Negotiating difference in an interdisciplinary collaboration

Lessons from a small islands developing states resilience project

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Key messages

- One's ability to get on with others is as important as one's expertise.

- Interdisciplinary work requires an experimental approach, giving individuals time and space to explore differences.

- Those who emerge as key leaders or managers need the skills to bring people together, often in challenging circumstances, to bring out the best in individuals and broker relationships between sub-groups. These skills are acquired by working in interdisciplinary contexts.

- Organisation and coordination work should not be underestimated: they must be valued, adequately compensated and clearly assigned to individuals.

- Prioritising interdisciplinary fieldwork can go a long way to helping identify and negotiate differences.

- Regular collective reflection on how the group is getting on, and paying attention to people's experiences, can be productive and therapeutic, helping to improve working relationships.

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Acronyms

DRM	disaster risk management
ESRC	Economic and Social Research Council
EWF	Earthquakes without Frontiers
GCRF	Global Challenges Research Fund
NERC	Natural Environment Research Council
PI	principal investigator
PNAS	Proceedings of the National Academy of Sciences
SIDS	small island developing states
STREVA	Strengthening Resilience in Volcanic Areas

Executive summary

At its heart, interdisciplinary work requires individuals to embrace, explore and negotiate their disciplinary and personal differences, in pursuit of innovative policy solutions. To do this effectively, it is important to understand the reality of how interdisciplinary projects work, and how to best navigate differences and negotiate conflict.

Yet, despite increasing trends toward interdisciplinarity, there are relatively few accounts or reports reflecting on researchers' efforts to work across disciplines. This paper seeks to redress this, by reflecting on the collaborative practices of a group of researchers convened to undertake an interdisciplinary project on the drivers of risk in small island developing states (SIDS).

Research questions and methodology

The research questions for this paper comprised:

- What approach was taken to managing this research project and why?
- What factors shaped the quality of communication amongst the collaborators?
- What differences emerged during the project, and why and how were they negotiated and reconciled?
- How did researchers' perspectives change during the project?
- What lessons are there for others pursuing interdisciplinary work?

Reflections in this paper are based on telephone conversations with 11 project team members based in the United Kingdom and observations from three team-wide meetings. From this study's key findings, this working paper draws out six key lessons for others pursuing interdisciplinary collaboration.

Key findings

Formation of the project team

The interdisciplinary team comprised a small group of core individuals who had worked together on a previous project. They were friends and colleagues, sharing an interest in continuing collaboration and in exploring new approaches to understanding and promoting disaster risk reduction. The group expanded to meet the need for varied disciplinary, thematic and geographical expertise. New members were identified through existing social and professional networks, resulting in a group of individuals that mostly knew – or knew of – one another. The

group included researchers from across social sciences, physical sciences and the humanities, from a mixture of universities, not-for-profit and for-profit consultancy firms. They all expressed an interesting in pursuing interdisciplinary collaboration. With limited resources, and a relatively short timeframe (15 months), it was an ambitious initiative. Given the limited resources, early-career researchers were given the largest time allocations, providing them with an opportunity to work on an interdisciplinary project – something that is otherwise not easy for more junior researchers to do.

Management of processes, people and time

The overall research problem was divided into smaller components and allocated to researchers with the relevant expertise. This led to the formation of three sub-groups, and the emergence of leaders (in addition to the overall principal investigator (PI)). This was perceived by many to be an efficient way to organise the project. However, it simultaneously led to the formation of silos, limiting interactions between groups to some extent. Divisions within the group were also determined, to some extent, by the amount of time people had allocated to the project, their seniority and geographical proximity to the lead institution.

Project meetings were democratic and the overall project management was iterative. Again, this divided opinion. Some team members appreciated the flexible approach, seeing it as necessary given the complexity of the project. Whereas others preferred a more structured way of working, feeling that it was not always clear who was responsible for what, or how all the different components would tie together to answer the shared research question. While senior academics experienced in interdisciplinary work helped to steer the project, serendipity played a role in how things unfolded.

The project required a great deal of organisation and coordination, and this work was often invisible and therefore not allocated sufficient time. This was frustrating for some, who felt that it left them little time to engage intellectually in the project.

Limited resources meant that only two researchers carried out fieldwork. As such, most of the interdisciplinary collaboration took place during the data analysis and writing stages.

Time (or lack of it) was a major theme throughout the project. Individuals' contributions were dictated by: how much time they were allocated; the organisation they worked for, and the extent to which it was influenced by commercial or market forces, and; crucially,

how interesting they found the project was from a professional perspective.

Communication

This research found that there is no substitute for in-person communication. Spending time in each other's company helped to build trust and empathy between researchers that simply couldn't be achieved through digital tools.

In the initial stages, scientists first had to engage in dialogue to overcome basic differences in concepts, terminologies and assumptions, before they could tackle methodological differences. During the research and analysis stages, visual objects, such as maps and charts, were useful tools for engaging researchers from different disciplines. Before starting to write the final papers, dialogue was yet again crucial, to reach agreement on what should be included, and how. But there was no 'silver bullet' for reaching consensus and these discussions could be challenging.

Negotiating difference

There were several fundamental conceptual and methodological differences between the researchers. Threading together work from different disciplines to find a shared objective for investigation was an ambitious endeavour. Negotiating those differences took time and practice.

Overall, the group worked well together, as it was made up of individuals who were interested in interdisciplinary work and therefore open to others ideas and concepts. However, at times, emotions ran high and conflict would manifest itself explicitly amongst team members, while others chose to conceal or regulate their feelings to avoid confrontation, or perhaps to keep the group together.

Changes in researcher perspectives

By integrating a historical approach into the project, many of the social and physical scientists were exposed to a broader understanding of the issues facing SIDS than they would typically consider.

There is also evidence that social and physical scientists learned from one another – with physical scientists gaining a greater understanding of some of the complexities surrounding policy issues, and the social scientists gaining a greater appreciation for the immediate impacts of natural hazards.

Key lessons

1. One's ability to get on with others is as important as one's expertise.
2. Interdisciplinary work requires an experimental approach, giving individuals time and space to explore differences.
3. Those who emerge as key leaders or managers need the skills to bring people together to explore their differences, often in challenging circumstances, bring out the best in individuals and broker relationships between sub-groups – skills that are acquired through much experience working in interdisciplinary contexts.
4. Organisation and coordination work should not be underestimated – it must be valued, adequately compensated and clearly assigned to individuals.
5. Prioritising interdisciplinary fieldwork can go a long way to helping identify and negotiate differences.
6. Regular collective reflection on how the group is getting on, and paying attention to people's experiences, can be productive and therapeutic, helping to improve working relationships.

1 Introduction

1.1 Background

It is now well accepted that policy problems tend not to lend themselves to study within individual disciplines (Ledford, 2015). Thus, academics and researchers need to collaborate and engage with each other's theories, concepts, approaches, experiences and knowledge in order to fully understand them and make recommendations.

However, the constraints to doing this are well documented. For instance, Sarah Byrne suggests that by participating in interdisciplinary projects 'there's a risk of ending up being an expert in nothing' (Byrne, 2014). Those straddling disciplines are often misunderstood as a 'jack of all trades, a master of none', and colleagues might see them as poorly grounded theoretically (ibid.). Early-career academics are most 'at-risk', as they need to demonstrate highly disciplined forms of knowledge in order to advance professionally – for example, to secure participation in a conference or an academic teaching position. Furthermore, journals, research councils, and teaching adjudicators have historically been divided along disciplinary lines. Early-career researchers who are publishing in journals across disciplines, therefore risk

being not visible to more senior academics who make decisions about their career progression.

Nevertheless, during the last decade or so, there have been a number of developments that have encouraged interdisciplinary work. Callard and Fitzgerald (2015) suggest that there are:

> More and more editors, research managers, heads of school, and other gatekeepers [who] are explicitly looking for people – in the humanities and social sciences as well as in the [natural] sciences – who have expertise in interdisciplinary, collaborative projects. The risks of interdisciplinarity aren't what they used to be.

They argue that staying within the confines of one discipline is not necessarily the best way to guarantee an academic career, in its widest sense (ibid.).

In addition, a growing number of funders have prioritised research that aims to bring together the natural sciences, social sciences and humanities. The Economic and Social Research Council (ESRC) has been awarding funds for interdisciplinary research for many years. More recently, the UK Research Councils launched

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Box 1   Types of disciplinary collaborations

Intradisciplinary: working within a single discipline.

Multidisciplinary: people from different disciplines working together, each drawing on their disciplinary knowledge.

Crossdisciplinary: viewing one discipline from the perspective of another.

Interdisciplinary: integrating knowledge and methods from different disciplines, using a synthesis of approaches.

Transdisciplinary: creating a unity of intellectual frameworks beyond the disciplinary perspectives.

Intradisciplinary → Multidisciplinary → Crossdisciplinary → Interdisciplinary → Transdisciplinary
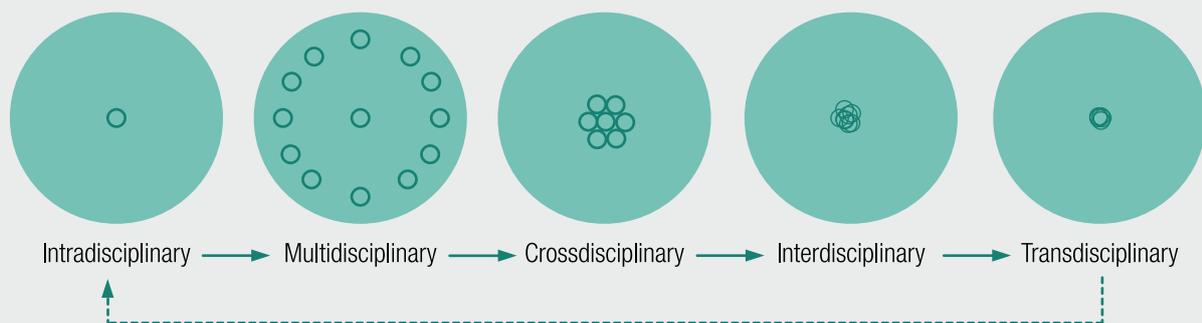
Source: Adapted from Stember (1990)

the Global Challenges Research Fund (GCRF) – a five-year £1.5 billion programme aiming to address problems faced by developing countries through 'challenge-led disciplinary and interdisciplinary research'.[11] However, although everyone wants to do interdisciplinary research, 'no one quite knows how' (Callard and Fitzgerald, 2015: 23). And despite increasing trends (or at least rhetoric) towards interdisciplinarity, there are relatively few accounts or reports reflecting on researchers' efforts to work across disciplines.

1.2 Objectives

This paper seeks to address the relative lack of accounts of interdisciplinary research. It reflects on an interdisciplinary project called 'Between a rock and a wet place: exploring historical trajectories of exposure, governance and tenure to build resilience to multiple

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Box 2   A project summary

Small island developing states (SIDS) are highly exposed to multiple marine- and land-based hazards. The project aimed to identify opportunities for reducing risk, taking an 'all-hazards' approach. It sought to explore how hazard exposure on SIDS is shaped by political, cultural and social processes, and how these have changed from the colonial era to the present day. It drew on concepts from different disciplines, including history, environmental science and geography, geophysical sciences, economics, and risk-modelling. It aimed to explore how these processes influenced disaster impacts and recovery over time in two specific cases, Vanuatu and Dominica. In doing so, the project hoped to reveal a new set of measures to reduce risk to multiple hazards in the future.[1]

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1   For more information about the project, see http://gtr.ukri.org/projects?ref=NE/P015719/1

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hazards in SIDS'. The project was part of the GCRF Building Resilience programme, funded by NERC in 2016. The project lasted for 15 months, including a six-month no-cost extension, and had a budget of £160,000 (see Box 2 for more project information).

This paper reflects on how the interdisciplinary project group convened, how it worked together to achieve its shared goals, and what lessons there might be for others pursuing similar interdisciplinary collaboration.

Specific research questions for this paper comprised:

- What approach was taken to managing the research project and why, especially with regard to reconciling diverse epistemologies?
- What factors shaped the quality of communication amongst collaborators?
- What differences emerged during the project, and why and how were they negotiated and reconciled?
- How did researchers' perspectives change during the project?
- What lessons are there for others pursuing interdisciplinary work?

This scope of this paper does not include efforts made to partner with stakeholders in the global South, nor does it cover the efforts made to share findings and policy implications with key external audiences, such as policy-makers and disaster management practitioners.

1.3 Methods

Reflections in this paper are based on 11, one-hour-long telephone conversations with project team members based in the UK, and observations from three team-wide meetings. Nine of the interviews took place in August and September 2017, after the fieldwork and much of the data analysis had been conducted, but before the paper-writing had started. The 10th interview took place about two months into the paper-writing process, while the 11th and last interviews took place about four months into the paper writing process. The meetings observed

Table 1   Key project activities and dates

Event	Date
Proposal submission	6 September 2016
Official project start date	1 November 2016
Skype meeting to introduce team members and review proposal	Early November
Inception workshop for Dominica case study	3 February 2017
Skype meetings to plan for Dominica fieldwork	Early February
Skype meeting to plan for Dominica fieldwork	Early March
Fieldwork in Dominica	13–31 March
Feedback on Dominica fieldwork	19 April 2017
Inception workshop for Vanuatu case study	26–27 April 2017
Fieldwork in Vanuatu	3–21 May 2017
Meeting about Dominica data	10 May 2017
Data analysis for Dominica	28 June 2017
Meeting to discuss modelling component	30 June 2017
Meeting to share preliminary outputs	27 September 2017
Formal project end date	31 January 2018
Journal submission	May 2018

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1   For more information on the GCRF, see www.ukri.org/research/global-challenges-research-fund/

took place in February, April and September 2017. Given the timing of the interviews and meetings, my analysis focuses more on the research process and less on the writing process.

It is important to note that collecting data and writing a paper of this nature was far from straightforward. There was a natural apprehension amongst some interviewees around being frank about their relationship with others in the team, and that their comments might be seen as criticism of colleagues. As such, institutions and interviewees have been anonymised, examples are often intentionally vague and direct quotes from interviews are rarely used.

As Karl Mannheim famously said, 'there is no view from nowhere' (1972). And so I will say a few words about my worldview and expertise. I am a graduate of both Manufacturing Engineering (drawing primarily on mathematics and physics) and Development Studies (drawing on various social science disciplines as well as the humanities). I was an engagement specialist for a five-year interdisciplinary research project called 'Earthquakes without Frontiers', funded by ESRC/NERC under the Increasing Resilience to Natural Hazards programme. To make sense of how the interdisciplinary collaboration unfolded, this paper draws on concepts from a range of disciplines and bodies of knowledge including organisational management and learning, complexity sciences, psychology, group dynamics and political economy – all fields that I have encountered while studying policy and group dynamics in an international development context.

2　Formation of the project team

Key reflections

The core project team comprised a group of colleagues with a shared interest in interdisciplinary collaboration to better understand disaster risk and resilience. The group expanded to meet the needs for varied disciplinary, thematic and geographical expertise. New members were identified through existing social and professional networks, resulting in a group of individuals that mostly knew – or knew of – one another. The (relatively large) group comprised researchers from across the social and physical sciences and humanities, from a mixture of universities, not-for-profit and for-profit consultancy firms. Given the relatively limited resources, a large proportion of funded time was given to the early career researchers; this provided them with an opportunity to work on an interdisciplinary project, something that would otherwise not be easy for them to do.

The initial project team comprised a small number of individuals based at a UK academic institution and an international development think tank. They had worked together on a five-year ESRC/NERC funded project called Strengthening Resilience in Volcanic Areas (STREVA). Two of the STREVA researchers had worked together on a paper exploring multiple hazards in the Caribbean and wanted to explore the topic further. There was also general interest in exploring a more historical approach to addressing disaster risk, while incorporating quantitative risk modelling (as is used in the insurance industry), because researchers' prior experience was that decision-makers find this approach useful.

The GCRF call for proposals explicitly required interdisciplinarity, and specifically the inclusion of academics from the arts and humanities. The call also stated that the research should be foundational, with the aim of developing a network, concept and/ or methodology that could be expanded, implemented or operationalised in the future. Funding was relatively limited, but so too were the number of expected deliverables. Given the exploratory and foundational nature of the call, a decision was taken by the core group to form a relatively large team, with each member having a small-time allocation, and no one working fulltime on the project.

As the proposal evolved, members of the initial group sought additional expertise based on the need for content knowledge, especially from diverse disciplines and regional experience. They did this through their professional and social networks, and through workshops held centrally by the UK Research Councils. Many of the initial group (but not all) subsequently either knew of, and/or had worked with the additional participants in an academic or professional context.

Although all the researchers working on this project were based in the UK, they were nonetheless diverse, coming from a variety of organisations and specialising in a number of academic disciplines. Individuals' expertise was broadly situated in the interpretive and positivistic social sciences, humanities, and the physical sciences. Researchers came with perspectives that originated in multiple disciplines including international development, environmental science, geography, earth/ geophysical sciences, political science, anthropology, history, civil engineering, economics, and risk modelling, amongst others. Although the project had a focus on disaster risk management, only a few had worked directly on this topic beforehand.

Researchers were affiliated to various organisations, including universities and for-profit and not-for-profit consultancy firms. The perspectives of individuals working in consultancy firms tended to be, to varying extents, explicitly shaped by commercial interests and market forces; they were often 'client-led' and were accustomed to working in a highly structured environment. Individuals working in universities were driven by the need to teach students, secure research grants, undertake fieldwork and publish in high impact journals; they were also working within an academic environment increasingly being shaped by market (if not commercial) forces.

Collectively, the team members – especially those within the lead institution – had a significant amount of experience working in teams with diverse perspectives; they had worked in a variety of developed and

developing country contexts, and were relatively adept at communicating ideas to non-specialists. Overall, the team was curious about undertaking an interdisciplinary collaboration.

During the proposal development stage, three early-career post-doctoral social science researchers were allocated the most time of all collaborators to work on the project. Collectively they were responsible for managing the bulk of the research design, fieldwork, analysis and write-up, with supervision from more senior academics. This decision was intended to give younger academics the opportunity to fully engage with interdisciplinary work, in a context where early-career academics are under pressure to demonstrate highly disciplined forms of knowledge.

At its heart, the project required several individuals, of different genders and with different personalities and ways of thinking, acting and writing, to converse and communicate with one another through one-to-one and group dialogue, exploring their differences and potentially navigating conflict. The next chapter explores how these differences were managed.

3 Managing people, processes and time

> **Key reflections**
>
> Initially, researcher relations within the group were seen as reciprocal and mutual. However, cleavages emerged, largely shaped by the allocation of funded time and the seniority and geographical proximity of researchers to the lead institution. This led to the unintended formation of three sub-groups, with three sub-leaders (in addition to the overall PI). Providing leadership required a flexible approach, and an ability to support individuals to negotiate differences.
>
> Interactions between researchers and sub-groups lacked structure. Serendipity was a key factor in determining how collaboration unfolded. Limited project fieldwork meant that most of the interesting discussions took place during data analysis and write-up.
>
> The project required a great deal of organisation, including arranging meetings, doing paperwork and dealing with partner and donor organisations. This work was mostly invisible and not always valued or allocated sufficient time. Due to the limited time allocations, individuals had to prioritise tasks and their contribution to the project. However, many researchers with limited funded time chose to engage with the project beyond their time allocation because they found it interesting and/or useful.

3.1 Subgroups and individuals

Specific tasks were allocated to individuals or small groups of people. For instance, the physical scientists were asked to focus on the occurrence of hazards, whereas those with a positivistic social science background were tasked with exploring how risk modelling might improve disaster risk management. And the principal investigator (PI), a disaster risk management (DRM) specialist, was tasked with assessing DRM policies in each of the case-study countries. Interviewees felt that dividing the problem into smaller components was an efficient approach, especially given the limited timeframe.

This initial division of labour led to the unintended formation of three main sub-groups, which became more coherent as the project evolved. I call these groups: (1) the key implementers, (2) the supervisors, and (3) the wider supporters (see Box 3). The key implementers and many of the supervisors, who together were responsible for managing or overseeing key tasks such as research design, fieldwork and data analysis, were both based at the same lead academic institution.

Interactions within the team, and subsequently the majority of formal and informal reflection and learning, were concentrated between the key implementers and the supervisors. Geographic proximity was clearly a key factor, but so too was familiarity, friendship, and similarities in disciplinary background (albeit to a lesser extent).

Interviewees suggested that the early division of labour set up processes of exclusion and inclusion. They felt that it inhibited individuals from adequately 'bridging' the gap between social and physical sciences. The arrangement failed to promote inter-group relations, which may have triggered new insights or brought to light more differences. Some interviewees also raised questions about whether the individual parts added up to a coherent whole, achieving what the project had set out to do.

The relationship between key implementers and supervisors was not always clear. For instance, the interviews suggest that key implementers were not always sure how much autonomy they had to make decisions. This was especially the case during fieldwork, when key implementers were not always able to get guidance from supervisors given time differences. Key implementers were therefore having to make decisions quickly, in uncertain conditions, using their own knowledge and judgement (and then reflecting on it afterwards).

Supervisors exerted slightly more control during the analysis and paper writing process than they did over the design and delivery of fieldwork, which was welcomed by the key implementers. Among some interviewees there

was a sense that supervisors, given their experience, were crucial in supporting key implementers to reconcile differences across disciplines. Wider supporters interacted with one another more remotely (largely online) and were brought into discussions between the supervisors and key implementers as and when they were needed –

Box 3   Key subgroups

1. Key implementers: this group comprised three post-doctoral researchers from the lead institution, including an environmental social scientist and interdisciplinary social environmentalist.

2. Supervisors: this group comprised mainly senior academics, mostly (but not all) from the lead institution (a university). It included experts in: disaster and climate risk governance; geological hazards and interdisciplinary approaches to risk reduction; vulnerability and adaptation to environmental hazards and climate change; two environmental social scientists, and an expert in early modern colonial and maritime history and cultural encounter. The principal investigator was in this group (but not from the lead institution).

3. Wide supporters: this group comprised consultants and physical scientists (from universities and not-for-profit and for-profit consultancy firms). It included an expert in approaches to, and applications of, natural catastrophe modelling, an expert in water security and climate resilience, an earthquake engineer, and a development economist.

for example, to provide a historical timeline of hazards that had occurred in the case study countries.

The PI – who was not based at the lead institution – was not allocated a significant amount of time to work on the project. Instead, a senior academic in the lead institution with more time allocated to the project became a de facto project lead, providing considerable guidance to key implementers (who were based in the same institution).

During the writing process, lead authors and writing teams emerged more or less organically based on individual interest. Opportunities were given to early-career researchers to play a significant role. However, these opportunities were not taken up, possibly due to commitments to other research projects and the aforementioned pressures to produce more intradisciplinary knowledge. Senior academics subsequently took on a more prominent role. Papers tended to have several authors, which meant that lead authors were required to play a significant role in ensuring a clear and consistent argument and tone throughout.

Interviewees suggested that managers who emerged during the project (in addition to the formal PI), demonstrated the following positive characteristics in leading or managing the group:

- creating excitement and anticipation amongst the group
- allowing a healthy balance of contributions between members
- checking-in regularly with all collaborators to ensure they were moving in the same direction and at roughly the same speed
- in meetings, identifying differences or issues that needed to be explored and discussed in more detail, and having conviction in this, even when others may express a desire to move on.

Given the interdisciplinary nature of the project, peer-review processes could be lengthy and challenging. Interdisciplinary papers are likely to be reviewed by experts from different disciplines – each of whom may have objections or criticisms for different reasons (Callard and Fitzgerald, 2015). Furthermore, deciding who gets to write for what journal is a political process, and the more experienced researchers get to write for the top journals. In this project, the team decided to submit a paper to the Proceedings of the National Academy of Sciences (PNAS) – a high-impact journal featuring natural science research. The publication required a strict word limit and a significant amount of quantitative data, illustrated using graphs and charts, giving prominence to physical scientists.

The project required a lot of organisation – the amount of time needed for which was underestimated before the project started. Tasks included arranging meetings and workshops; coordinating tasks happening in parallel and ensuring that they came together on time; dealing with paperwork; and liaising with the partner and donor organisations. One interviewee suggested that undertaking organisational tasks meant that they were only able to engage intellectually with the project during the writing phase.

Some interviewees described the collaboration as somewhat 'messy', with individuals' interactions with one another ebbing and flowing. The most important factors in shaping people's interactions with one another were: the team-wide meetings and the fieldwork; individuals' commitments to other projects; and chance – for example, who was on leave or not, or whether people fell ill at key times.

The project process was fluid and required team members to 'go with the grain'. Interviewees suggested that tasks were largely planned iteratively, with actions followed up in a way that supported flexibility, within the broad framework set out in the funding proposal. However, some interviewees who were accustomed to more structured work felt a degree of discomfort with this approach. They felt confused and somewhat anxious about what it was they, and others, were supposed be doing at various points during the project.

3.2   Time, and attitudes towards it

Unsurprisingly, time, and people's attitude towards it, played a significant role in shaping the collaboration. Key time-related parameters were set during the proposal development stage. As discussed, key implementers did the bulk of the work with their time collectively equating to one fully funded academic (for the initial nine-month duration). They received guidance and supervision from the PI and senior academics at the lead institution. Supervisors were allocated just four hours a week on the project. This was less time than the key implementers, and, in some cases, the bare minimum required by university guidelines. A limited amount of time was set aside for the wider supporters to provide advice and expertise. The uneven distribution of time across the team resulted in certain asymmetries within the collaboration.

Given the limited time, some interviewees found it challenging to attend meetings and contribute to certain tasks. Academics struggled to find time to meet and work on tasks due to other commitments, including teaching, grading, commissioned work, and other substantial research projects. While the project was extended for another six months, with no extra funds, those who had used up their allotted time had to 'volunteer' to do tasks such as data analysis (it was noted that university institutions often encourage academics to write papers in their own 'spare' time). For instance, not all authors were able to attend or prepare for the writing workshops organised by lead authors, impacting on the quality of papers produced. Those who volunteered their time did so because of the interest they had in the content, as well as the pressures to publish.

One particularly experienced interviewee suggested that academics within the natural sciences were traditionally more likely to 'go that extra mile' and undertake tasks, even if they were unfunded, because of a history of limited funding for the generation of original knowledge in the natural sciences. Although that has been seen to change in recent years, with some convergence taking place between the natural and social sciences.

Those working for consultancy firms (both for-profit and not-for-profit) preferred to work as subcontractors, on an output basis, with time inputs and deadlines specified in advance. This limited their flexibility, and they often did not have the time to prepare for group discussions (or chose not to). Some contractors would put in a lot of time in the early stages, and then not be available later in the project, while others decided to reserve their allocated time to contribute at the writing stage). They also found themselves unable to make contributions to outputs other than those they were allocated to. This meant that in some cases, tasks were undertaken in parallel, with little interaction between them.

Given the limited funding assigned to most individuals, the supervisors coordinating the work felt they had to be mindful not to ask researchers to go beyond the 'call of duty'. This was far from straightforward, given the desire to produce high-quality work. Limited time also meant researchers were primarily focussed on completing discrete tasks and less able to be curious about other people's disciplines (or as Callard and Fitzgerald put it to 'inhabit the other's arguments, when one is led down the paths of the other's preoccupations, and when one is absorbed by the other's milieu' (2015: 130). This potentially closed down interesting or experimental conversations. As one interviewee said, 'there wasn't time to disappear off at a tangent' – which is often how new ideas emerge.

4 Facilitating communication

Key reflections

Group dialogue was an important component of collaboration. It promoted new ways of working and revealed new insights. But a lot of groundwork had to be done to discuss differences in language and assumptions, before scientists could begin to collaborate successfully (especially where there were significant conceptual and methodological differences). Boundary objects, such as maps, charts and infographics, served as a useful interface between researchers from different disciplines. Dialogue was particularly crucial to agree on the content, framing and approach to writing papers.

Nevertheless, group dialogue offered no 'magic bullet' to reaching consensus on what the team did and how the team worked together. Furthermore, it was difficult to organise logistically and dialogue could just as easily lead to a 'dead end'. Spending time in each other's company and deliberating in person enabled researchers to engage with one another relatively deeply. Digital tools subsequently helped researchers stay connected to the project but did not help them to engage substantively.

4.1 Key vehicles

The absence of joint fieldwork meant that workshops and meetings (both in person and virtual) were used as the primary vehicle for team members to: get to know one another better; encourage collaborators to work with one another; generate and sustain a sense of enthusiasm around particular research questions; and create a space for 'experimental' conversations.

Face-to-face meetings were more valued than virtual meetings: interviewees felt that there was no substitute for being in the same location as others, for both formal and informal interactions. With people in the same room, able to see each other's facial expressions and body language, engagement was deeper, a stronger sense of empathy was created, and differences or misunderstandings were more likely to be brought to the surface.

The lead institution had state-of-the-art meeting facilities that were generously made available to the project at low cost, and often at short notice. This was helpful in facilitating much of the project communication.

As discussed, a team-wide inception meeting was seen as important. It helped to: strengthen relations between the key implementers, the supervisors and the wider supporters; expose differences in terminology and understanding and build consensus on what the team was trying to achieve collectively. Most team members attended the inception meeting in person.

Although people came away from the first team-wide meeting with a better shared understanding of what they needed to do together, only one more team-wide meeting was held, two months later. Setting up regular team-wide discussions proved difficult due to the logistical difficulties of synchronising the calendars of a relatively large group of people. Furthermore, some people may have found speaking in a large group uncomfortable. While others found the negotiation and contestation too time consuming. Much of the substantive conversations subsequently took place in the smaller key sub-groups (see Box 3). For instance, during the data analysis stage, individuals from the lead institutions held a series of meetings to code field data and write up the findings. Some of the team would have preferred more meetings to help share ideas and perspectives, while others saw this as an ineffective use of limited time.

Digital tools played a key role in facilitating conversations across the team. Several meetings were convened using Skype, enabling team members to contribute to discussions even if they could not attend key meetings in person. Before fieldwork commenced, wider supporters were invited to comment on interview protocols via email. Requests were made for certain types of data to be collected, or for particular questions to be included in the protocol. Furthermore, during fieldwork, key implementers would call supervisors via Skype for advice on matters such as selection of field

sites, key informants, and interview questions. Dropbox – a file hosting service that provides cloud storage and file synchronisation – enabled researchers to share documents with one another.

However, digital tools were not without their faults. Poor internet connectivity often resulted in fragmented meetings. Even if connectivity was good, researchers found it challenging to engage meaningfully. During the course of the project, researchers lost track of what documents had, and had not, been shared using Dropbox, with some work being duplicated. Furthermore, some interviewees suggested that there was an over-reliance on team-wide email correspondence, fuelling a sense of confusion about what they were supposed to be doing.

4.2   The structure of meetings

A democratic approach was favoured for running meetings. This emphasised negotiation and consensus building in which the needs, interests and views of all members were valued. No formal rules of engagement were constructed in advance. Given that it was an interdisciplinary project, most team members came with an open approach to engaging with one another. Free-flowing conversations promoted an exchange and fusion of perspectives, from which new ideas or thinking sometimes emerged for both parties. On occasion, a difference would emerge, and it would be sometime before the group would meet again, meaning that they had time to reflect on, and mull over apparent contradictions. In some cases, this promoted creativity and innovation, for example one such exchange led to the incorporation of social networks into a disaster risk model. However, in other instances, issues remained unresolved.

This democratic approach to conducting meetings was appreciated by many of the interviewees. However, some found it unsettling: they preferred a more structured approach (favouring concepts of efficiency and control) to provide order to what were already complicated interactions, and to keep discussions on track, even if this meant sometimes closing down interesting discussions that were not on the agenda. Some interviewees were not always clear about what the meeting outcomes or action points were. Some expressed concern at meetings potentially turning into 'talking shops'. It also meant that issues for discussion agreed prior to the meeting would sometimes fall off the agenda and not be addressed afterwards.

4.3   The nature of discussions

Many of the initial meetings were primarily discursive and conceptual, with conversations not necessarily producing anything concrete. However, towards the end of the project, workshops and meetings were more practical, devoted to writing up and finalising papers.

Despite knowing that there would likely be disciplinary differences in perspectives, meeting agendas often did not identify them in advance or set aside time to address them. For instance, on one occasion researchers did not realise that they had very different interpretations of the concept 'social network' until considerable time had passed. Time was subsequently spent clarifying what individuals understood by this term.

Boundary objects[2] – notably maps, charts and infographics – served as a useful interface for discussion between researchers from different disciplines. For instance, one graphic brought together two different data sets by plotting changes in the exposure of people and communities across the two case study countries, against changes in the number and type of hazards that had occurred over time. It highlighted the complex relationship between hazards, people, and human settlements. However, it's unclear whether this resulted in a significant benefit to team relationships, or if it had any policy implications.

> ### Box 4   The writing process
>
> Authors (especially those based at the lead institution) met frequently during the writing process. Outlines were drafted during team meetings, with the lead author playing a key role in identifying overarching themes. The authors aimed to avoid having different sections draw on different types of data (qualitative versus quantitative, or historical versus socioeconomic), and instead identify themes and subjects that drew on different sources of data to build a set of arguments. Authors were asked to expand the outline into bullet points (usually in pairs), before expanding bullet points into prose. Lead authors then drafted the introduction and discussion sections, drawing on their own discipline, but with a good understanding of the data that other authors offered. Once all sections were drafted, the paper as a whole was sent to the whole team to review.

2   Boundary objects can serve as an interface between different stakeholder groups. They contain sufficient detail to be understood by different groups but are viewed or interpreted differently. Neither group is required to understand how they are used by the other. They are flexible enough to adapt to the needs of different groups, but at the same time robust enough to maintain a common identity across the stakeholder boundaries. As such, boundary objects can facilitate mediation and negotiation. They can be physical artefacts such as maps, field notes and specimens. But they can also be information, conversations, interests, rules and contracts (see Star and Griesemer, 1989).

In preparing to write the final papers, interviewees emphasised the need for authors to have an initial discussion with others to agree on the publication content, its framing, and the approach to writing. Furthermore, interviewees also felt that it was important for co-authors to have a shared understanding of how they were approaching specific issues, without which there was likely to be a significant amount of contestation during the writing process. Box 4 describes how interviewees envisaged the writing process.

5 Areas where differences emerged

Key reflections

Several conceptual and methodological differences came to light during discussions amongst researchers, such as: the role that history had in influencing current disaster management practices; the definition of policy and policy implications; what was meant by 'social networks'; the value of quantitative data; and data analysis and writing practices. By bringing together researchers from epistemological and ontological domains, across the humanities, interpretive and positivist social sciences, as well as physical sciences, the project was ambitious. This was arguably more so than an intradisciplinary project – in which researchers are more likely to have a common language or set of practices, even if they disagreed with one another profoundly – or a multidisciplinary project, in which researchers are not expected to open themselves up to the other's methods and ontologies.

5.1 Conceptual differences

Interviews suggested that there were some conceptual differences among researchers about the overall project objective. The funding proposal set out a number of key elements that were to be explored during the project, namely multi-hazards, historical analysis, and risk modelling (see Box 2). When asked retrospectively about the aim of the project, many interviewees emphasised the historical component (with a focus on colonial history) and, to a lesser extent, the multi-hazard nature of the project. Interviewees were relatively silent on the risk modelling component.

With regard to the historical approach, some interviewees felt that its integration was experimental or novel. Some suggested that it served to test the hypothesis that there is a direct connection between historical processes and events, and current approaches to disaster management. However, there was not a clear consensus amongst interviewees on this point. There were also differences in opinion as to how far back one ought to go with the historical analysis; whether the team should consider as far back as the beginnings of the quest for empire, to colonial history itself, or just recent history. One positivist social scientist questioned whether history shaped the current context at all, believing that they needed good data only in relation to the last disaster. This led to somewhat of an impasse. Moreover, there were differences in the level of detail in which people thought histories ought to be described, given, for instance, the often divergent historical trajectories of different parts of an island state or different islands within an archipelago state.

There was significant discussion at the beginning of the project about differences in concepts and terminology. Some of this was planned for, while others emerged and were addressed in an ad hoc manner. Within these discussions, it was not only what was said, but also what was understood by the different parties that was important. For instance, participants spent significant time discussing the concepts of 'exposure' and 'vulnerability', and which should be used as a core concept. The term 'vulnerability' evoked different understandings: an engineer was more likely to view vulnerability in physical terms, such as the resilience of infrastructure, while a social scientist might see vulnerability in social and economic terms, such as class, gender and ethnicity. However, there was more agreement on what was understood by exposure. And so, the interpretive social scientists were able to remove the concept of vulnerability from discussions and the research.

Interpretations of 'social capital' and 'social networks' also differed between disciplines. The archival analysis of historical trends suggested that social capital (especially in the form of networks) were an important factor in determining a community's resilience to natural hazards. But this was not something that is typically taken into consideration in the risk modelling industry. In this case, these conceptual differences led to an interesting discussion on whether, or the extent to which, social capital and networks could be quantified and incorporated into a risk model.

The project proposal included the development of policy recommendations or implications. However, given the short project timeframe, some thought that the project could only go as far as developing a set of questions for further research. Some saw policy implications in terms of investments at a granular level, others in terms of broad national-level systems and governance, and others saw policy in terms of individuals and groups at a grassroots level and what they could do to improve risk management. Some researchers questioned whether it was appropriate to make policy recommendations at all, suggesting that the role of research is simply to provide analysis of what was observed.

5.2   Methodological differences

During field work design, differences emerged amongst post-doctorate researchers and supervisors as to how interview protocols should be drawn up. In addition, a question was raised as to the extent a researcher (as an outsider) could assert oneself (given their level of seniority) in arranging interviews in field sites with different stakeholders (given 'cultural' constraints and expectations).

During the fieldwork design, perspectives from the wider supporters were appreciated and valued by the key implementers. However, while the key implementers and supervisors did their best to accommodate some requests, others could not. In one case, two researchers found it challenging to collect the quantitative data requested by wider supporters, because of availability, ethical reasons, or because the questions were not understood by interviewees. The researchers were not able to rephrase the questions to help the interviewees understand, because they did not know how the data would be used by the wider supporters, or what hypotheses were being tested. The logistics of communicating with the wider supporters from the field meant that dialogue was not always possible.

Not all participants were familiar with the concept of analysing field data or the software designed to do so (preferring to code the data manually). Some required

training, and the merits of doing so was questioned, given severe time constraints. Joint meetings to code qualitative data nevertheless provided an opportunity to explore how the same data was being interpreted differently by researchers. For instance, during one such meeting, data collected by interpretive social scientists was identified by a researcher in the humanities to be historical. Consequentially, the data was given additional markers for software analysis that would not otherwise have been identified.

Analysis of the same data by researchers from different disciplines, highlighted different disaster management problems faced by SIDS. For instance, social scientists suggested that the main problems being faced by societies in Vanuatu and Dominica were a lack of resources, poor governance (in relation to priority setting and delivery capacity, despite coherent disaster management plans having been developed) and the location of settlements (shaped by historical, cultural, economic and social factors). On the other hand, Physical scientists and engineers emphasised a lack of resources, poor infrastructure, a lack of skilled engineers, poorly managed recovery processes, and poor catchment and land management.

With regards to writing, Lewis (2015) suggests that individuals from the natural and social sciences have different practices. Physical scientists tend to produce several, shorter, articles, with multiple co-authors and author hierarchy. Whereas, those from the humanities tend to write less frequently, with one sole author, or one co-author, who would usually be considered as not just a colleague but a friend (Lewis, 2015).

These norms emerged during the project. Both the social and physical scientists were taken out of their comfort zone during the writing process. For instance, interviews suggested that authors from the physical sciences preferred to start the paper with a description of the data collected, followed by a long discussion section, before concluding. Meanwhile, social scientists preferred to alternate descriptive data and discussion/analysis throughout the text.

6 Negotiating differences

Key reflections

The team generally worked well together, as it was made up of individuals who were relatively self-reflective about the value judgements embedded in their ideas; were willing to give respect to and learn more about the 'other'; and were open to using models and taxonomies used by other disciplines. This included coming to terms with the (strategic) reduction of one's owns concepts by others

However, threading together the work of a large number of researchers from a variety of disciplines to find a shared object of investigation was an emotional endeavour. The various differences between individuals from different disciplines were in some cases quite stark. Conflict sometimes manifested itself explicitly, with people expressing their differences frankly, or with emotion. Others chose to regulate their emotions to varying extents, or conceal their feelings altogether, perhaps in a bid to hold the collaboration together.

The assumption is that tensions need to be resolved through dialogue. However, some researchers expressed that they may have wanted to stay with these feelings, rather than talk through them (this did not necessarily mean acting on or dramatising). Some in the group accepted this predicament, deciding not to make 'too much of a fuss' about the situation. They contributed what they could to the project without expecting much in return. And in one case, withdrawal from the collaboration was deemed appropriate, to enable the researcher to develop their work on their own.

Interviews suggest that team meetings and interactions (whether online or face to face) were, on occasion, characterised by participants feeling irritated, anxious, disorientated, embarrassed, envious, ambivalent and upset. In this chapter, I discuss what provoked some of these feelings. Nevertheless, given the relatively short duration of the project, having prior social or professional relationships with other team members helped to develop trust and made discussions easier.

6.1 Difficult feelings

In the early stages, a few team members were anxious that they had not yet reached a consensus on the precise nature of research questions, or the research methods for undertaking historical analysis.

Observation in some team-wide meetings suggested a degree of irritation between social scientists and physical scientists over the different approaches taken. For example, social scientists experienced frustration towards physical scientists (and positivist social scientists) who adopted simplistic or reductionist models of social dynamics (such as social networks). Conversely, physical and positivist social scientists experienced some frustration towards social scientists, whom they

perceived as making issues more complex than they needed to be.

According to some interviewees, emotional or blunt language was sometimes used to raise concerns about how the project was unfolding, and about the value of other disciplines. For example, they spoke of disappointment, concern and shock. One positivist social scientists questioned in rather blunt terms the value of taking an historical approach.

Some interviewees suggested that a degree of envy was felt amongst the positivistic social science researchers in the wider group towards the social scientists based at the lead institution. This was primarily due to the disparity in resource allocation, and consequently their power to influence the project activities. It is worth noting, however, that envy is not necessarily a negative feeling, as it can bring to attention a perceived inequality that can then be addressed (see for example, Sianne, 2005). To some extent this presented a reversal of the envy stereotypically felt by those in the social sciences and humanities towards those in the physical sciences. This was due to a notion that the latter tended to be granted more significant epistemological value, where physical sciences (or positivistic social sciences, like economics) was seen as more 'cutting edge'. In this scenario, experts

from the social sciences and humanities were often brought into interdisciplinary work to merely provide context and/or interpret or fine-tune insights from the natural sciences (see Callard and Fitzgerald, 2015).

There was a subtle level of competition between some team members. A few interviewees suggested that certain individuals felt that their discipline or approach was more relevant to understanding the nature of the research problems and solutions than others'. Competition may have been reinforced by a lack of transparency by some researchers about tools or approaches used.

Some interviewees suggested that, at times, frustration among researchers may have manifested itself as confusion and bewilderment. For example, in one team-wide email thread, one researchers expressed that they didn't know what was going on. However, it is not clear whether these instances indicated a genuine confusion or an attempt to express emotional frustration or anguish.

Some interviewees suggested that they were worried about whether they were making a significant contribution to the project or not. They perceived what they could offer from their field of expertise to be too basic. Some interviewees reflected that their disciplinary perspective did not add anything important to certain discussions. Conversely, some researchers wondered whether they were getting anything significant from the project.

During the writing process, some interviewees suggested that authors endured anxiety as they read, absorbed and addressed the comments and suggested additions and deletions from colleagues. With each draft, authors carefully adjusted words and sentences to satisfy the perspectives of their co-authors, ensuring demands for both nuance and clarity were addressed.

6.2   Learning to live with one another

Working together took practice, and interactions among the team became easier over time, with some starting to enjoy seeing issues from a range of different perspectives. In any relationship, when conflict arises people have a choice: either walk away and end the relationship, or work through it. Haraway (2010) calls this 'staying with the trouble'. During the project, team members would on occasion reach an impasse. Rather than walk away, some researchers would spend time reflecting on what had happened and then return to the group and re-engage more constructively (interviews with two key informants, between September 2017 and January 2018). I now turn to some of the strategies researchers took in 'learning to live with one another'.

Observation of team-wide meetings suggests that over time, social scientists were able to value the benefits of the strategic reductionist approach taken by the physical scientists. They began to accept that complex concepts, such as social networks, needed to be reduced to a number of variables for collaboration to proceed. Furthermore, they began to see the value in

simplification, especially in getting disaster risk managers and practitioners to engage with the work.

Some interviewees suggested that where power appeared skewed in favour of some, those with less power came to accept this. Accepting their apparent subjugation, some researchers (amongst the wider team) took a more passive approach to engaging with the key implementers and their supervisors, offering perspectives only when asked, rather than actively attempting to influence others to adopt certain positions. Although interdisciplinary research is not always about researchers trying to influence one another, it is often about encouraging empathy amongst others on the team.

Some interviewees suggested that researchers with less time on the project were able to take a more detached view of their own disciplinary area and individuality, and look after the needs of the broader group. Observation of team-wide meetings suggested that others chose not to attend meetings and workshops towards the end of the project, reducing the space and opportunity for collaboration. Adopting this strategy may have been a result of researchers not prioritising this project or not valuing its benefits.

In some instances, interviewees suggested that researchers were careful to keep frustrations to themselves. They did not speak up when they thought that others were wrong, when they felt they were being talked down to, or when they thought something was a bad idea. Instead, they regulated these difficult feelings and moved on. In many instances, if disagreements were expressed, this was done subtly and with a high degree of politeness. Although those pursuing interdisciplinary work are often advised to be frank in negotiating difference, not all researchers saw this as a realistic approach. Regulating one's emotions appeared key to holding together what was at times seen as a fragile configuration, even if this went against the scientific principles of objectivity and transparency (Stavrianakis et al., 2014).

Differences were not always easy to reconcile. Observation of team-wide meetings suggests that many researchers demonstrated a patience and an openness to engage in lengthy conversations, in order to arrive at a shared understanding or consensus on an issue. However, on occasion this led to an unsatisfactory result or a dead-end.

Some senior researchers, although well known in their own field, were not necessarily known by those in other fields. Interviewees suggested that they were nevertheless able to demonstrate humility and curiosity about what others had to offer in discussions and the project more broadly.

Interviews suggested that some researchers found it a challenge to ask others to explain a concept that they felt they might be expected to know already. As one interviewee said, this required an ability to be vulnerable and honest in front of peers, with the hope that they would not be judged for asking seemingly simple questions. Conversely, interviewees suggested that researchers had to have empathy, not assume prior

knowledge amongst others, and be prepared to explain complex ideas to non-specialists.

Interviewees also highlighted the importance of: being willing to learn about, and use, new concepts, tools and approaches; taking a modest view of one's own opinions and interests; and being able to reflect on how one's own frames of reference had shaped one's conceptualisation of a problem, and subsequently be able to critique this in light of exposure to a body of knowledge from a different discipline. According to some interviewees, senior academics, given their greater levels of experience with interdisciplinary work, were more likely to demonstrate such thinking.

Equally as important as making efforts to suture together a diverse 'orchestra' of researchers was knowing when the barriers to collaboration were too great, or when certain disciplinary perspectives were not necessarily adding anything important (Callard and Fitzgerald, 2015). Key to this was getting out of the way and enabling people to withdraw from the collaboration, or work on their own. An example of this observed in team-wide meetings and referenced in interviews was when positivist social scientists set about exploring how social networks might be integrated into risk models; this was almost a separate strand of work with limited engagement from the wider group.

As discussed above, senior academics were often faced with the task of facilitating interpersonal relationships amongst the team. According to one interviewee, this was time consuming, hard work, and emotionally demanding. The role required one to (ironically) mask one's own feelings, to appear approachable, calm and objective (even in the face of great anxiety about how one's approach to engaging with others might be perceived by the group).

7   Changes in researchers' perceptions

Key reflections

Overall, there was evidence that collaborative work led to changes in some researchers' perspectives. In particular, including a historical approach appeared to be influential and thought-provoking for both social and physical scientists. For some interviewees, a historical approach gave them a broader understanding of the issues facing SIDS that they would not typically consider within their discipline.

When asked about what they had learned, or how they were influenced, during the project, several researchers from across the social and physical sciences emphasised greater knowledge of how historical events and trends had shaped current disaster management problems and practices in SIDS. One interviewee recounted that during their engagement with a historian, on a number of occasions, they said to themselves: 'Oh, I hadn't thought about that'.

Physical scientists emphasised that they came to appreciate the complexity of disaster risk management, and the absence of straightforward solutions. They moved away from a pure problem-solving mindset to one that embraced curiosity about problems and their complexity. Some social scientists emphasised acquiring new knowledge about the impact of natural hazards through engagement with physical scientists. One interviewee said that engagement with them had 'opened up a whole new area in terms of research.'

Some interviewees reported interest in learning about how historians treated evidence from a methodological viewpoint. One researcher pointed to the similarities between methods used in history and the geological sciences, which both aimed to reconstruct events from multiple sources and partial evidence.

Some members of the team had had little opportunity before this ptoject to work closely with a diverse group of researchers before this project. They emphasised that they had learned about how researchers from other disciplines approach their work, as well as how they go about negotiating their differences with them. Interviewees highlighted that they had also learned to genuinely listen to others, detach oneself from one's own world view, and open up to new ideas and approaches.

Some interviewees reported changes in people's thoughts and arguments, especially during the writing process. For instance, an interviewee talked about how one academic's perspective on the relationship between intensive and extensive risk and its role in shaping climate change adaptation in SIDS had shifted, albeit incrementally.

Despite pressures faced by authors during the project, they derived significant pleasure from preparing a joint paper. The process reflected a fruitful exchange in which new ideas and approaches were surfaced and developed further. Moreover, publishing in a high-impact (physical) scientific journal provided social scientists the opportunity to influence an entire community of physical scientists.

8 Key lessons

In this concluding section, I outline a number of noteworthy lessons for other researchers and practitioners to consider when pursuing interdisciplinary collaborations.

1. Threading together the work of multiple researchers from varied disciplines to find a shared object of investigation, is practically and psychologically demanding. Thus, **equally important as one's expertise is one's ability to get on with others.** Or as Callard and Fitzgerald put it: '[ones' ability to] fold into and expand a matrix that is developing around a particular question' (2015: 88).

2. Serendipity played an important role in determining how the collaboration unfolded. Thus, **interdisciplinary work requires an experimental approach, in which individuals are given space to explore and contest differences in their ideas and approaches** – and ideally in person.

3. **Providing leadership to an interdisciplinary group requires a flexible approach.** The skills needed are akin to that of an orchestra conductor, bringing out the best in each individual member, while brokering relations between sub-groups and supporting them to negotiate their differences. They also need to have the skill and creativity to maximise the time and space individuals have to work together given how difficult this is logistically. However, all this is time consuming, hard work, emotionally demanding, and is achieved only through considerable experience in undertaking interdisciplinary work.

4. Interdisciplinary collaboration requires a great deal of organisation, including arranging meetings, paperwork and liaising with universities and research councils. **To help facilitate constructive collaboration, this work must be valued, clearly assigned to individuals and adequately compensated.**

5. Fieldwork involving researchers from wide-ranging disciplines can provide a valuable space to contest different ideas and approaches, without appearing confrontational. **Prioritising interdisciplinary fieldwork – especially where resources are limited – can go a long way to helping identify and negotiate key differences within the team.**

6. Interdisciplinary work is an emotional endeavour for all collaborators. **Regular collective reflection on how the group is getting on, and paying attention to people's experiences, can help improve working relationships.** This can help the group make decisions about, for example, how to manage the project and how much time ought to be spent on various components. Furthermore, bringing to the surface how different and difficult interdisciplinary work is, can both be therapeutic and help to clear blockages and keep things moving things forwards.

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