed. The researchers' "home" disciplines are given to illustrate some of the disciplinary divides they are talking about working across.

Sociologist:

> *I think what happens is I'll express [an idea] in a sociological way and X [a co-researcher not present at the interview] will pick it up in a cultural studies [way]. You know, he gets what I'm saying and he says it in a different way. And I mean, a lot of our conversations have been similar when we've gone "Oh, right, so the sociologist would say this - and you get it, but you think about it differently" [...] Different disciplines have different ways and concepts for talking and understanding the social world (Researcher A).*

Artist:

> *[...] I remember that one meeting and I was listening to one person. I was thinking, "Oh, but you do get it. We're on the same page." I just have to remind myself "Okay, where is this person coming from? What's their background?" You know what I mean? And it's like, well, actually we're totally on the same page. We're just using different language and it's all because we're stuck in different policy jargon [...] [It's about] different kinds of translations of the same idea... I would see the goal of the project to be moving towards interdisciplinarity, which would be creating that shared language (Researcher B).*

Anthropologist:

> *I think we have an interdisciplinary project, not a multidisciplinary one [...] We had a good alliance and alignment, I think, of approaches, but it was very dialogical [...] Sorry for all the jargon – it reflects how we're approaching the project [...] In the [community] space itself we weren't trying to essentialise that – we were always thinking about difference relations and relationality between us and space, and us and the people [...]. It was like the whole thing was all embedded in this difference, social relations of us being there [...] It's just about being open to, I guess, all those different variables and variations of being in the field, which was really mind expanding for us [...] I guess just 'cause we were open to changing, and that was what we tried to keep reminding ourselves of, which speaks back to the interdisciplinary stuff [...] [We] talk about not fixing ideas of things, but being open. We tried as much as possible to keep that ethos in practice and the field as well (Researcher C).*

Sociologist:

> *[...] I need to be challenged sometimes too about – 'cause I have been working on this [topic] for a long time. Sometimes I'm in my little rut and it's been quite good to be challenged [...] It's partly a personality thing, I think too, actually. And partly, perhaps, a practice thing - to be used to being challenged [...] (Researcher A).*

Artist:

> *You know, and not everyone can have the patience to push through that (Researcher B, Group Interview 1).*

While this group were especially explicit about exploring interdisciplinary and transdisciplinary differences and reflective about the challenges involved, many other researchers similarly noted the conscious effort needed to get everyone 'on the same page'. As seen above, others also mentioned that despite an intellectual commitment to being open to deep critique from co-researchers, receiving such feedback (e.g., questions about one's epistemology) can be personally confronting. As an interviewee reflected:

> **Performing interdisciplinarity required researchers to consciously share perspectives, with this intellectual collaboration itself viewed differently among alternative research traditions.**

> *I think there's this term that I've come across recently of in the Oxford Handbook of Interdisciplinarity. A writer was talking about "epistemological humility" and I reckon that that is so significant... As a [member of her profession], you develop a way at looking at the world and so it's actually quite confronting to have X [her co-researcher] looking at the world differently. It's enriching, but confronting too - having people that work differently and so potentially are quite critical of the way you work, and you're quite critical of the way they're working... You have to somehow get over that hurdle and realise that, well, they work differently, but the way they work actually has strengths. And sometimes I think we do drive each other*

crazy a bit at times, but also benefit from each other (Researcher B, Group Interview 3).

This excerpt illustrates further how the collaborative and interdisciplinary aspects - the social and intellectual aspects - of the ISG projects are entwined, with interpersonal interactions being the medium through which epistemic differences (as in different areas of knowledge) and epistemological differences (as in different forms of knowledge or conceptions of truth) are negotiated.

Listening to and learning from others is only one half of the iterative interpersonal and intellectual challenge of collaboration. Reflecting, expressing and teaching one's own perspective is equally important. How this is performed by different individuals seems to be a further site of disciplinary difference, overlaid by more generic differences in personality and style. As a researcher explained, the way one researcher 'talks through' their perspective may be frustratingly indirect for another's liking:

> *...But I think personality style, whether it's male or female... These amorphous projects - like problem-based learning - you need to be in a bit of a mess and talk it through. And there are some people, whether they're male or female will, say "Well, come on. Just get to the point. What are we doing here? I've only got an hour. Quick!" You know? And it's not going to work that way. There may have been some engineers on our project feeling that way (Researcher A, Group Interview 3).*

We see here that the researcher detected a tension between the "messiness" or non-linearity of her and her colleagues' social science based contributions and the discussion style preferences of her engineering co-researchers. While she refers to the unquestionable effect of personalities (and time pressures and gender), she also indicates that some types of knowledge simply require different types of communication style, and place more emphasis on the role of exploratory expression generally. Thus, regardless of whether an interpretive social scientist is personally interested in examining their own assumptions and thus enjoys this part of group process, the discursive character of their knowledge requires that, even when hurried, a more intuitive and dialogical mode of communication is needed than researchers from more quantitative traditions are accustomed to.

Higher level differences between research traditions also shape how intellectual collaboration *per se* is perceived. Researcher comments indicate that for those espousing a a positivist world view, collaboration was less about exploring different 'framings' of the problem in question than about identifying and addressing specific knowledge deficits among different researchers and reaching agreement about the correct interpretation of the problem. One medical scientist, for example, highlighted the way that some initial high-level shared language among his group disguised the partiality or incorrectness of different researchers' understanding of the research problem:

> *Often people who come to these meetings from different fields have already dabbled a little bit and that's why they're interested in it in the first place. Unfortunately by dabbling they [...] bring in all these prejudices and ideas and things that really aren't true in a sense. So, then you've gotta sort of like allow the other person to explain it in a sense that's particular to their particular field or in the overall field of theirs... But one of the things that happens is that people bring to the table ideas that are*

completely wrong. And that's exactly what happened here (Individual Researcher Interview 2).

This interviewee went on to explain how one of his co-researchers' initial ideas about their project was based on a misunderstanding of a central concept that he was able to recognise thanks to prior knowledge of the two fields involved. He then acted as a teacher.

So he [a co-researcher] was coming at it thinking this is what we need to do, when actually, no, you don't need to do those things [...] Now, because I've worked in both fields [...] I knew where [he] was coming from. I could then say "Okay [...] it's not this [...] it's these ones we really should be looking at" (Individual Researcher Interview 2).

In this situation the co-researcher's misunderstanding arose because he was not familiar with finer divisions within a chemical category that he was familiar with, leading him to miss some important details about the project's object of study (the so-called fallacy of division). As the researcher above continued, the mistake came down to neglecting the significance of a particular adjective and in his group 'the language aspect is something that they didn't really quite understand before'. Generalising the process, this researcher went on to explain that once his co-researchers all recognised the specifics of what they were dealing with, they were able to consider the implications from their field's perspective, develop a new understanding, and make a further suggestion about method:

They can then usually just mix [their new understanding] in with something you've got and then come out with something: "How about if we do this and this?" you know. And then that sort of works out quite well (Individual Researcher Interview 2).

We see here again the way that teaching as well as learning is part of the interpersonal and intellectual challenge in CIDR. The role of teaching within an interdisciplinary research group was emphasised by an institute director:

I think that some people who are getting involved in interdisciplinary work [...] sometimes find that by working with people outside their field and explaining it to others, it's a bit like teaching. It's something like a teaching tool, to better understand a topic. Working with others and explaining and interfacing your topic to another topic helps you to understand it, as well (Institute Director 1).

As this quote emphasises, even when in the "teacher" role, learning continues and one's understanding continues to develop. The iterative, effortful and developmental character of the communication and learning involved creates an image of a project proceeding in a step-wise manner as a group collectively digs down to a finer level of detail, establishes shared ground by mapping and interweaving their disciplinary perspectives, and then digs down again.

2.3.7 Writing and publishing together

Writing up project findings within the group context was mentioned frequently by researchers as one of most testing and interesting phases of their collaborations. As the final performance of most projects, written products emerge out of a 'collision' between the pressure of interdisciplinary

interpretation, the preciseness and permanence of written expression, the pragmatics of writing together, and the politics of publication.

One reason why the writing up phase is challenging - and rewarding - is because it requires that conclusions are drawn from the research. This can be intimidating during any project but is especially so when the research is unusual, partial or multi-faceted, as many of the ISG projects are. For example, many of the ISG projects use innovative methodologies or techniques, which means that interpreting results is a less straightforward exercise than in more conventional projects. The pilot nature of many projects also means that in some cases researchers had questions about whether their results were significant or convincing enough to warrant academic publication or support further grant applications. A number of groups mentioned that they needed to do more work beyond the timeframe of the funding to collect enough data for what they wanted to demonstrate.

> **Producing interdisciplinary publications is a particularly challenging intellectual and interpersonal exercise that again exposes differences between research traditions.**

Drawing conclusions is also especially challenging when different disciplines are involved. This is not just about content, but process. Reflecting similar variation in the preferred role and style of verbal expression discussed in the previous section, disciplinary differences may emerge in how writing is positioned in relationship to analysis. In quantitative traditions, analysis is generally understood as occurring prior to writing up, enabling detailed paper outlines to be developed then populated. Guided by strong conventions around how scientific papers are organised, writing up in this mode can be a relatively straightforward process. In more qualitative, dialogical traditions, analysis tends to continue during the act of writing. Words are themselves the findings and questions about how a paper is framed and structured are consequential and open-ended. Expressing the project is therefore a continuation of the research process and an act of exploration. As a researcher from the humanities stated: 'We are now writing up *and* making sense of what's happened' (Researcher C, Group Interview 1, italics added).

'Making sense of what's happened' is of course especially challenging when a project has involved different disciplinary perspectives. Researcher comments suggest that committing to the content of a written piece demands a degree of conscious interdisciplinary work often previously not attempted. Vague areas of overlap between perspectives are revealed to be riddled with disciplinary variation. A casual turn of phrase or use of terminology by one writer can cause misunderstanding or alarm in another. The word 'scaffolding' was found to have very different meanings to the architects and educationalists in one group, for example[12]. This was underlined when a researcher in this group from a third perspective used the word in writing:

> *X [her co-researcher], who's the sustainability expert, she wrote a paper recently that I looked at from an architectural view point. I said: "You've used scaffolding in the incorrect way or maybe you're using it in an assumed way. You need to check that your audience - who are likely to be architects - aren't going to think "Why you have*

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[12] It refers to a material structure in architecture and is a metaphor for a particular teaching approach in education.

put a bit of [scaffolding on]?"…when you're actually talking about it from an educational [metaphorical] perspective". And she realised she'd actually started to take the educational [use] of the language, rather than the architectural and hadn't even realised it (Researcher B, Group Interview 3).

Collaborative interdisciplinary sense-making also involves finding an agreed balance between different disciplinary elements of the story. What this balance looks like is a matter of opinion. Some researchers indicated that the process of distilling key messages catalysed discussion about the significance of different findings from different disciplinary standpoints. What seemed inconsequential to one was considered highly significant to another. How disciplinary aspects are balanced may also be shaped by a writers' discomfort or limited knowledge in writing from the viewpoint of other disciplines. As the researcher above continued, for example:

I noticed in X's [her co-researcher's] writing that she does have a very strong - as she should - a very strong environmental viewpoint. But when she gets into the educational and space, it's very brief. So I think that in order to develop an interdisciplinary team, you need to have a lot more conversations (Researcher B, Group Interview 3).

Groups' deliberate or inadvertent choices about the mode of interdisciplinarity that they are seeking to practise are exposed and tested during the writing process. In projects aiming for deep interdisciplinary integration, the challenge of balancing how disciplinary components are expressed within a written piece of work is replaced or exacerbated by questions about how those 'components' are combined conceptually. As discussed above, how these questions are resolved depends the intellectual and social aspects of research projects and how they intersect. In working out the role of different disciplines and thus individuals in a research team, part of what needs to be negotiated is the weight given to problem-based criteria (determining people's relative contributions on the basis of what the research topic requires) versus a concern with inter-personal equity (seeking balanced contributions from team members for philosophical and group harmony reasons)These considerations, in turn, reflect researchers' motivation for and approach to their research. In a problem-based oriented project motivated by a desire to change society, for example, a researcher indicated that her group's highly integrated form of interdisciplinarity has been driven by a shared political commitment:

I'm not sure how self-conscious we are in our writing about the - when the papers come together - about the interdisciplinariness. Or whether we've actually transcended that a little bit and we've got a message, and the message is about the social and all the other things that we want to say (Researcher A, Group Interview 2).

It was mentioned in Section 2.3.5 above that many projects were conducted over the year in a largely multidisciplinary (multi-stranded) manner, often with the intention of more fully integrating the strands towards the end of the project - that is, at the writing up phase. The subsequent production of journal articles and other written outputs is thus long awaited and is accompanied by much anticipation and perhaps an outpouring of competing ideas. Written products serve as much-needed physical and symbolic 'boundary objects' for research groups, focusing their attention and

providing a shared surface on which interdisciplinarity is (finally) attempted and competing expectations play out.

Producing written objects serves to facilitate interdisciplinary integration in part because irrespective of the degree of interdisciplinary integration attempted, the fixed, singular and linear nature of written texts requires that ideas and representations are condensed, simplified, organised and agreed by collaborators. While many authors may be involved in the writing process, one coherent voice and one streamlined image of the project is presented. This singularity of perspective may belie more differentiated views and struggles among the researchers involved. As one reflected:

> *...A difficulty that we've probably had generally [...], and I think it's something the University might think about, is it's in fact incredibly difficult I think to write across disciplines [...] How do you open up writing so that it enables different voices to be embedded in the same paper? (Researcher A, Group Interview 3).*

Not only is the authorial voice limited within a single piece of writing, but so too is the audience. Another researcher implicitly pointed to this challenge when she reflected on how she usually frames the research differently for different audiences.

> *It's always happened that I kind of tell a different version of the same story to a variety of different people. And part of that works, but I also see it as a tension. And that's something that I'm looking to resolve. It's about finding, maybe, that shared language. I don't know. I don't know if it's possible. Maybe it'll always be that (Researcher B, Group Interview 1)*

As with the question of interdisciplinary integration, the degree to which a singular authorial voice and an official representation of a project are created by a research group raises questions about the advantages and disadvantages of difference versus holism. While the above project wanted to explore the possibilities of developing a shared language between them, they were also sensitive to not papering over the 'difference relations' and politics involved.

At the same time as writing any one piece requires presenting a synthetic perspective and encourages the integration of ideas, the linearity of the conventional writing process (taking turns, writing then editing) may encourage the re-emergence of a degree of multi-disciplinarity. Groups indicated that their general approach was for an individual (with associated disciplinary expertise) to take the lead in writing, either as the single designated writer for the group, as one of a series of authors working on the one paper, or as part of a process in which different individuals contribute different parts of a paper before one person pulls it together. An interviewee explained, for example, that in his group a co-researcher took the lead and commissioned work from the others involved:

> *I think that we were called to, each called on, to contribute words, a number of words. And then [his colleague] took it on herself to put them together in a coherent paper and then showed the paper to us and we all made our comments. And once it was clear with all of us, she sent it off to the journal (Individual Researcher Interview 3)*

Most researchers would agree that the alternative to having one or two lead authors (that is, writing by committee) is too painful to attempt and no groups in this study reported using such a method. The common mention of publications as personal benefits from the projects indicates that they would most likely also agree that it is desirable to contribute to the writing process in some way, both in order to be a good group member and to be recognised on paper as such.

Producing written objects also serves to facilitate interdisciplinary integration because such objects are the currency of academic achievement and so tend to attract the attention of all researchers in the group. At this stage of the projects, the pragmatics of writing work intersects with the politics of publication. Writing reports and papers takes precious time and effort but also offers a degree of creative control and public recognition. In those projects in which the bulk of the prior research 'grunt work' was intentionally or unintentionally carried out by a limited number of (junior) researchers, the proportion of active engaged researchers seems to swell during the write up phase, complicating decisions about how the writing process is to be managed. The project group described above as operating in two 'silos', for example, deliberately organised themselves in this way and were planning on reconvening as one for the write up phase:

> *We will be writing together, sometimes [...] Not just our little teams, but the two teams combining [...] We decided who would write what and who would try to find out places to publish, because obviously that's what the University wants [...] We've written reports and we're waiting on some of the measurements to finish a joint report, but we haven't actually got past that yet [...] Even at the writing stage, you still need time, don't you? (Researcher B, Group Interview 3).*

Having more researchers involved in the write up phase reduces, in theory, the amount any one researcher needs to do. It also increases the number of perspectives and needs that need to be accommodated, expanding the total amount of work involved. One force acting to reduce numbers is that, to the extent that the writing up phase extends beyond the formal funding period of the project, those previously employed on the project may have to reduce their involvement to take up other opportunities. While some researchers mentioned continuing to work on their projects past the funding period, others referred to the number of days that researchers employed on the projects had left to work on it, indicating a strong awareness of the time constraints of the contractual period. For all projects, difficult decisions have to be faced about how to represent the relative contributions of different researchers at the various stages of the research process in the authorship of formal written products, given the linearity and symbolism of citation conventions.

At the opposite end of the spectrum to the joint production of one tightly co-authored, highly interdisciplinary piece of writing is the production of a single-authored disciplinary piece by each of multiple researchers. Decisions about which way to go along this axis reflect the characteristics of different projects, the professional needs and preferences of different researchers, the drive to increase research productivity, and the politics of audience and outlet selection. While no groups reported going to the extreme of each writing up the research separately (though some may publish independently at a later point), most groups indicated that they were, or were planning to, collectively write into different discipline based literatures in preference to or addition to writing into an interdisciplinary space.

For some this was a deliberate choice driven by a desire to reach different audiences, reflecting the way some interdisciplinary research can act as a reconnaissance tour from which researchers return to educate their disciplinary peers. A researcher who advocated for this approach highlighted the useful juxtaposition that presenting the research in different disciplinary contexts would provide for the research team's understanding:

> *I guess, it's good to go interdisciplinary journals, but it'd be even better if we had similar versions of the same story, different same story, going into different journals (Researcher C, Group Interview 1).*

Another researcher indicated that for his group the decision to divide and target their research at different discipline based audiences was made early in the research process for pragmatic reasons:

> *[Writing] has been one of the more difficult aspects of our collaboration. There are a few different reasons. I think it was fairly clear to us early on that we should generate outputs in the two different areas [...] We did have a clear idea at the outset that we'd have the same general body of work, but prepared in one way [...] that would go into a [Discipline X] type journal and then, particularly with a much bigger emphasis on the [technique] side, would go into a [Discipline Y] journal. But as I say, it's the same task, it's the same question answered (Researcher A, Group Interview 4).*

In this group, there was an acute awareness of the pressure on at least one of the researchers to produce discipline-based publications. The decision to try to achieve such an output from the ISG project reflects an attempt to negotiate the tensions between this institutional context and the desire to do interdisciplinary research, as discussed further in Section 2.4.5 below. As a researcher from another project described:

> *There are quite distinct objectives/obligations coming from different departments... (ie to publish in a general or specialist journals depends greatly on pressure from departments and is often completely opposite) (Survey R1 28).*

A similar tension in publication targets was described by another researcher in the context of previous projects he had been involved in:

> *Previous to this I did different cross-disciplinary research [...] and that was very hard because clearly [the scientists involved] want it published in [their discipline's] papers and computer scientists want it published in computer science journals and there's nothing in common and it does change how you write the paper completely (Individual Researcher Interview 1).*

Part of the issue is how a given publication fits within a researcher's professional life. This is not only about what sort of research is valued within their current organisational location, but how a publication adds to their own corpus of work over time. To avoid a publication sitting on a researcher's CV like a souvenir from a one-off excursion to a foreign disciplinary territory, the publication needs to build on past interests or be positioned as a deliberately created foundation for

future research. To the extent that these requirements are personal to each researcher, they raise the issue of whose needs are met by different publication choices.

Nevertheless, for most researchers interviewed, the core concern about journal choice was less about discipline than about ranking or quality. In some areas, this is synergistic with interdisciplinarity as some of the highest quality journals are interdisciplinary (to a degree). In other areas, there is the much-discussed problem of a dearth of highly cited interdisciplinary outlets and one of the drivers of producing multiple disciplinary products is a desire to publish in eminent journals.

How these tensions are negotiated is influenced also by the conventions of different disciplines. Once again a division between interpretive and positivist traditions emerges. In the first, the same data (e.g., interview transcripts, survey results) can be published more than once when it is subject to different analysis, in part because such analysis is not interventionist and so the data remains intact. As long as the same interpretation and ideas are not re-presented, projects based on such data can be written up in different ways, increasing the number of publications that can be produced from it (at least in theory). In the positivist tradition, data and analysis are more tightly integrated. Self-plagiarism can be committed if the same data is presented in more than one publication. This constrains the ways in which the findings from a single research project can be presented across more than one journal. In contrast to the ability of interpretivist social sciences to explore an entire research project from different angles, producing multiple publications in the positivist sciences relies on dividing the project between publications. As a scientist explained, to produce two articles (including one for the researcher in a faculty antagonistic to interdisciplinary work) his group needs to divide the project into two components to avoid self-plagiarism:

> ...There's an ethical issue that came up very early, which is "Can you publish the same data twice?". Which of course you can't [...] Apart from the fact it's unethical, clearly there's a lot of attention to the fact that you can't be just re-publishing the same things in different journals. So we grappled with that for a while. (Researcher A, Group Interview 4)

Interpretivist disciplines also have the advantage of being able to explicitly juxtapose complementary interpretations of the one project or area of work within a single body of work, such as an edited book or special issue of a journal. Two projects mentioned that they were taking this approach to presenting their project's findings. While comparison based collections are possible in positivist science, academic conventions in these areas mean they are less easily produced out of a single (small) research project.

A further issue to note about the writing up phase is that academic publications are not prioritised by all academics. While, as mentioned above, all academics indicated that they intended on producing such outputs in accordance with the privileged status of such work in university life, a small proportion also indicated that they are as or more interested in writing up their project for a non-academic audience. This attitude reflects the Agonistic-Antagonistic mode of interdisciplinarity adopted by these researchers, discussed in Section 2.2.1, in which interdisciplinarity is favoured as a mode of challenging all kinds of knowledge hierarchies and constraints, not just disciplinary borders. As one researcher explained:

I try to resist some of that stuff around journal rankings. It just drives me nuts [...] Often I'm thinking: who do we want to read it? Who is going to be most interested in hearing about this? [...] I feel like there's people who work in the centre of things, whereas we kind of work on the edge. And so [...] with publishing, it's like, well, you're thinking about that, but you're also trying to shift and change this edge, which sometimes is about pushing the disciplinary boundaries or pushing the community to have a voice. And it's also embedded in other kinds of issues and perhaps it gets back to the orientation and connections you share with people [...] Research is partly a political process. It has political implications, who is in and who can't speak and those kinds of things (Researcher A, Group Interview 1).

A researcher on the same project similarly expressed her commitment to translating the academic work of the project into something targeted at the community they had been working with:

In all my work, I have always [...] produced a community report of my academic papers [...] So I will do the same thing [with this project]. I think they work quite well together in terms of a plain language version of an academic piece of work that serves really well for workers [...] So you're not excluding them (Researcher C, Group Interview 1).

Effectively feeding back research findings to participants takes skill, time and effort, and in this project involved making a video and doing an art installation. The researcher last quoted went on to note that while she is ethically committed to doing this work, she is frustrated that it is not recognised or valued within the academy, even though it is part of good (social science) practice. This includes not being funded to spend time on such work. She therefore noted: 'I think that might be another important thing to say here, is that with the seed funding, you might need extra money to do that' (Researcher C, Group Interview 1).

2.4 Outcomes, learning and impediments

2.4.1 Overall

So what, overall, has emerged from the ISG scheme? The previous sections have illustrated in detail the many factors and choices that shape researchers' experiences of the research process. What do researchers feel to have been the main outcomes of these experiences? This section summarises findings to date, noting the partial nature and early timing of the MICE research. It begins with an overview of respondent feedback and then describes researchers' perspectives on the formal and informal outcomes, plans for the future, the role of CIDR in their careers, and lessons learned.

Virtually all researchers in the sample rated their projects as moderately or highly successful but for diverse reasons.

Overall, 90% of survey respondents reported that they feel their project has been moderately to highly successful, with 50% in the latter category. Noting that success is subjectively defined and that

there is likely to be some sample bias, this is a very strong response. It reflects the range and quality of intended and unintended outcomes achieved. Numerous survey respondents emphasised that their experience on their ISG project was a positive one and expressed gratitude for the scheme's existence.
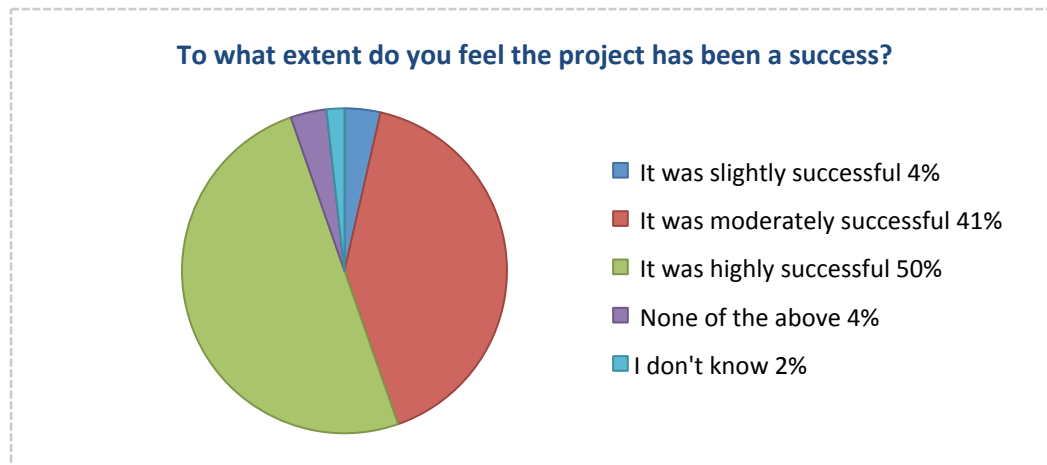
To what extent do you feel the project has been a success?

- It was slightly successful 4%
- It was moderately successful 41%
- It was highly successful 50%
- None of the above 4%
- I don't know 2%

Figure 2. Self-reported survey responses on how successful researchers from both Rounds 1 and 2 feel their ISG projects had been (n=56)

Researchers provided open-ended survey responses about why they rated their project in the above way, allowing insight into what people count as success. The major distinguishing factor of those projects rated as moderately as opposed to highly successful was a degree of caution or frustration about the actual success the project had achieved *at the time* (relative to expectations), versus the trajectory of the project and its perceived potential to deliver desired outcomes in the future. In keeping with the discussion of delays above (Section 2.3.2), some described their "mixed" assessment of their projects' success to date with the following comments:

We had some great technical difficulties with the project that took long time to solve (Survey R1 18)

We failed to get an ARC Linkage proposal in in October, but this will most likely happen in April 2011, and should be a strong proposal with several high level partners committing funding already (Survey R1 1)

Research applications and publications are still in process of generation, given it has taken some time for a common focus to gel (Survey R1 32)

The short term success has not been as high as there were a number of teething issues that slowed things down. But it is a positive experience even when you don't immediately get a paper out of it (Survey R1 28).

We have bought a key piece of equipment that will enable us to collaborate. We have installed the instrument, now we need to get students and start some project work, so we really haven't got far yet. If we get some students for 2011 we will really be on our way. The key thing is: to get a $60K piece of equipment with no track record in the area or history of collaboration is very difficult. The seed funding allows

us to get into the field and hopefully generate some real data, so we can apply for further funding (Survey R1 11).

In one sense the project was highly successful in that it re-established my work on X and trained a laboratory member in the techniques. It also introduced our colleagues in engineering to a new are of biology that demands their expertise. However progress in the actual primary aim of the project has been slow. Collaboration will continue in the new year (Survey R2B-8).

We have new and interesting data but we need more time and more $$ to complete the work (Survey R2B-6).

Other caveats were also given. Some comments simply reflected the exploratory, uncontrollable and potentially unsatisfying character of research, in part due to the ability of nature to act independently and in unanticipated ways. As one researcher commented: 'Would have expected better responses of the bacteria' (Survey R1 25). Others reflected that their data was weaker in some ways, but stronger in others, than what they originally expected: 'It has enabled the gathering of a greater level of data than was originally envisaged, although this data was not as broad as had originally been hoped' (Survey R1 21); 'Not as much data was obtained as we hoped but what we have is enormously useful for future research' (Survey R2B-20).

One of those who rated their project as only slightly successful pointed to issues with people in the group. He expressed disappointment with their collaboration relative to the high expectations he began with.

The thing is that I expected a lot from this project. I thought there was something we could really publish in because the thing that we are trying to tackle, we have not done before. And on all sides of the project we saw great progress, great data, and we thought, "Mm, this is really interesting. Let's invest in that."[...] [But for some of my collaborators] this seed project was not the top priority. She always [said it was] in the top three, but I don't think so, especially for the amount of work they did, they didn't, the data that it provided. It was obvious that they were not as interested as we were [...] So [...] it was not a total failure, but [...] Unfortunately I'm still, I'm still doing the work without funding, as we always do in a way [...] Because I want this work to be published. I'm pretty sure it can help to get bigger grants, and the main purpose of this seed money was to apply for NHMRC (Individual Researcher Interview 6).

Here we see that a combination of procedural and output aspects of the project contribute to this researchers' disappointment. Conversely, both aspects were also mentioned by other researchers as contributing to the perceived *successfulness* of their projects.

Overall, researchers associated a range of formal and informal, tangible and intangible, outcomes with success (see Table 3 for a range of comments), representing a mix of existing and potential intellectual, institutional and interpersonal benefits. These and other outcomes are now discussed in more detail.

Table 3. The types of outcomes that researchers associate with success in their ISG projects

Example survey responses by researchers on why they rated their project as "highly successful"

- *We got our data, we got publicity, we got the Linkage grant (R1 30).*

- *Have large dataset for future work and already have had one article accepted for publication (R1 4).*

- *We completed the job on time, within budget, and published the findings. We also had fun doing it (R1 19).*

- *Really supportive research relationships; new knowledge; two publications (R1 36).*

- *We worked well together, and complemented expertise to enrich the project's depth and scope (R1 14).*

- *We don't have final data yet. However, we have dramatically advanced the concept by working together and early small scale testing. Further, we have built a very strong team that could easily work on other projects of an interdisciplinary nature again. Most importantly, we have opened the minds of some people who otherwise were resistant to what we were proposing (R1 23).*

- *Project is still in progress but preliminary investigations indicate strong likelihood of achieving long term goals (R1 10).*

- *Although we are yet to apply for joint funding, this grant has been a logical progression from an initial conversation to a joining of interests and people (R1 31).*

- *[Highly successful] if the aim was to get different groups working together with a long term goal of increasing research productivity and research quality (R1 28).*

- *It brought about a lot more than anticipated; broadened my perspective considerably; and gave me broader and yet more focused research directions than before (R2B-15).*

- *Partly due to this project an ARC fellowship was awarded, journal paper was submitted (IF=12), the project is expanding this year, international PI got involved (R2B-3).*

2.4.2 Formal outcomes

Contributing to researchers' perception of the successfulness of their projects are the various "formal outcomes" that have emerged or were in the process of emerging from the ISG projects. "Formal outcomes" refers to outputs that have particular visibility and value within academia (and are thus implicitly positive). Those reported are:

- academic publications
- grants applications
- partnership agreements
- student training and
- new teaching roles and areas.

In support of the relatively non-prescriptive flavour of the ISG, this study indicates that academics do not need to be prompted to produce such academic outputs. Rather, they generally seem to be actively seeking opportunities for such products, particularly in cases where they want to gain an academic presence in a new area. Achieving such outputs takes time, however. At the time of field work in February-March 2011, most researchers noted that it was too early to report on such outputs. This extension of the "delivery period" beyond the formal funding period supports institute directors' expectation that there will be a lag time before the formal outcomes of CIDR are apparent.

Publications were mentioned across the board by interviewees as something they had produced, were in the process of producing or, in most cases, planned on producing. The ubiquity with which publications were mentioned as a target output juxtaposes with the relatively limited mention of publications in project applications, suggesting that they are simply a taken for granted part of academic life not in need of great emphasis. The strength of researchers' focus on publications is also notable because, unlike future grants, the ISG does not prescribe such an output and the rationale for some research projects was as much about societal as academic value. The ongoing prioritisation of publications in this context may also reflect the way such public documentation offers a sense of project completion, recognition, engagement with peers and the literature, and personal satisfaction.

As mentioned earlier, a few projects involving external partners or participants had also produced formal reports for these groups. The extent to which they have currency in academia is unclear. Although their production is a form of good practice in relating with research participants and partners, and can involve a large amount of effort and intellectual work (including extensive communication skills), the fact that reports are not peer-reviewed means they are generally accorded a minor status within academic workplaces.

One of the stated criteria of ISG-funded projects is that they show significant potential for future funding from (other) granting bodies. In keeping with this, grant applications were a strong focus across most projects. A few projects reported that they had already put in grant applications. As with publications, others mentioned that they are in the process of doing, or planning to do, the same. In virtually all cases, the grants referred to were those offered by the ARC (Linkage and Discovery) or NHMRC, so of an order of magnitude larger than the ISG project grants. A few researchers indicated that for them the success of the project hinged largely on the outcomes of these projects. As one wrote in the survey: 'We can't know how successful this project was until the outcome of the NHMRC grant application is known' (Survey R1 12).

Most researchers were strongly focused on producing academic publications and grant applications from their projects.

In some cases ('branch projects'), groups had previously applied for grants together and so it cannot be claimed that the ISG is wholly responsible for post-ISG applications. In general, though, it is clear that the scheme has been highly valuable in helping many groups strengthen further funding applications. It has achieved this by providing an opportunity to build research experience, outputs, credibility and linkages with other researchers and/or community and industry partners. For researchers with new ideas and collaborators of the sort that interdisciplinarity can inspire, the ISG especially functions as a stepping stone to other more

conventional and high-status research opportunities. By reducing the initial burden of proof placed on researchers about their research idea, the ISG scheme allows researchers to test and demonstrate their and their research project's merit to a more conservative funding audience.

While researchers generally expressed enthusiasm about the promise of establishing a new research project, some also expressed ambivalence about focusing on this outcome. In part this was due to wanting to celebrate other achievements as a sign of success in their own right as well as being a route to a grant. This mixed view was expressed by the following researcher:

> *What we're now doing is pulling together what we've done and we're hoping to leverage that into an ARC discovery grant [...] X [his colleagues] are fantastic to work with, so it was really quite exciting to have a small amount of money to make something happen and I'm quite seriously expecting that I'll be working on an ARC with them one of these days. [...] We've got one publication out of it already and another one that we expect to have this year. And it will have been a pilot study towards something that will be much more substantial and durable. I suppose the success of it depends on whether or not we're able to leverage it into an ARC grant. If we're not, that'll be tough luck, but nobody's going to think it will have been a waste of time (Individual Researcher Interview 3).*

Another researcher questioned the timeframe over which it is appropriate to measure grants and other outcomes, emphasising as many did, how long these processes can take:

> *You know, I'm involved in about three or four inter-disciplinary projects and I've found them very stimulating. But it's hard to know when you evaluate their outcomes. Do you do it in the year they got funded? Do you do it two years later? Do you do it four years later, because most of them are supposed to lead to larger grants applications (Individual Researcher Interview 5).*

Other researchers expressed ambivalence about the presumption that they would apply for large grants because of the risk such applications represent, commanding considerable time and effort but offering little guarantee of success. A couple of researchers expressed weariness and cynicism about applying for ARC grants in particular, pointing to the gate-keeping role played by the ARC, the limited array of other large funding opportunities seen to be available, and the personal (including emotional and motivational) costs of investing in large grant applications that prove to be unsuccessful.

Related to the question of research funding is a further formal outcome of the scheme noted by some researchers: the development and formalisation of agreements with new funding partners. In the case of ARC Linkage projects, this prior 'funding agreement' (albeit contingent) provides a valuable vote of confidence and thus symbol of success for researchers. One researcher, for example, described how, as a result of her ISG project, a government department who had previously rejected her invitation to be a potential ARC Linkage partner was now signed up. Reflecting on the project, she was very positive about the opportunity and outcomes:

> *I wanted what we've done, I think, which was the opportunity [...] to trial an innovative method and methodology, to try a new way of going about things [...] We*

were able to test this different kind of approach and it's even more different than I initially imagined [...] It's established a really good platform that hopefully the other work [they were not funded to do within the ISG project] will go on and I'm in the process of now preparing an ARC Linkage (Researcher A, Group Interview 1).

Numerous other researchers similarly noted that their project had led to funding agreements or closer relationships with industry partners. To the extent that these and other groups are successful in securing significant external grants for further research, both in the immediate and longer term future, they inject research dollars, innovation and opportunities into the University.

A further important type of formal outcome to emerge is student research training. Few projects requested funding for Honours and PhD projects, but a couple noted that being able to support such student qualifications was an unexpected benefit of their projects. More generally (relating to the informal outcomes discussed below), a researcher noted that they 'didn't anticipate how many students across the groups would come to share their methodologies and train one another' (Survey R1 31).

Student training represents supervision opportunities. A researcher explained how such opportunities had arisen for an early career co-researcher as an indirect result of their project:

I think the relationship between X and Y [the project co-leaders] has really been formalised through this project. [...] X is on the advisory committee for one of Y's PhD students and she's just picked up a PhD student who will start not this week but the next through Y, through some of Y's connections. So X's network has grown out in that direction and, yeah, it's been really good (Individual Researcher Interview 6).

More generally, a survey respondent noted that as a result of two laboratories becoming better acquainted through their project, there was more collaborative supervision on other projects:

Our groups are much closer and there is now much better collaboration across a number of PhD and Postdoctoral projects (Survey R1 31).

New lecturing opportunities also arose out of project-based connections in a couple of cases. For one individual this was through connections with the project partner:

It's actually built some nice networks for the people involved that have actually led on to other things. I know that X [her co-researcher] is going to do some stuff for the [NGO project partner]. Teaching and things like that that have come out of making those connections (Researcher A, Research Interview 1).

As a result of another project, a new area of teaching is opening up in the University between the two faculties involved:

It's also opened up links between them [the two disciplines] - incredibly so. The X faculty now actually teaches specifically, or has a few sessions, about [their topic area]. [...] We've also got [people from the two disciplines] talking together. Not just on our project, but through our project. [...] So we're part of a wave, which is nice. [...]There'll be a takeover soon! (Researcher A, Group Interview 3).

Such outcomes in the teaching realm are formal outcomes in the sense that they are recognised within the academic context. But they are also unexpected. About half of Round 1 survey respondents (46%) noted that 'unexpected outcomes' had emerged from their projects. Some such reported outcomes were process obstacles of the sort discussed in earlier sections. Other positive unexpected outcomes include 'significant publicity' (Survey R1 30) and the expansion of a team to include more researchers as official collaborators. Such formalised relationships are a small proportion of all the relationships developed directly and indirectly through the projects. As one researcher described, in her project:

> There's a lot of unplanned things happening as well as planned things. [...] Even the formation of the networks, no matter how generative they are, are actually having other impacts, some of which are very close to the project, some of which are further out. [...] Even with this one, where we've had passengers and just a few key drivers, I still think it actually will pay off in the longer term (Individual Researcher Interview 5).

Although, as the quote above emphasises, the true "pay off" of projects can only be considered in a longer term time frame, numerous informal outcomes had already emerged from many projects at the time of research, as we now discuss.

2.4.3 Informal outcomes

A range of less formal, inter-personal, intellectual and emotional outcomes have emerged from the ISG projects for some researchers. Direct and indirect, these outcomes provide insight into the wider effects, role and potential of the scheme in researchers' professional lives. Representing the *potential* for more formal outcomes to emerge in some cases, the intangible outcomes reported were generally very positive and included:

- feeling revitalised and stimulated by doing something different to the norm
- feeling satisfied at having completing a short, sharp project
- collegial relationships and mutual support among co-researchers
- new potential collaborators and partners
- extended or strengthened research networks/communities of practice
- new ideas, analytical tools and sensitivities
- new understanding of, and skills in, interdisciplinarity
- new understanding of, and skills in, collaboration and team management/leadership
- knowledge and confidence to explore new research areas
- awareness of new publication outlets and style
- insight into and validation of one's disciplinary perspective
- deepened self-knowledge and professional identity
- new perspectives on the University and Academy.

As discussed further in the following section, to a degree these outcomes reflect researchers' responses to the general characteristics of the ISG scheme and its existence and value for them.

These outcomes also stem from the specific aspects of people's project experiences, many of which have been described in previous sections, such as the enjoyment many researchers gained from their projects. As one commented, the project had led to 'an enormous sense of excitement and satisfaction' (Survey R1 25).

Besides enjoyment, some researchers emphasised the importance to them of having developed supportive relationships with their co-researchers – support that extends beyond the specifics of their project to enhancing their work life more broadly. This was particularly apparent in a couple of projects where researchers found they shared more than just a common interest in the topic. As one stressed:

> *We shouldn't discount that we've actually created a really nice supportive network*
> *amongst ourselves professionally and personally (Researcher A, Group Interview 1).*

Another group emphasised in interview that they were linked by a 'shared approach' (Researcher B), a 'kind of shared understanding [...] or values' (Researcher A, Group Interview 1). This was combined with an explicit respect for each other's different standpoints. The latter helped to make the project experience professionally validating for all involved.

> *I think it's been useful for my individual identity as a researcher. It has been*
> *affirmative [...] It helped affirm my ability and my identity as a researcher to work in*
> *an interdisciplinary way (Researcher B, Group Interview 1).*

In this comment, the researcher is focused on his performance of interdisciplinarity. Another focused on his developing understanding of a new discipline that he wanted to shift into, noting that the project had been 'a positive way to make that transition properly' (Individual Researcher Interview 6). Others discussed the implications of the research for their *disciplinary*-based identity, noting how the value of their disciplines was affirmed by others new to their perspective. As one commented:

> *Just hearing X [her co-researcher] say that she respects [my profession] [...] Well,*
> *that's great. She respects the way we think and work etc [...] It's mutual, but it's nice*
> *when a profession is espoused to be okay by another one [...] I think that we've all*
> *developed respect for each other's disciplines (Researcher B, Group Interview 3).*

Receiving positive feedback on the validity of one's discipline and disciplinary perspective illustrates what one of the institute directors emphasised as a benefit of interdisciplinary collaboration, which is learning to 'think about what we don't know that we do know' (Institute Director 3).

Besides being validated by others, researchers were challenged by others and this added to the intellectual stimulation of the project experience. Many discussed how 'conceptually and intellectual stimulating' (Survey R1 23) they found the research, with new approaches and vistas opening up to them. One, for example, commented that through her group's project, she now felt equipped to engage in an area of research she had

> **Researchers reported a wide**
> **range of positive informal**
> **outcomes, including new**
> **insights into their professional**
> **identity and context.**

long been interested in but had felt she did not know enough about. She stated that some of the flow-on intellectual benefits of interdisciplinarity for her were:

> *On some level there's new analytical tools that you take on, new sensitivities in your analysis that you acquire. And another is consideration of issues that you've had an interest in, but you didn't feel you had the knowledge to really properly engage with. So there's that as well - that I've gained knowledge in new areas - that I think "Oh, I can pursue that further." (Researcher A, Group Interview 2)*

The new research directions this researcher refers to are indirect personal extensions of (aspects of) her project's topic. Besides the specific details of research projects catalysing new research experiences and contexts, the innovative, interdisciplinary and collaborative character of the ISG projects also provided some researchers with a more general sense of possibility and openness to difference. A Research Assistant on the project discussed in the previous quoted found the experience raised her awareness and understanding of the different ways people work and the potential benefits of working in a group:

> *So it was really interesting for me because it was working with people from different disciplines [...] It was like "Well, I wouldn't have thought about it in that way". So it really just opened my mind up [...] in different analytical ways going, "Well okay, you can interpret things like that"... And then for me it was like the first time I really worked as a research team instead of just doing my own papers, and so it's really opened my eyes to another way of thinking, and how you go through the process of working as part of a research team [...] And this process of writing a paper has been really, really interesting for me because it's... I guess [...] when you're learning at university you follow a set pattern of what you're used to doing. But everyone has different ways of doing it. [...] I think if, you know, each individual person had tried to tackle this project it would never have been as rich as it has been. So having the team work together through the discussions that everyone's had... [...] For me it's, like, practical and intellectual, different ways of thinking, that's really helped me [...] It has given me another insight into a different way of looking [...] another lens [...] It has been really, really interesting for me and it's got me thinking that that's a different way of going forward in future research (Researcher D, Group Interview 2).*

We see here the recognised role of 'learning, unlearning, and relearning' in CIDR (Rhoten 2004, p. 11). Such processes are stimulated by awareness that things are different to the norm (e.g., single discipline, individual work) that one is used to. Weick *et al.* (2005) refer to this as 'sensemaking':

> *Explicit efforts at sensemaking tend to occur when the current state of the world is perceived to be different to the expected state of the world... In such circumstances there is a shift from the experience of immersion in projects to a sense that the flow of action has become unintelligible in some way (p. 409).*

It is by making 'the flow of action' in a project unintelligible that unlearning and relearning are demanded and collaborating and interdisciplinarity become both effortful and intellectually stimulating. As illustrated by the Research Assistant's comments above, awareness that such learning is happening is in itself a positive intellectual outcome of such research work, encouraging

reflection on one's prior presumptions and so deepening self-knowledge. A quantitative social scientist reflected, for example, that she found the process lead by her more interpretive social science colleagues incredibly organic and reflexive, making her more aware that she expected a more linear research process (Researcher A, Group Interview 1). In some projects, external stakeholders were also assisted through the projects to become more reflexive:

> *I think that it was successful for the people we worked with as well, because it actually got them to think about this important move that they're undertaking and to explore their thoughts and certainly talk about their experiences and how it had moved them along (Researcher B, Group Interview 3).*

Whether officially or unofficially, many projects engaged a diversity of people external to the core project group. Besides these connections leading to outcomes such as improved knowledge for these stakeholders, researchers also benefited. 54% of researchers reported that they have met new potential collaborators (outside of their project group) as a result of their project.

Other positive informal professional outcomes also emerged out of the existence and value of the projects and ISG scheme. Numerous researchers emphasised how much they enjoyed *the opportunity to do research of the sort* involved in their ISG project. One noted how much she enjoyed being able to escape from other more mundane and stressful aspects of academic life to participate in meaningful and interesting intellectual work with like-minded others. She commented:

Researchers reported a high level of interest in doing further collaborative and interdisciplinary research, and on the same topic and with members of their project group in particular.

> *We all get limited time to do research. [...] Well, I get very limited time. So for me the opportunity's been just to keep my hand in and keep my eye out and just be - it's just such a lovely space to be able to be talking with other people who've got a different set of information and insights into a field that I'm interested in [...] The best part about this project has been the time we've put into working together to do it: to think and to think conceptually. And, just, it's been such a lovely space. I know I keep going on about it, but it's true (Researcher B, Group Interview 2)*

For this researcher the project provided her with a space - a refuge - in which she could engage in the type of creative intellectual work that she most enjoys but has limited opportunity to do. Participating in quality intellectual engagement is key to most academics' job satisfaction (Bexley *et al*. 2011). By making this possible in a highly accessible manner, the ISG scheme carries positive emotional value for many researchers, both through their direct experience and by giving them optimism about what is possible within the University and academia.

It is significant here that the treasured opportunity for interesting new research is funded by the University itself (and not an external body). By addressing a deeply held researcher desire – to be able to escape daily binds and engage in creative research – the ISG scheme positions the University as responsive, understanding and enabling. If the funding had alternatively been provided by an

external body (e.g., through the coveted freedom of an ARC fellowship), the University would be more strongly positioned as merely the source and site of professional distractions and frustration from which escape is needed through external grants, and/or as a master to be pleased with grant offerings.

Significant also is that the scheme makes the opportunity accessible in a way that suggests a trust in academics, which is often missing in more managerial processes that implicitly communicate to academics that they and their research represent downside (rather than upside) risks for funding agencies. Adding powerfully to the ISG scheme's association with intellectual freedom and thus respect for researchers' desires is the positive value of some of its seemingly incidental details, notably:

- The absence of conventional merit-based criteria that require prior demonstrated success in an area of research or in a collaboration
- Openness to researchers from all areas, backgrounds and stages of career within the University, including untenured staff
- A prospective rather than well-established linkage with an institute
- The simplicity of the application process.

More broadly, the ISG projects and scheme in general is "read" by researchers (and no doubt all applicants) as a window onto the University and what is valued in the institution. While this is true of all experiences with the institution, with researchers building up a multi-layered and fragmented picture of the imagined whole through a series of specific interactions, it is perhaps especially the case for the ISG scheme because it is relatively anomalous as a funder of interdisciplinary research. The ISG scheme also attracts curiosity because, as indicated in Section 2.3.1, its origins and intention are somewhat mysterious to researchers. This includes the character and role of the research institutes in the scheme and more generally, as discussed further below.

2.4.4 Future plans

An informal outcome of special note is how the projects have shaped researchers' sense of what sort of work, and with whom, they would like to engage in the future. In the survey, researchers were asked if they would like to continue working on the same topic and whether they expect to continue working with (some of) the same people as on their ISG project. The vast majority gave an affirmative answer to both questions (Table 4), with around 10% indicating that they are not sure and no one indicating that they are definitely not interested. That slightly more researchers are definite about continuing to work on the same topic than with the same people may reflect the different wording of the questions. Alternatively, it may reflect the fact that for some people the intellectual benefits were gained through and despite some unenjoyable aspects of their group work (as described in Sections 2.3.3, 2.3.4 and 2.3.5). Some may also have interpreted working together as a formal relationship, which may disguise the intended continuation of more informal connections over time. As one interviewee stated: 'Speaking personally, I'd be keen to continue the group in whatever form' (Researcher A, Group Interview 2). In this and other groups, it seems that as found by Rhoten (2004), the projects may be giving rise to what could be called 'communities of practice' (*cf.* Lave and Wenger 1991) or more distributed 'networks of practice' (*cf.* Brown and Duguid 2000):

loose groups of researchers interested in collectively exploring similar issues/practices but not necessarily with the aim of achieving a direct or immediate 'expressive effect' (Strathern 2005).

Table 4. Extent to which researchers want to or expect to continue working with their ISG topic and/or collaborators (n=25)

	Would you like to do more work on the same topic?	Do you expect to work with any of your ISG team members in the longer term?
Yes, definitely	72 %	62 %
Yes, probably	20 %	27 %
Possibly	8 %	12 %
No, not likely	0 %	0 %
No, not at all	0 %	0 %

How project groups, informal networks, new formal collaborations, and their topics of interest extend, fragment, evolve and solidify over time is a question for future research. Some projects may continue a pre-existing process of branching off, while others may start something new or cease their contact. While many groups indicated that they thought their group and project topic would extend relatively unchanged into the future, others emphasised the uncertainty, contingencies and variations involved. As one researcher commented about ISG projects in general, reflecting the expectations of institute directions described in the Section Aims and expectations for the projects:

> *Some of them will [fail] [...] and I think that's fair enough. Some will have a short life and even though they might have some other applications, the actual project will come to an end with some outputs. But others will go on. Well, they won't go on, they'll go for other money and if they get other money then they'll have a life. But if they don't, they won't. And then some partnerships will work out of these projects - there might be one or two people who'll get together and really gel in terms of future research applications (Individual Researcher Interview 5).*

Irrespective of the trajectory of specific groups and projects is whether researchers are interested in doing further interdisciplinary or collaborative research. A striking 96% of Round 1 researchers indicated in the survey that they would like to pursue future opportunities for further interdisciplinary research in the future. Some of this derives from a pre-existing interest in such research. As one person commented 'I always try to conduct interdisciplinary research' (Survey R1 14). Nevertheless, 35% indicated that their level of interest in interdisciplinary research had increased moderately as a result of their ISG project experience, and 4% indicated it had increased dramatically. The potential for ISG projects to also influence (positively or negatively) Round 2 researchers' attitudes to interdisciplinary research is suggested by the fact that 23% noted that they do not yet know whether they want to participate in more interdisciplinary research than they do[13]. Importantly, interest in doing more interdisciplinary research

> **The main barrier to researchers doing more CIDR is a lack of time to invest in slow and risky research.**

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[13] 65% reported that they already want to do more; 12% indicated that they do not want to.

does not mean that researchers will be indiscriminate in what opportunities they pursue. Some noted that it depended on the quality of the interdisciplinary research opportunity that arose. This depends in part on who else would be involved. Some specified they wanted to work with 'a smaller interdisciplinary team' (Survey R1 22), with 'responsive researchers' (Survey R1 9), or with 'the real interest of people willing to collaborate' (Survey R1 6).

Associated with a greater interest in interdisciplinarity is a greater interest in the research institutes. Most researchers indicated that as a result of their projects, their level of interest in the associated institute had increased to a degree (Figure 3). Some were unsure, or indicated that their interest remained unchanged or had decreased.

In terms of collaborative research in general, 77% of Round 1 researchers indicated that they would like to participate in more collaborative research than they do. A lack of time was overwhelmingly the main reason given for why they are not collaborating to their desired extent, with a lack of grant money also frequently mentioned. This issue of obstacles is taken up in the following section.

Has your level of interest in the research institute(s) your project is associated with changed as a result of your involvement in the project?

- It has decreased 4%
- It has not changed 20%
- It has increased 56%
- None of the above 4%
- I don't know 16%

Figure 3. Reported levels of change in how interested researchers are in the research institute their project was associated with (n=25)

2.4.5 The career context

Despite the ongoing unusualness of interdisciplinary research in the University context, and much discussion in the literature about the bias in academic success measures towards disciplinary based outputs, survey respondents in this project were generally very positive about the role of CIDR in their careers. While there is simmering frustration about the narrowness of the existing performance development framework, only a few reported concerns about the way in which their interdisciplinary work is perceived by their disciplinary peers and supervisors, suggesting that such a direct bias against interdisciplinary work is limited to some quarters of the University.

In contrast, it seems that related but less direct barriers are more influential. Among these is the relative lack of research and lectureship opportunities for those interested in making CIDR a major component of their career. While it seems that opportunities such as those provided by the ISG scheme contribute to the ability to engage with CIDR as a "side project", some researchers noted that to the extent that interdisciplinarity is still under-represented in ARC-type grants, it is less

apparent how researchers can forge whole careers in such work. Here, the modest scale of the ISG scheme was noted as an important introduction to CIDR but not as an indicator of longer term or more substantial University support for such research. An absence of perceived career paths increases the relative riskiness of the research for researchers, underlining the multiple ways in which their CIDR efforts involve forging new ground.

Representing another indirect influence, the most serious and institution-wide barrier to researchers' ability and willingness to do CIDR seems to be a clash between the typically large time demands that collaborative and especially interdisciplinary research involves, and the time pressures that academics are already under. Thus, while in most cases CIDR is not overtly discouraged, combined with limited funding opportunities in the existing risk-averse funding environment, the structural context militates against such research. In this time constrained context, relatively small, contained projects and focused opportunities of the sort the ISG scheme supports seem to be an appropriate mechanism for stimulating CIDR. As one researcher put it:

> This is a broader issue: there's countless initiatives, networks, things going on, and it comes down to the fact that most of us don't have the time to go along to these things, and collaborations have to come out of a very specific process like ours did (Researcher B, Group Interview 2).

Time pressures add to the riskiness for researchers of investing time and energy into CIDR, given that such research is often not straightforward or rapid. These and other disadvantages are summarised in Table 5 where advantages discussed in the previous section are also listed.

Table 5. Summary of career advantages and disadvantages reported by survey respondents for Rounds 1 and 2 of the ISG scheme (italics indicate dominant responses)

Perceived career advantages of CIDR	Perceived career disadvantages of CIDR
• *Innovative, interesting and socially beneficial research* • New insights, ideas, skills and knowledge • New terrain to publish in and more publications • Broader networks and new collaborators • More grants • Possibly increased professional profile	• *Extra time and effort required* • Slowness of apparent progress • Riskiness of collaborations and research process • Perceived disloyalty to home discipline • Lack of recognition for achievements in conventional measures of academic performance • Lack of funding and therefore career opportunities

When asked what the University could do to support CIDR, the vast majority of researchers requested the continuation of the ISG grant scheme or provision of other longer-term funding opportunities to help embed it more centrally into the University and help change the culture in the ARC and other governing bodies. Some also suggested more general networking opportunities, but

others, like the researcher quoted above, were ambivalent. More common were requests for direct, focused engagement with the institutes to link the projects in with specifically interested others.

Some also suggested that more attention be given to building skills in group facilitation, project management and interdisciplinary. Based on her experience with interdisciplinary in other institutions, one researcher outlined in detail what she considers to be missing at Melbourne:

> *In the first instance I'm absolutely for these developments, so my criticisms are within the context that I think it's been a very good initiative and I think it should be forwarded. I think people need to be held a bit more to account with these projects by the funding body [...] I think it is good to have some experienced academics in the work who are also good at group facilitation, because there are some people that don't have the first idea about getting a group to work. I mean really basic stuff. And different professional groups have different skills in this regard, so as well as the intellectual leadership, you do need some sort of appreciation of group process. [...] You do need some maturity and leavening in the teams. [...] It would be good to compare what different projects have done. Maybe some sort of [...] comparison of successful projects in terms of what people have seen of the developmental phases. I mean if you want some prescription of this, [you need] some sort of first meeting and then first hurdles, and then sort of building in the longer term. And people have to commit to it (Individual Researcher Interview 5).*

What this researcher is proposing is a process to facilitate and formalise learning within and from the ISG projects in order to both improve their outcomes and accelerate the progress of subsequent projects. Much as was argued about teaching within academia ten years ago, this is about acknowledging that CIDR are skills that people need to learn about, work at and reflect on. It is also a way of compensating in part for the narrowness of existing performance development criteria and its ill-fit with the broader and less easily quantified outcomes of interdisciplinary research. Huutoniemi (2010) suggests that as 'both the benefits and challenges of integrative research are often found in the collaboration and communication process itself', a 'coaching' model or 'interactive peer review' to facilitate self-reflection is more appropriate for fostering and institutionalising learning about interdisciplinary than the conventional 'jury model' focused on merely assessing a limited array of knowledge outputs (p. 314). As a step towards facilitating self-reflection among researchers as a group, we now consider, in the final empirical section, some reflections from researchers about what they think others need to know.

2.4.6 Lessons

A broad lesson identified by researchers is the need to "prepare". More specifically, three broad lessons emerge from the many comments researchers provided about what they consider others need to know about CIDR:

1. Enjoy it but recognise it takes time and effort
2. Be open-minded, listen hard and communicate carefully
3. Consciously manage the group and research process.

The first of these reflects the mixed outcomes some researchers reported, particularly the lag time in achieving formal outcomes. It reflects the way that perceived success is relative to expectations, and that rather than thinking it is a quick and easy route to getting a publication, people need to be prepared to work at making a CIDR project work. The message is that neither the collaborative and interdisciplinary elements of projects happen automatically or effortlessly but take commitment, tenacity and the ability to take on the risks inevitably involved. As respondents emphasised, newcomers need to recognise that:

> *There can be ups and downs, fruitful as well as frustrating experiences (Survey R1 32).*

> *The key fact is its more fun, but takes more effort to keep focus and hit KPIs (Survey R1 11).*

> *There is a need for all collaborators to be patient (Survey R1-8).*

The second broad lesson stems from the many reflections described throughout previous sections about the ways in which interacting with new topics, ideas and others' perspectives can be intellectually and emotionally challenging. Part of the need to be mentally prepared to expend considerable effort, this message was emphasised by many researchers as recognising the importance of "communication". People emphasised the need to be respectful of other disciplines and conscious of when one was feeling defensive. A scientist in particular stressed the need to communicate clearly, avoid jargon, and continuously test the effectiveness of communications:

Researchers underlined that CIDR is facilitated by being highly organised and conscious of the process and tradeoffs.

> *Often a lot of the problems that come around [...] is about just not communicating and making sure that what you're communicating is being communicated. So often people hear, but they don't understand. Or they misunderstand, or they don't get what's the meaning for them. So reiterating - making the communications in a number of formats – like, a meeting format and verbal format and then a written format. People one way or another will suddenly go "Okay! Do you mean...? I'm not sure that will actually work now" - even though they've said "Yes, it will work fine" and that they can do it no problem. They've just completely misunderstood what the hell's going on [...] People reinterpret stuff. Even if it's written, they'll go "Okay it doesn't really mean that, it means this" you know. [...] You get material that isn't what you think it is, isn't what you specified [...] If you can't communicate to your collaborators, then you're stuffed [...] So that would be my biggest set of advice is just keep the communication things going. And make sure that, upfront when you start anything, that people really do know what's going on. It means that you may seem a bit simple in a sense, or you may think "This is being a bit idiotic isn't it? Surely they should be able to get that sorted" [...] [You need to] make sure that you sort of communicate in a way that isn't dumbing down, but also a way that they're going to get it. So get to know the other people a little bit in terms of where their backgrounds are, what research they've been doing in the past. That gives you a*

better understanding of how best to approach something [...] [Watch out for] shorthand and things like that that people use a lot. It's good to know that you don't need to be jargonising a lot of your work (Individual Researcher Interview 2).

Another researcher made a comment that points to the need to communicate clearly and honestly about different collaborators' motivations and expectations, noting that in his group: *'Greater success would have been possible if hierarchy/motivation of different teams was better understood'* (Survey R1 9).

This brings us to the third broad lesson, which is about the need to consciously devote effort to managing the group and research process. The most number of suggested lessons were about the need to approach the projects in a reflexive, focused manner in order to facilitate the group and organise the research. This emphasis on planning and management represents a complement to the emergent and uncertain character of the intellectual work. It suggests that the open-endedness of interdisciplinarity needs to be balanced with the closure provided by a structured project management process, including taking time to build a shared understanding and rapport. As some emphasised, what they have learnt is that:

Clear goals, a project plan to achieve objectives, and conservatively estimated project schedule [are needed] (Survey R1-8).

With the right goals in place it works well (Survey R1-1).

Good preparation, management and planning is essential (Survey R1-21)

Within this emphasis on structure, there is also the need to maintain some flexibility in the face of the emergent character of the projects. As one commented:

Need to be flexible about adjusting methods and goals according to the dynamic of collaboration as it emerges (Survey R1-36).

The overall message then is about balance: between pros and cons, fun and effort, emergence and goals, flexibility and forward planning. It is about recognising that CIDR involves downside and upside risks, but with skill and effort the balance can be tipped in favour of the latter.

3 Conclusions and possible future directions

3.1 Conclusions

Collaborative research and interdisciplinary research are being promoted within academia in response to overlapping but distinct drivers that reflect broader concerns about how academia is positioned in society. Along with the development of the research institutes (and a program of Future Fellows), the University of Melbourne has started to institutionalise its stated commitment to both through the ISG scheme. The researcher feedback reported in this document suggests that the ISG scheme is successful at many levels. While projects are diverse and ongoing in formal and informal ways, the researchers involved have generally found the experience valuable and products of significant academic and societal worth have started to emerge. In this way, the scheme is helping to address academia's modern need to be innovative, productive, and accountable and useful to society. In addition to fulfilling these logics of interdisciplinarity, a few projects have successfully been working toward critically engaging with and seeking to improve aspects of the *status quo,* including conventional academic practice.

Researchers also reported diverse personal benefits such as meeting like-minded others. In a sense, researchers benefit from simply knowing that others in the University are interested in CIDR, including the institute directors who have supported their ISG projects. By providing for researchers not only opportunities for fruitful research but a window on to the University that they are part of, the ISG scheme strengthens researchers' institutional identity at a time when this is being stressed by other developments. Concurrently, small aspects of the ISG scheme (namely a low level of institute involvement) inadvertently obfuscate researchers' understanding of how CIDR, institutes, and thus the researchers themselves are positioned within the University, creating for some a sense of confusion, and missing an opportunity to deepen researchers' sense of professional community.

In a similar way, the mundane, incremental decisions researchers make about how their projects are organised - from the moment of application and team formation, through to the details of how to write together - can have strong epistemological and interpersonal implications, shaping the type of interdisciplinarity that is consciously or unconsciously performed by individuals and projects groups. More than actual disciplinary differences, systemic differences between research "traditions" (namely positivist and interpretivist traditions) emerge in the ways different researchers approach research practice, including its interpersonal aspects. The project structure provided by the ISG scheme offers both advantages and disadvantages and familiar and unfamiliar aspects for different researchers. Limitations are introduced by the modest size of the grant but so too are welcome containment, accessibility and accountability. While the timeline of funding does not capture the full extent of work done on many projects, the low transaction costs and trustfulness of the application process are appreciated by researchers.

The timeframe of this MICE project similarly does not capture the full extent of the outcomes of the ISG projects. Researcher interest in pursuing avenues opened up by their ISG projects indicates that outcomes are likely to be prolific and diverse, if not always traceable. It is an open question how the innovative content and refreshing researcher experience of CIDR (of different modes and orientations) is altered as it is translated into the more risk-averse but high-status sphere of ARC-

type funding, or even by the expectation that it will ultimately lead to research in such a established sphere. It is also an open question how this sphere itself may be altered by CIDR over time.

A strength and weakness of CIDR is that it is risky. Interdisciplinary research in particular promises new and innovative insights and experiences but only on the proviso that considerable intellectual, interpersonal and personal challenges are successfully negotiated. Researchers as well as research funders carry this risk. It is important to recognise that the time pressures they are under are not only a predominant barrier to CIDR but a systemic consequence of the productivity push that collaborative research is a direct response to, exposing tensions within the trajectories and logics of modern research institutions.

Collaboration and interdisciplinarity are approaches to research that prompt us individually and collectively to ask what sort of research we value and why. As such they prompt us to consider the context in which research is being conducted, both within and beyond institutes, departments and the University. Reflexivity of the sort needed for successful CIDR is needed more broadly to address the question of how individuals and the academy are adapting to the diverse societal demands upon them, as well as how they in turn can contribute to adapting that societal context as needed.

3.2 Possible future directions

For the 2011/2012 projects

1. Formally recognise and celebrate the successful applications (e.g., phone calls to research leaders, letters to all members of the research groups) to: communicate that the projects are taken seriously; help build (all) researchers' focus and drive; welcome the project groups into the institute communities; and facilitate inter-personal engagement.
2. Formally acknowledge and provide feedback on all unsuccessful applications
3. Consider meeting early in the research process with the whole of each research group to talk through the substance of their research ideas and plans, including what each researcher will contribute. Alternatively, organise for an appropriate mentor to do so. Point them to successful projects.
4. Distribute simple documentation to researchers about the administrative details of the scheme, including expectations on researchers, such as the Interact forum. Encourage people to present their research in different fora within the University (and beyond) to help build recognition of and discussion about the scheme. Request that the ISG scheme and relevant institutes are acknowledged in all such presentations and publications.
5. Request 1-2 page progress and final reports. Include in these not only project finances but some reflection about outputs, presentations, the regularity and effectiveness of group interaction, each person's contribution, learnings to date and future plans. Require that any publication, presentation or successful grant application is reported back to the scheme/relevant institute to help track outputs.
6. Facilitate networking opportunities between project groups and cohorts, and within and across institutes, as well as between projects and other institute initiatives/researchers
7. Consider setting up a website for the scheme to facilitate information sharing and networking between researchers

8. Increase publicity about the projects within the University and beyond to help build the kudos of the scheme and people's awareness of the University's commitment to facilitating CIDR. Brand the projects as ISG projects to encourage understanding of the university wide nature of the effort, but also acknowledge the connections to institutes. Concurrently publicise those projects funded independently by institutes to communicate the extent and cohesion of the scheme's reach and the financial support provided by the institutes.

For the completing 2010/2011 projects

9. Meet with each group separately or together to celebrate their achievements and reflect on their experiences. Celebrate research findings and publications as an achievement in their own right and not merely as a ticket to a further grant.
10. Ask successful project groups whether they would be happy to be involved in efforts to facilitate learning among other groups.
11. Collate the outcomes by institute and publicise to facilitate further recognition and collaborations.
12. Ask for specific feedback on groups' interactions with the institute over the course of the grant and identify areas for improvement.
13. Consider applying all of the above to 2009/10 projects as well.

More broadly

14. Issue a statement about the ISG scheme that positions it within the University's strategy and other initiatives (including those for early career researchers) so that its purpose is clear and it is seen as part of a broader effort rather than ad hoc. This will help give researchers the confidence to invest in it.
15. Link the scheme to other initiatives around collaboration and interdisciplinarity, such as the Future Fellows scheme (e.g., invite Future Fellows to scheme-based networking events)
16. Consider collating a media-friendly version overview of each project at the end of each year in a type of annual report on the scheme.
17. Be upfront and reflective about the challenges of interdisciplinary research. Encourage a culture of reflection and learning about conducting CIDR, acknowledging the diversity of approaches possible and the relationship between these and decisions about research process. Provide researchers with learning opportunities and tools (e.g., a tip sheet, project checklist or guide, recommended reading or workshops).
18. Celebrate success stories while acknowledging the exciting risky nature of interdisciplinary research in order to help develop acceptance of the value of "failures".
19. Extend the scheme for another 3 years and then re-evaluate the need for it. Consider reducing the number of projects by a third and increasing their length and funding by a third (ie 18 projects funded for 18 months with approximately $60,000 each, as opposed to 24 projects funded for 12 months with approximately $40,000), with the explicit expectation that grants are applied for after 12 months. This would better reflect the true costs and timing of the projects, help to maintain research and collaboration continuity between the ISG funding and subsequent grants, and signify the University's understanding of and commitment to quality interdisciplinary work.

20. Consider ways of enhancing the cohesion and clarity of the scheme and cross-institute researcher linkages. This could include considering the pros and cons of administering the grant through a central university unit and allowing institutes to focus on providing intellectual communities of practice.

21. Further develop the option of submitting an application to the scheme not directly connected to any of the institute's stated research interests to allow for innovative ideas that are beyond the confines of existing themes or beyond the confines of a problem-based orientation to interdisciplinary research.

22. Collate financial spending on the scheme and related institute-specific seed funding initiatives across all of the institutes to help track return on investment.

23. Develop and advocate for a way of better recognising interdisciplinary research in researchers' performance development framework appraisals.

24. Extend this evaluation and couple it with socio-cultural research that explores the specificity of situated knowledge production in interdisciplinary contexts beyond outputs. One example of this was the highly successful ESRC-funded research program at the University of Cambridge titled 'Interdisciplinarity and Society: A Critical Comparative Study' (see Barry *et al.* 2008, http://www.sci-soc.net/SciSoc/Projects/Governance/Interdisciplinary+and+society. htm). The University of Melbourne can make valuable contributions by researching its own growing strengths in interdisciplinary research this way, building on the start it has made with this MICE project.

References

Alvesson, M. and K. Skoldberg (2000). Reflexive Methodology: New vistas for qualitative research London, Sage.

Barry, A., G. Born and G. Weszkalnys, (2008). "Logics of interdisciplinarity." Economy and Society **37**: 20-49.

Behrens, T. R. and D. O. Gray (2001). Unintended consequences of cooperative research: impact of industry sponsorship on climate for academic freedom and other graduate student outcome.

Bexley, E., R. James and S. Arkoudis, (2011). The Australian Academic Profession in Transition. A report for the Department of Education, Employment and Workplace Relations, Australian Government. Melbourne, Centre for the Study of Higher Education, The University of Melbourne.

Bolitho, A. and M. McDonnell (2010). Interdisciplinarity in Research at The University of Melbourne, University of Melbourne**:** 38.

Bourdieu, P. and L. Wacquant (1992). Invitation to Reflexive Sociology. Cambridge, Polity.

Brew, A. (2008). "Disciplinary and interdisciplinary affiliations of experienced researchers." Higher Education **56**(4): 423-438.

Brown, J. and P. Duguid (2000). The Social Life of Information. Boston, Cambridge University Press.

Bruce, A., C. Lyall, J. Tait, and R. Williams, (2004). "Interdisciplinary integration in Europe: the case of the Fifth Framework Programme." Futures **36**: 457-470.

Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jager and R. B. Mitchell (2003). "Knowledge systems for sustainable development." Proceedings of the National Academy of Sciences of the United States of America **100**(14): 8086-8091.

Committee on Facilitating Interdisciplinary Research, N. A. o. S. N. A. o. E. I. o. M. (2004). Facilitating Interdisciplinary Research: Executive Summary, National Academy of Sciences, United States.

Davies, M. and M. Devlin (2007). Interdisciplinary higher education: Implications for teaching and learning. Melbourne, Australia, The University of Melbourne**:** 14.

Evans, R. and S. Martin (2004). Disciplining the sustainable city: moving beyond science, technology or society? , Paper presented at the Leverhulme International Symposium on the Resurgent City, London School of Economics.

Fox, M. F. and C. A. Faver (1984). "Independence and cooperation in research: the motivations and costs of collaboration." The Journal of Higher Education **55**: 347-359.

Frodeman, R. and C. Mitcham (2007). "New directions in interdisciplinary: Broad, deep and critical." Bulletin of Science, Technology & Society **27**(6): 13.

Gill, N. (2006). "What is the Problem? Usefulness, the cultural turn, and social research for natural resource management." Australian Geographer **37**(1): 5 - 17.

Golding, C. (2009). Integrating the Disciplines: Successful interdisciplinary subjects. Centre for the Study of Higher Education, University of Melbourne.
http://www.cshe.unimelb.edu.au/resources_teach/curriculum_design/docs/Interdisc_Guide.pdf

Guggenheim, M. (2006). "Undisciplined research: the proceduralisation of quality control in transdisciplinary projects." Science and Public Policy **33**(6): 411-421.

Guston, D. H. (2001). "Boundary Organizations in Environmental Policy and Science: An Introduction." Science, Technology & Human Values **26**(4): 399-408.

Hunt, J. and S. Shackley (1999). "Reconceiving science and policy: academic, fiducial and bureaucratic knowledge." Minerva **37**: 141-164.

Huutoniemi, K. (2010). Evaluating interdisciplinary research The Oxford Handbook of Interdisciplinarity. R. Frodeman. Oxford, Oxford University Press**:** 309-320.

Jacobs, J.A. and S. Frickel, (2009) "Interdisciplinarity: a critical assessment." Annual Review of Sociology **35**: 43-65.

Jamison, A. (2008). "To Foster a Hybrid Imagination Science and the Humanities in a Commercial Age." Ntm **16**(1): 119-125.

Lave, J. and E. Wenger (1991). Situated learning: Legitimate peripheral participation. New York, Cambridge University Press.

McCalman, J., L. Muir and C. Soeterboek, (2008). Adventures with Breadth: A story of interdisciplinary innovation. Report on the subject An Ecological History of Humanity. Centre for the Study of Higher Education, University of Melbourne. http://www.cshe.unimelb.edu.au/resources_teach/curriculum_design/docs/Adventures_with_Breadth.pdf

Miller, C. (2010). Policy challenges and institutional reform. The Oxford Handbook of Interdisciplinarity. R. Frodeman, J. T. Klein and C. Mitcham. Oxford, Oxford University Press**:** 333-337.

Morgan, M. S. (2010). Travelling Facts. How Well Do Facts Travel? The Dissemination of Reliable Knowledge. P. Howlett and M. S. Morgan. Cambridge, Cambridge University Press**:** 3-40.

Office of the Vice Chancellor (OVC) (2009). Refining our Strategy: A discussion paper that invites involvment and response. Melbourne: University of Melbourne.

Petts, J., S. Owens, and H. Bulkeley (2008). "Crossing boundaries: Interdisciplinarity in the context of urban environments." Geoforum **39**(2): 593-601.

Reisinger, A. (2011). "Interdisciplinarity: are we there yet?" Climatic Change **108**(1-2): 23.

Rhoten, D. (2004). "Interdisciplinary Research: Trend or Transition." Items and Issues **5**(1-2): 6.

Rhoten, D. and A. Parker (2004). "Risks and rewards of an interdisciplinary research path." Science **306**(5704): 2046-2046.

Sa, C. M. (2008). "'Interdisciplinary strategies' in U.S. research universities." Higher Education **55**: 16.

Star, S. L. (2010). "This is Not a Boundary Object: Reflections on the Origin of a Concept." Science, Technology & Human Values **35**: 17.

Star, S. L. and J. R. Griesemer (1989). "Institutional ecology, translations and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939." Social Studies of Science **19**(3): 387-420.

Strathern, M. (2005). "Experiments in interdisciplinarity." Social Anthropology **13**(1): 16.

Strober, M.H. (2011) Interdisciplinary Conversations: Challenging habits of thought. Stanford< Standford University Press.

van Rijnsoever, F. J. and L. K. Hessels (2010). "Factors associated with disciplinary and interdisciplinary research collaboration." Research Policy: 10.

Weick, K. E., K. M. Sutcliffe and D. Obstfeld (2005). "Organizing and the process of sensemaking." Organization Science **16**(4): 409-421.

Appendix

Two examples of using Social Network Analysis to visualise co-authorship patterns between ISG project group members
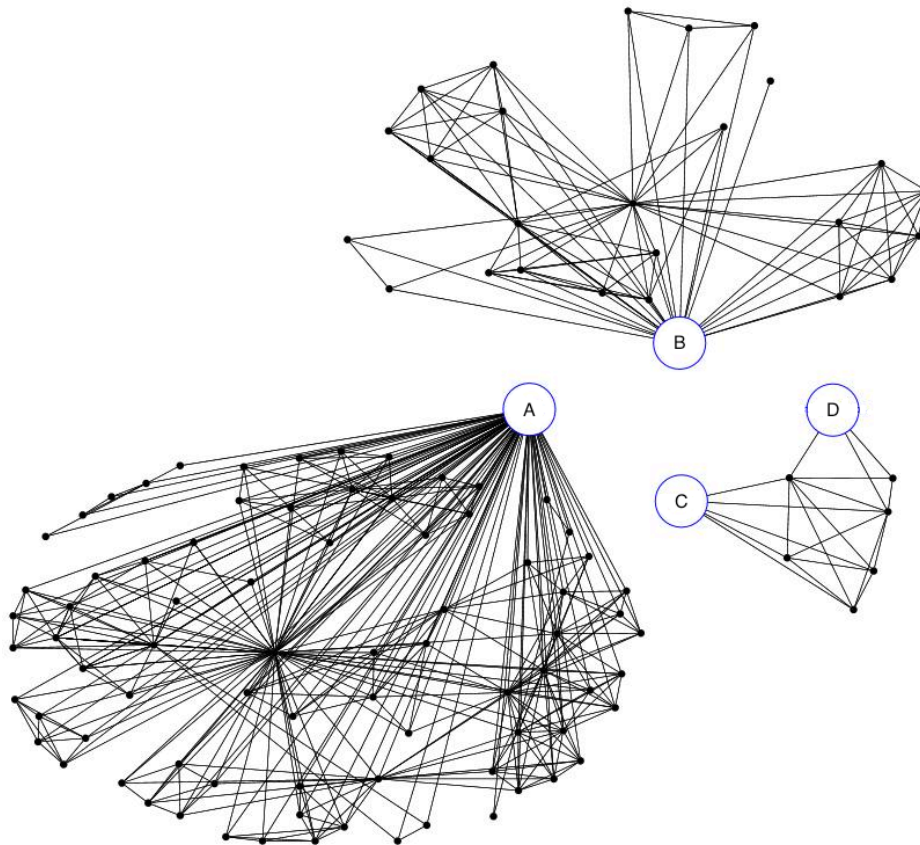

Figure a. Example of authorship patterns among the 4 reseachers (represented by nodes A-D) of an ISG project group, prior to the commencement of the ISG project. The black dots represent other co-authors and lines represent publications (each line may represent one or more co-authored publications between the authors). In this case, none of the ISG researchers had published together, but two of them (C and D) had two co-authors in common.
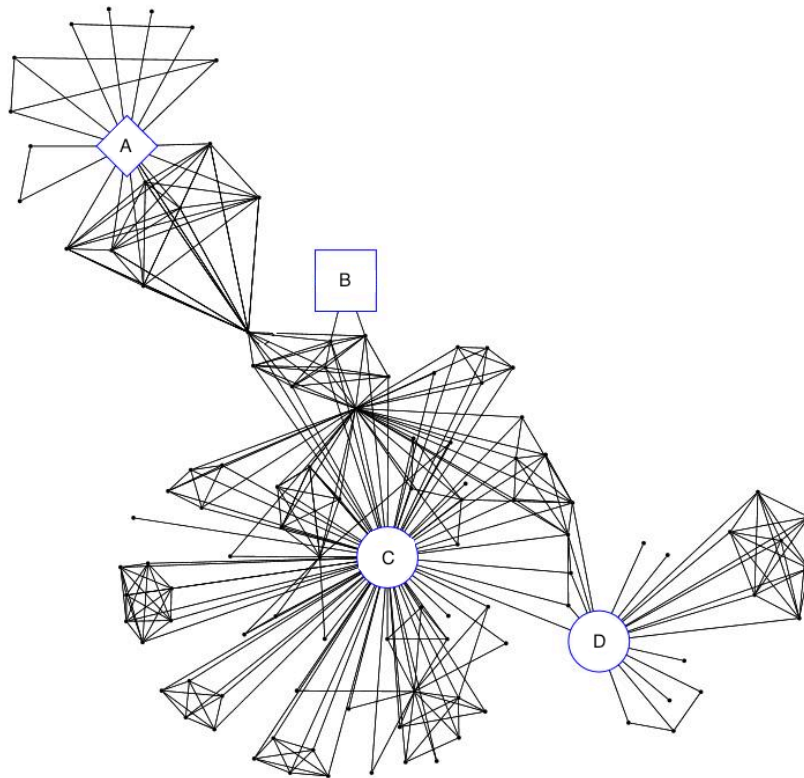
Figure b. Further example of authorship patterns among 4 reseachers (represented by nodes A-D) of a different ISG project group, prior to the commencement of the ISG project. In this case, researchers C and D had published together and B, C and D shared many co-authors in common. Researcher A has a slightly separate co-authorship network, connected to that of B through one common co-author.