University of Glasgow

Adopting Responsible Innovation to Accelerate Your Route to Impact

handbook

WORLD CHANGING GLASGOW

UKRI Engineering and Physical Sciences Research Council

IAA Strategic Aim

To increase the global impact of the University through greater levels of external engagement and entrepreneurship

- Deliver this by building on previous IAA investments, and a focus on 4 core objectives:
  - Networking & Relationship Building
  - Funding Mechanisms
  - People Support
  - Training

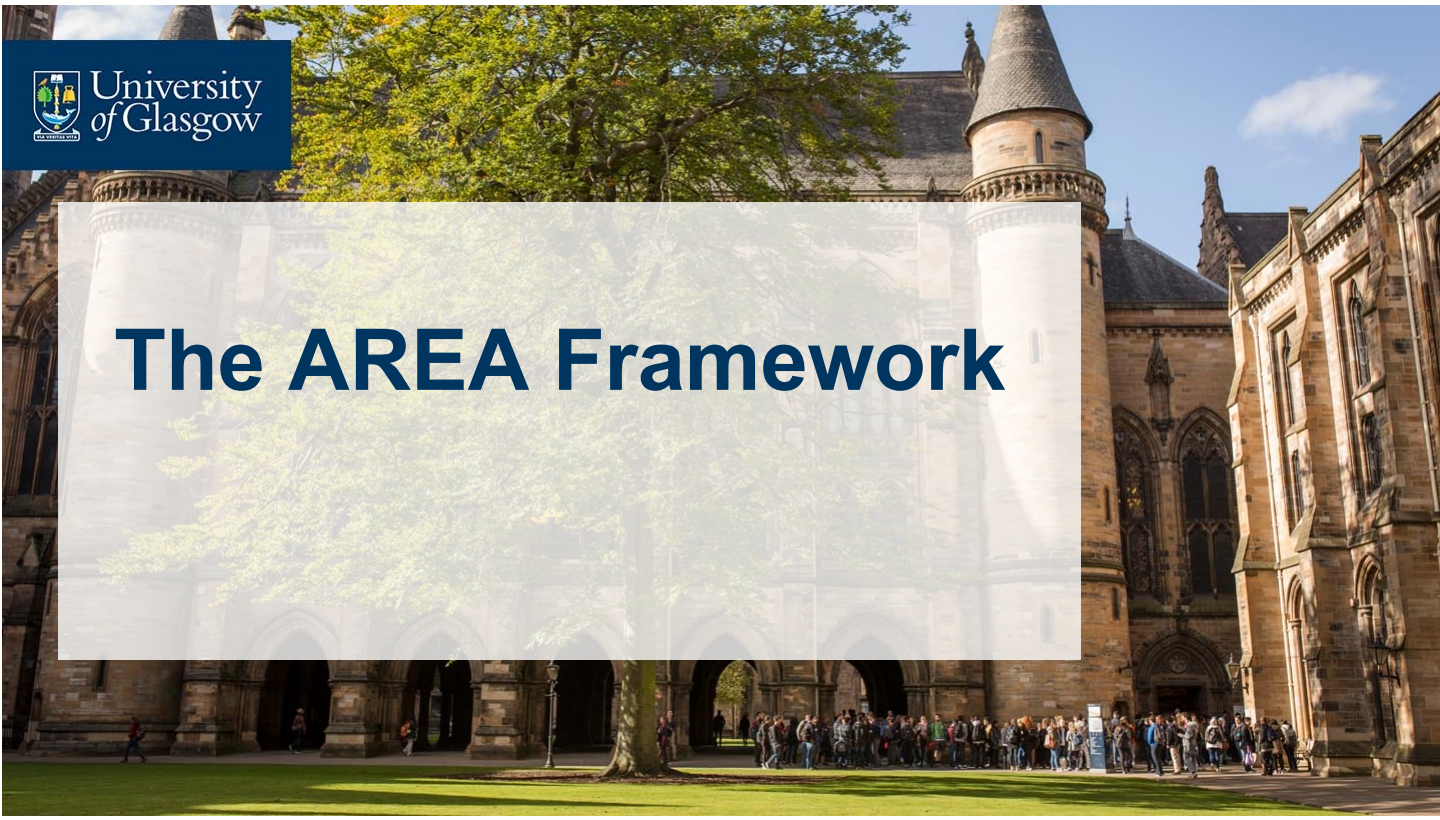
- Funding awarded - £1.13m

How to use this handbook

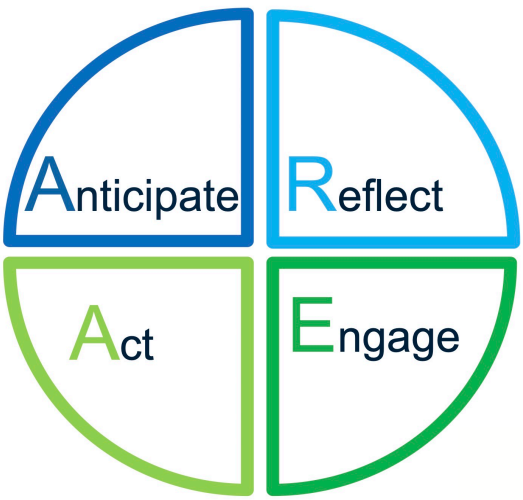
The EPSRC Impact Acceleration Account (IAA) is flexible funding to enable EPSRC funded research to develop into activities which can lead to impact beyond the contribution to knowledge (a.k.a. academic impact.).

The short video introduces you to the concept of responsible innovation and the EPSRC-endorsed AREA framework[1]. We suggest that you consider using this framework to develop a case for support, which you can put forward for IAA funding. This handbook gives a more detailed introduction to the AREA framework and contains questions you can answer to help you highlight ***gaps*** that may currently exist in your understanding of how your research could lead to impact. You can then use the framework to help you design activities to fill in the ***gaps***. These can then be developed as a case for IAA funds.

There is also a question on responsible innovation in the funding application. Developing your case using the AREA framework will make answering this simple!

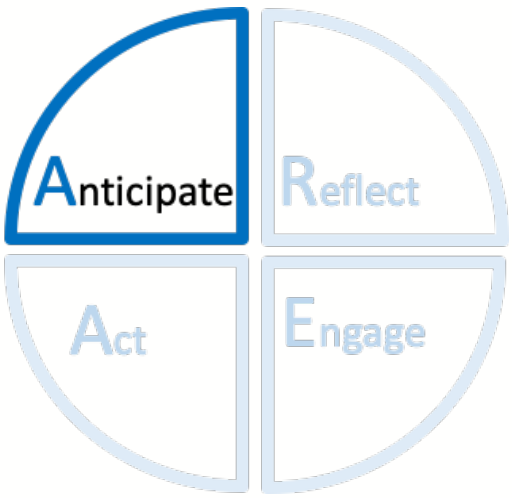


The AREA Framework



- AREA is an acronym for Anticipate, Reflect, Engage and Act[1].
- It was designed via a collaboration between scientists, engineers and social scientists to help put responsible innovation into a practical context.
- The AREA framework describes four processes or steps you can go through to help you put your research in the context of responsible innovation
- These will be elaborated on in the proceeding pages
- Appendix I contains an explanation of the case study presented in the original article (ref. 1).

Anticipate



Anticipation gives us the opportunity to address the possible implications of the proposed research project.

- Researchers should consider the potential longer term impacts, both positive and negative (risks).
- Researchers should think beyond technical outcomes and consider social and (in some cases) political implications too.

Anticipating risk – questions to guide us

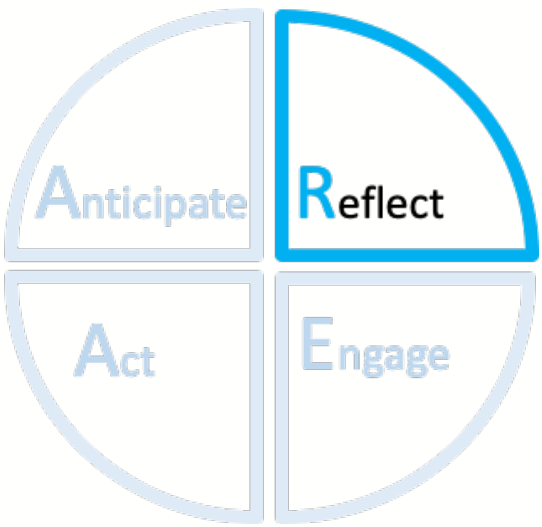
Although it is not easy to imagine all the long-term risks associated with some research, can you think of the risks that are currently connected with your field of research? Some common themes are IP ownership and sustainability?

How could the research impact society, both immediately and more long-term? If this research goes on to have a big impact and create a certain version of future society (e.g.: ubiquitous use of wearable medical devices so that healthcare is personalised and provided on-demand), will some 'sections' of society stand to gain more over others?

Do you know the regulatory landscape surrounding your field of research and as this research progresses as a product, process or service in society, will regulation need to evolve, if so, how?

Do you know the policy landscape surrounding your field of research and as this research progresses as a product, process or service in society, will policy also need to evolve?

Reflect



Reflection is an opportunity to think critically about current methodology and your own research practice.

- This is about looking inwards and considering how your values impact research culture and practice.
- What values are embedded in the project leadership?

Questions to help us Reflect on our values and practice

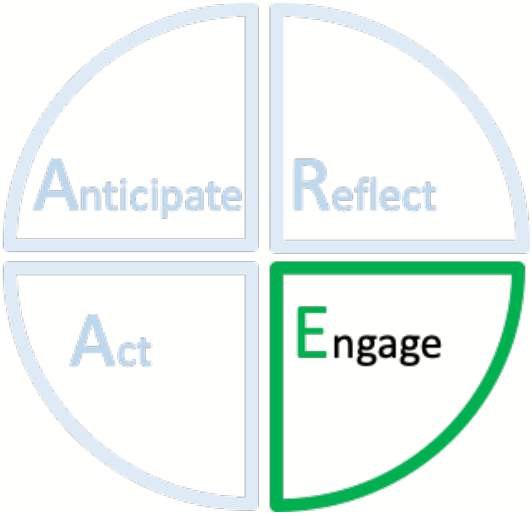
Are the methods being used acceptable? If yes, then were any underlying assumptions made to lead to this acceptance?

If there were underlying assumptions, are they based on gaps or uncertainty in knowledge? If yes, then how comfortable are we with discussing this uncertainty?

How do I approach criticism and/or advice as a researcher?

Do I tend to either overestimate or underestimate expertise? And how does this impact how I perceive my role as a researcher in society?

Engage



This dimension enables us to both develop and embed a communication strategy for the research.

- Talking *and* listening between a wide set of stakeholders.
- Collective decision-making.
- Start early and keep this going throughout the project lifecycle.

Engagement – developing an appropriate strategy

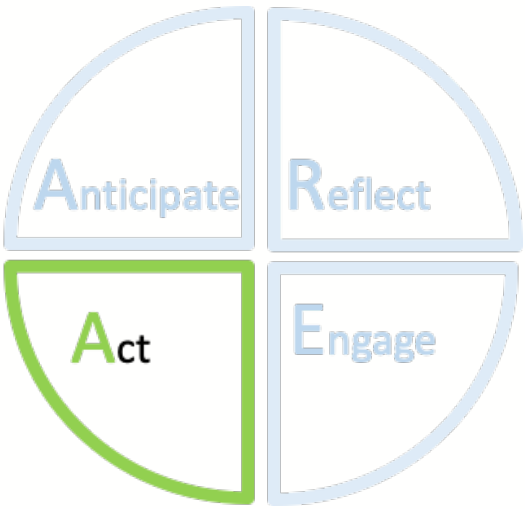
Who will we engage with? Think widely and inclusively

What is the best way to query societal needs and opinions?

What types of forums will be best for this? e.g.: conferences, workshops, focused meetings?

Do I have the adequate information, training and the right collaborators?

Act



This part of the framework enables you to develop a strategy on how to act upon the information you get from engaging with stakeholders.

- Will you be responsive to wider views?
- Will you consider altering the direction of a project, if raised?
- Ongoing, throughout the project lifecycle and beyond. These interactions could lead to long-term impact plans.

Acting is all about being responsive

Can I build measures into how I carry out my research to help me be responsive to wider views?

Will I alter the direction of a project if it means making the proposed innovation better for society in the long run?

Do I have the adequate information, training? The right collaborators?

Spotlight on engaging with stakeholders

- A stakeholder is a key individual or a group who is/are impacted by the project and/or are critical to the project's success.

- Engaging externally with a wide variety of stakeholders is key to putting responsible innovation into practice.

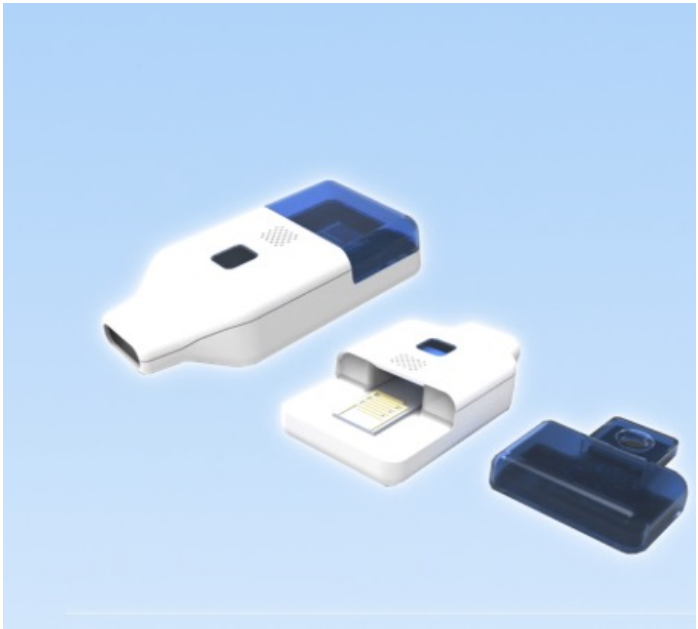
- You may already know of and interact with stakeholders within your research networks. However, if you are looking to expand your network or to move into new areas, you will need to identify stakeholders.

- The short introductory video highlights the innovation ecosystem as a good starting point. Reaching out to individuals within this space, for example, individuals in the innovation centres may help you establish connections.
- We have also outlined three case studies of colleagues within the University who have used IAA funding to help them interact with stakeholders.

- The Impact Acceleration Account team and individuals within Research and Innovation Services at the University are also a great resource and should be at the top of your list!

Case study - From research to innovation, the Nebuflow™ story

The following section features an interview with **Elijah Nazzarzedeh,** a researcher and entrepreneur at the University of Glasgow, giving his account of engagement that helped him develop his Nebuflow product to go from research to an innovative product.



https://nebuflow.com

Describe how your research transitioned from the lab to an external product, and how you decided on the final application? As I remember you said there were at one stage, multiple applications on the table?

- We were aware of the need for better control on aerosol droplet size in various fields such as mass spectrometry and respiratory drug delivery. Therefore, I started my market research with an open mind and looked at a wide range of potential applications such as thin film deposition, spray drying and pesticide delivery, to name a few. I also looked at other applications that can have lower barrier to entry.
- I analysed my data from different aspects such as the user need, industry traction and market value/price. In many of these applications, I could not find good traction from industry. Also, for some other ones, e.g. in the fast-moving consumer goods, the market is very competitive with low price tags. These can be very challenging for a new technology.
- Considering various parameters and the interests from industry, we concluded that respiratory drug delivery is the best application. However, I am still monitoring other opportunities and interests.

We were also very interested in your story of stakeholder engagement. How you went about this, and how you found the correct people, to support your commercial journey and the shaping of your product?

- I started by reaching out to people in the field including university researchers, clinicians, nurses and market experts. I did lots of searches to find these people, sent emails or contacted them through LinkedIn. I also tried to find the events that these people are attending ranging from trade exhibitions to very specialised conferences for clinicians and training events for nurses. In addition, I made contact with communities such as charities and union/societies for clinicians/nurses to ask for contacts/introductions.
- It wasn't always straightforward. I could have sent out emails and LinkedIn invitations for days without a single reply or meet people in exhibitions who don't like to talk. However, there were many helpful people who either directed me towards or made introductions to other people and other companies.
- I also I met people who could talk for hours about the issues they have, and that was a real measure for the need (and pain) of different people in the supply chain. In short I can say it could be very frustrating at times but you can usually find very helpful people.

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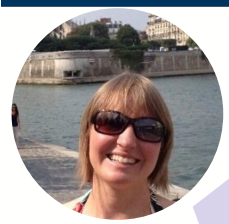
Case study – Impacting policy by building a long-term collaboration

Professor **Larissa Naylor** from the School of Geographical and Earth Sciences led the project.

"Dynamic Coast Downscaling: coastal assessment of Edinburgh's Shoreline", an IAA project which involved collaborations with two key public sector partners: Scottish Natural Heritage and Edinburgh City Council.

Here are some highlights of our interview with Larissa.

Your proposals clearly highlight that you've developed a relationship with end users over the course of the work. How did this come about?



- Like a lot of engagement work, there are very long-standing relationships that evolve and develop through time. I think one of the things that's key in all of this public engagement is the role of a ***gatekeeper*** - organizations or individuals that help open up opportunities for the research base to work with the practitioner base. In this case, as part of a NERC funded knowledge exchange fellowship I had ***Adaptation Scotland*** as a partner. They then asked me to sit on their advisory network. Adaptation Scotland was then a partner on the ***Edinburgh Adapts*** plan development. They brought myself and Jim Hansom from Glasgow University into the discussions at the very end of a long broad community - public sector - industry consultation and facilitation. They had been through 95% of the consultative process and they had no coastal actions around climate change. This then helped us build the relationship.

This Responsible Innovation training that we're developing is to help researchers plan for impact. They might have an awareness that their research ***could be*** relevant to potential stakeholders outside academia.

Can you give *UofG* researchers one or two specific pieces of advice on how they could go about, first identifying appropriate stakeholders, and then, how they could get these stakeholders to notice them or want to engage with them?

- Identification of stakeholders will vary highly by discipline or type of research. It will also depend on whether it is government, industry, SMEs, NGOs or communities. And identifying them requires an understanding of what your research is and who the target non-academic audience of that research would be. So, they would have to go through a process, either through a web search or attending non-academic events. You're having to go outside of the normal academic conference circuit in a way.

- But actually, when it comes to an individual, absolutely, unequivocally, pick up the phone. Do not send a cold email. Also, have a short brief which you can send quite instantly afterwards. Have this prepared. You should also really give a sense of what the benefit is to them. In our case, it was improving their ability to, deliver against national policy requirements or legal requirements, so we've helped them towards their progress towards adaptation reporting, because those lunchtime seminars were things that allowed them to deliver their climate change adaptation progress targets to Scottish Government. So, we're coming in saying, well, we might be applying for funding that actually can help you deliver on things you already have to do, why don't we do it together.

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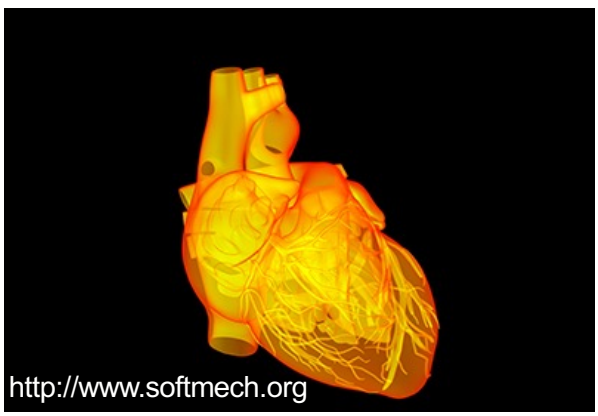
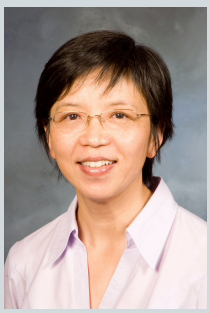
Case study –Reaching across disciplines to accelerate research to the clinic

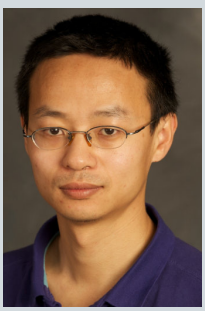
SofTMech



SofTMech is a multidisciplinary group comprising mathematicians, statisticians and NHS clinicians from multiple centres in Scotland.
This case study is a fantastic example of how differential stakeholder engagement supports and accelerates academic research to the clinic.

The team featured here (see below) had two previous IAA awards for projects centred around mathematical modelling of the heart, and were well placed to quickly answer the call for emerging scientific and clinical information to respond to the Covid 19 Pandemic. Therefore, a third IAA award was granted for the investigation of cardiac injury in relation to COVID-19.



The investigators (L-R): Professor Xiaoyu Luo, Professor Dirk Husmeier ,Professor Nick Hill, Doctor Huo Gao, all from Mathematics and Statistics at the University of Glasgow and Professor Colin Berry and Doctor Kenneth Mangoin from NHSGGC.

IAA project story - Cardiac endotypes in COVID-19: quantification and mechanisms of cardiac injury

*So, the **question** is - at the beginning there were tons of COVID 19 patients and almost a quarter of them developed heart problems. So why is that? Our **hypothesis** is the Covid19 is causing microvascular dysfunction.*

Professor Luo

To find out, the team turned to MRI imaging, a standard method used by cardiologists to view and diagnose damage to the cardiovascular system. **However…**

Professor Husmeier

We've seen that the magnetic resonance images alone are not sufficient to identify COVID19. We want to investigate if in combination with the cardio-mechanic model we can then get a reliable classifier and get deeper insight into the cardio physiology of COVID-19 in comparison with standard heart attack.

The IAA project will provide my research group with essential data to inform, test and develop our coronary blood flow computer programmes, and with those to predict what's happening in the smallest blood vessels of the heart in the COVID-19 patients. Which hopefully should allow us to develop further biomarkers to understand the progress of disease and the presence of disease.

Professor Hill

The patient imaging data is part of the of the CISCO19 clinical study, led by Professor Colin Berry - a cardiac consultant at the NHS. This is a significant clinical study funded by the Chief Scientist Office and involves three hospitals, the Queen Elizabeth University Hospital, the Royal Infirmary and the Royal Alexandra hospitals.

Dr Andrew Morrow

We hope to be able to put this all together and create a model that's showing whether or not it is all down to the big arteries or what we suspect, which is that actually some of the areas of profusion will be due to problems with small arteries and microcirculation. And we hope with all this hard work from ourselves and mathematics colleagues will help us identify something that we should target in the treatment for both the short term and potentially for Long COVID as well if we can understand the mechanism a bit better.

Contact the IAA team

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Appendix I: Case study – The SPICE project

- This case study is detailed in section three of the paper "Developing a Framework for Responsible Innovation" by Jack Stilgoe and colleagues (2013)[1] . Figure 1 maps a timeline of key events which were highlighted in the study.

- A short video featuring Professor Matthew Watson, the SPICE Principal Investigator explaining both the project and the reasons the team cancelled the field test is a helpful resource. He makes many poignant comments about his experience, particularly about working across disciplines and about how information is disseminated in the public domain. https://www.youtube.com/watch?v=FPYhJ_7W_Cc.

- **Project Aim:** "to investigate whether the purposeful injection of large quantities of particles into the stratosphere could mimic the cooling effects of volcanic eruptions and provide a possible means to mitigate global warming" (http://www.spice.ac.uk).

Case study – The SPICE project

The SPICE project was a collaboration between several UK universities and had three aims:

(1) investigate suitable particles for injection,
(2) conduct a proof-of-concept test of a particle delivery system,
(3) model the impact of the chosen particle(s) and the delivery system.

It was funded by the EPSRC, NERC and STFC, all part of the UKRI. Aim two was a proof-of-concept test, a small-scale environmental test. This would comprise attaching a 1-km-long hose pipe to a tethered balloon. Once in its location, the pipe would spray a small amount of water (the particles) and model the results, detailed in http://www.spice.ac.uk/project/delivery-systems/).

The funding councils felt that this test, although safe for the environment, could potentially lead to external scrutiny and therefore requested that the investigators start to consider responsible innovation. This took the form of a five-criteria *stage-gate* process which contained questions from the four AREA dimensions (figure 2). The researchers would need to address each criterion and be reviewed by a panel before proceeding through each 'gate'. At the same time, there were additional debates and calls for governance of geoengineering that were external to this individual project. Eventually, the SPICE team decided to halt the project for several reasons. The most significant of these was a a series of conflicting interests involving patents, which the researchers were not fully aware of at the start of the project.

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June 2009

Royal Society publishes report calling for a geoengineering research programme worth £10M per annum over 10 years.

July 2009

Three research councils (EPSRC, NERC, STFC) undertake a scoping exercise to inform a programme in geoengineering. Although themes relating to governance, ethics, public acceptability and public engagement were discussed, these were not considered a priority.

Oct. 2009

Mar. 2010

EPSRC, NERC, STFC host a sandpit to bring together researchers from different backgrounds to encourage new geoengineering ideas. N.B.: social scientist involvement was limited.

SPICE was one of two projects **funded by the sandpit**. The team did not include persons with social science or ethics competency, however, there was awareness of wider issues surrounding these aspects of the project. One work package (WP) for this project entailed a small field trial.

Although safe for the environment, the research funders saw that this field trial could potentially lead to external scrutiny and therefore requested that the investigators start to consider responsible innovation, which took the form of a five-criteria stage-gate process, created by social scientists.

June 2011

The SPICE team worked through the stage-gated process and were reviewed by a panel. More work was requested for three of the five criteria. Out with the project, other organisations were also advising caution on field testing of geoengineering.

Sept. 2011

Test-bed experiment postponed. This allowed the team to respond to the additional requested work from panel on the stage-gates.

EPSRC received a letter signed by 50 NGOs calling for the test-bed to be stopped.

May 2011

While exploring 'sticky questions' – part of criterium #3 of the stage-gate, the team became aware of a potential conflict of interest involving patent applications. In response, they took the collective decision to halt the project.

June 2012

Fig. 1: timeline of key events for SPICE project

Figure 2: AREA dimensions addressed in the case study

Anticipate

- Researchers were required to assess both future applications and impacts of the work while broadening what they though the impacts and applications could be.
- Researchers were also asked to conduct a literature review of risks and uncertainties associated with solar radiation management.
- Overall, the stage-gate enabled both the researchers and the research councils to become aware of unexplored impacts, applications and issues.

Reflect

- Researchers were asked to reflect on social, technical and ethical questions that would need to be considered between the time of the test-bed deployment and the deployment of a full-scale system.
- Overall, Stilgoe and colleagues reported that the culture within the project group started to change as the project progressed. Researchers became more reflexive and deliberative.

Act

- The research team were responsive to the stage-gate process.
- The team deliberated with the research councils and others about the potential to halt the project, and eventually took the decision to do so.
- A broader theme here is that the research councils also developed an awareness of unexplored impacts, which led them to bring responsible innovation into the project.
- geoengineering governance was also created around this time.

Engage

- Could the team produce a communications strategy that was informed by a dialogue with diverse stakeholders?
- Communication had to acknowledge uncertainties and ignorance.
- Both public dialogue exercises and stakeholder engagement were carried out during the project.
- The public dialogue revealed that once they understood it, participants were supportive of the test bed experiment. However, they were still unsure of a full- scale use of this technology.

References

1. Stilgoe, J., Owen, R., & Macnaghten, P. (2013). 'Developing a framework for responsible innovation.' Research Policy, 42(9), 1568-1580. https://doi.org/10.1016/j.respol.2013.05.008

2. Stahl BC, Obach M, Yaghmaei E, Ikonen V, Chatfield K, Brem A.(2017). 'The Responsible Research and Innovation (RRI) Maturity Model: Linking Theory and Practice ' Sustainability, 2017, 9, 1036. https://doi.org/10.3390/su9061036

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