Cambridge Centre for Housing & Planning Research

Centre for Science and Policy: Exploring Impact

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Contents

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1. Introduction

The Centre for Science and Policy (CSaP) was launched in 2009 at the University of Cambridge, with the aim of improving public policy through the more effective use of evidence and expertise. It does this by creating opportunities for public policy professionals and academics to learn from each other.

This pioneering work has created a diverse network of professionals from all disciplines, providing a platform for the exchange of ideas and building relationships based on mutual understanding, respect and trust.

At the core of CSaP's work is the Policy Fellowship Programme, an initiative that acts as a knowledge broker in addressing public policy challenges. Since its launch in 2011, the Programme has brought together 360 Policy Fellows and over 1600 academics and other experts. Policy Fellows are drawn from the public sector, industry and civil society, recognising that public policy is shaped through interactions between representatives of these sectors. This two-year bespoke professional development programme starts with five days spent at the University of Cambridge, where Policy Fellows meet with relevant researchers from a wide range of disciplines. Policy Fellows identify the questions that they would like to explore during the Fellowship as part of a competitive application process. These are then addressed through interactions with researchers using a multidisciplinary approach over the course of the two years. During this time, Fellows have access to, and collaborate with, the Policy Fellows Network, which comprises nearly 2000 people, including Policy Fellows from government, industry and the third sector, researchers and other experts.

CSaP receives a mix of funding for its activities. This includes institutional support for knowledge exchange work from the University of Cambridge via the Higher Education Innovation Fund. A significant proportion of CSaP's income also comes from the fees paid by the employers of Policy Fellows for their professional development.

As CSaP's aims are to improve public policy and provide opportunities for learning among policy professionals and academics and, in the context of this funding mix, in evaluating its work, CSaP is interested in exploring:

- Its contribution to knowledge exchange between academia and public policy
- Its impacts on the policy development process
- Learning outcomes among its Policy Fellows and the academics who meet with the Policy Fellows

1.1. Outcomes and impacts

Outcomes have a dictionary definition as simply 'consequences', 'the way things turn out', and are often considered as the near-term results of activities. Organisations considering whether their aims are being achieved in the longer-term, often look to measure both outcomes and longer-term impacts. Within UK universities policy, the influential definition of impact used for the Research Excellence Framework is: 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia'.

This definition of impact refers primarily to impacts that can be measured in institutional terms, and to changes that can be evidenced in organisations, services or policy. CSaP's work with individual policy professionals, and academics, means that it is interested in individual outcomes as well as organisational impacts.

1.2. Aims of this research

This research was commissioned by CSaP and the Research Strategy Office at the University of Cambridge. The aims were:

- To identify whether there were any particular outcomes from the Policy Fellowship programme, not yet captured, that could contribute towards impact case studies or environment statements for the upcoming Research Excellence Framework
- To learn about the types of outcomes from Policy Fellow meetings, and to help understand what the programme is achieving and whether ideas for developing the programme emerge

1.3. Methodology

CSaP carries out an ongoing, in-house evaluation of the Policy Fellowship programme. The data collected include surveys and interviews at the end of Policy Fellows' initial programme of meetings at the University of Cambridge, as well as follow-up interviews and surveys one year into the programme and at the end, after two years. Academics are only currently systematically surveyed by an email sent on the evening of the meetings they have with Policy Fellows.

CSaP sought 'pairs' of academics and Policy Fellows to approach for interviews. All interview transcripts and surveys from over eight years of the Policy Fellowship programme were

reviewed by CSaP staff to find examples where there was an indication that there had been follow-on activity after initial meetings. From this, a long list of approximately 20 potential 'pairs' was generated where there had been tangible outcomes beyond the exchange of information in initial meetings. Academics and Policy Fellows were contacted from this list by the researchers. In a few cases, the passage of several years after initial meetings meant that there was no recollection of outcomes from meetings, and in some cases planned activities had not taken place, and on that basis, some potential interviewees declined the invitation to take part.

Eight academics and ten Policy Fellows from the list who were approached agreed to be interviewed, in order to gain insights into their experiences on the Fellowship Programme and the results of their interactions.

2. Benefits and challenges

The research revealed a number of benefits resulting from interactions between academics and policy fellows. These impacts included:

- Knowledge exchange between academia and policy makers
- Contribution to policy
- Creating and widening networks beyond the CSaP Fellowships
- Interdisciplinary collaborations
- International collaborations and international impact
- Generation of new data and new fora for sharing data and information
- Personal development

However, several challenges were found in trying to identify impact, and these included:

- The difficulty in relating interactions to specific policy impacts
- Understanding the impact of interactions which existed before the Fellowship

More detail is provided in the following sections.

2.1. Benefits

2.1.1. Knowledge exchange between academia and policy makers

From the research, it is evident that there has been knowledge exchange between academics and policymakers. The resulting collaborations have allowed innovative academic research to influence thinking and policy development in various government departments and in industry.

For example, the interactions between Policy Fellow Dr Craig Davies and Professor Alan Short, a leading expert in designing climate resilient buildings, contributed to the development of the European Bank for Reconstruction and Development's (EBRD) Green Cities investment programme, which finances sustainability in emerging cities. Professor Short's participation in a high profile debate had a positive impact on EBRD's thinking on prioritising investments in building sustainable cities.

In a similar way, Dr Alexander Churchill's interactions with Professor Mike Gregory fed into the Ministry of Defence's Security Review of 2015. It also led to the co-production of a report, 'The Defence and Security Technology Competency Report: Collaboration and leveraging towards the UK 2035 landscape', which helped to inform the development of the Ministry of Defence's strategy for research and development in technology.

However, the influence and impact is not one way. The research revealed that policy makers also have a bearing on the direction of academic research and allow for practical knowledge to filter into what in some cases is purely desk-based research.

For example, Policy Fellow Scott Dennison regularly provided input into Dr Rory Coulter's work on housing supply, home ownership, and equal opportunity to access housing. Scott also served on Dr Coulter's advisory board and continued to provide feedback on Dr Coulter's reports and research results.

Furthermore, Professor Franz Fuerst's interactions with Policy Fellow Paul Crawford enabled a transfer of practical knowledge to academic desk-based data analysis:

> *"My day-to-day work as a researcher is really more desk-based, looking at data, analysing data patterns with econometric models. So, there is an inherent danger in that. If you only look at what you see on your screen and you get the data patterns, that sometimes you might be missing something. And I think that's why it's important to talk to people who are more engaged in what's out there beyond the confines of this wonderful University and have a dialogue with them about what you've found. So you show them what you find and then get some response to it….That was very much the case with Paul and other CSaP Fellows as well."*
>
> Professor Franz Fuerst, Professor of Real Estate and Urban Economics, Department of Land Economy

The programme also allowed for the exchange of knowledge in a more 'organic' rather than 'transactional' manner:

> *"I think some of the other sort of programmes at other universities tend to be a bit transactional, so that they're really focused on trying to solve specific problems or sell things that the University has….The Cambridge approach is to develop new neighbours, so develop a network, develop good dialogue, and then from that good discussion and insight, intellectual transfer. Transfer of intellectual knowledge from the University to government happens in a more organic way."*

Dr Alexander Churchill, Head of Science and Security, Government Office for Science.

The programme, therefore, allows for a two way transfer of knowledge across the academia-public policy divide. It provides an opportunity for cutting-edge research to find its way to policymakers in a useable and easy to access manner, and for the knowledge and experience of policymakers to inform academic research.

2.1.2. Widening networks beyond the CSaP Fellowships

In addition to providing a platform for academia and policy to interact directly, the Policy Fellowship also leads to the creation of networks involving academics and policymakers outside the CSaP programme, and for knowledge to be shared beyond CSaP's immediate network.

For example, following their initial conversation, Professor Andy Parker introduced Dr Tim Whitley to Dr Austen Lamacraft at the Cavendish Laboratory, which led to a workshop and project on improving speeds over copper networks. Scott Dennison shared Dr Rory Coulter's work with colleagues responsible for developing policies on home ownership at the Ministry of Housing and Communities for Local Government. This has fed into the Ministry's work on housing provision.

In addition, many Policy Fellows have recommended the programme to colleagues, thereby increasing the reach of the Fellowship:

> *"I've recommended it to someone in my current team who is about to apply for… the upcoming round of applicants….I think that's sort of evidence of the extent to which I found it useful, and I strongly recommended it to him and other members of my team."*
>
> Scott Dennison, Deputy Director in charge of Housing and Planning Analysis, Ministry of Housing and Communities for Local Government (MHCLG)

Another Policy Fellow reinforced this view:

> *"I'm always an advocate for CSaP, and I think quite a few times I've had people ask me, say I'm interested in this or what I think they should be doing about their careers, and usually one of the top things I say is it's CSaP. I'm now aware of quite a few people from my networks in Whitehall who are on the programme or have just finished the programme…. So, in that sense, I think I've been able to sort of steer people at [different] stages of their careers towards CSaP."*

Dr Mark Bale, Deputy Director, Department of Health and Social Care

Interactions between academics and policy fellows are not only relevant for participants in the programme. They provide a network for further collaborations and the sharing of information with others outside the network, some of who apply for the Fellowship themselves.

2.1.3. International collaborations and impact

Although many of the Policy Fellows and academics are UK-based, there has been a crossover of collaborations and influence outside the UK's borders.

Collaborations between Professor Jim Haseloff and Dr Linda Kahl have led to co-authorship of papers that bring together perspectives from the US and the UK. This collaboration allowed Dr Kahl, a US-based policy professional, to have access to UK research institutions and data, policy makers, people who work in administration, and funders. For Dr Kahl:

> *"The reason that CSaP was so attractive, [was] because it offered a formal connection with a UK university or university programmes, and connected me with people who had expertise and knowledge that I needed access to. But that alone would have taken me a year or two, just to get that network together and ask the questions. Whereas I could do it in a matter of weeks with CSaP."*
>
> Dr Linda Kahl, Adviser, BioBricks Foundation

Policy Fellowship interactions have fed into policy making in international organisations, thereby influencing decisions that affect multiple countries. Dr Mark Bale's involvement with the Organisation for Economic Co-operation and Development (OECD) have meant that his work with Dr Kathy Liddell and Dr John Liddicoat at the Faculty of Law have been used in OECD's work, in particular, the review of the 2006 Genetic Conventions Licensing Guidelines.

Another example of cross-border influence of the Policy Fellowships is EBRD's Green Cities Investment Programme, which benefitted from the input resulting from exchanges between Dr Craig Davies and Professor Alan Short. The Green Cities programme helps cities in the EBRD regions identify and address their most pressing climate change and local environmental programmes:

> *"The exchange that we had with Cambridge and with Professor Short was a useful input into the development of this [Green Cities] programme… Climate resilience is one of the themes that's very much part of this programme, because, obviously, many of these cities are in countries that are experiencing increased heat stress, increased water*

stress, increased exposure to extreme events. So, the input that we got from Cambridge was very useful in helping us to develop that aspect of the Green Cities programme."

Dr Craig Davies, Head of Climate Resilience Investments, European Bank for Reconstruction and Development

2.1.4. Interdisciplinary collaborations

An important outcome of the Policy Fellowship programme is the interdisciplinary nature of interactions. The programme brings together researchers from all disciplines to address the questions posed by Policy Fellows. The flow of knowledge across disciplinary divides allows for the development of different perspectives to address research and policy challenges.

For example, Dr Mark Bale's interactions with Dr Kathy Liddell and Dr John Liddicoat at the Faculty of Law has allowed science to interact with law at a policy level.

"So getting together with Kathy, and getting some experts from different jurisdictions, and also from completely different areas… one of the meetings had people from the plant breeding community, where they have a completely different approach to broad intellectual property, and how you can still breed crops without infringing somebody else's intellectual property. So, it was a really useful opportunity, because we would not have had those contacts immediately. We were looking, obviously, at this as a genomics healthcare issue. Kathy - and her colleagues - were looking across as an intellectual property issue, so the intersection was perfect."

Dr Mark Bale, Deputy Director, Department of Health and Social Care

2.1.5. Personal development

In addition to creating networks, conversations between Policy Fellows and academics have led to personal development for participants. The interactive approach creates an opportunity for knowledge exchange in different fields in a way that allows for both fellows and academics to engage in discussions outside their areas of expertise.

"From a personal development point of view, it moved my thinking and gave me some new ideas. It was a chance to step out of the day to day work and reflect on what we were doing... each conversation added a little bit of the puzzle, and a little bit of the picture, and over time it moved my thinking."

Stephen Elderkin, Project Director, Highways England

2.2. Challenges

The research revealed significant benefits of the Policy Fellowship programme, as highlighted above. However, below are some challenges observed from interviews with fellows and academics in identifying impact.

2.2.1. Inability to relate interactions with specific policy impact

Perhaps the most important consideration is the measurement of impact resulting from the Fellowship programme.

Narratives such as those provided in this report provide a thematic discussion on the results of the Fellowship interactions. However, whether this general narrative is enough to indicate actual policy impact proves challenging when input provided by academics and Policy Fellows into reports and publications cannot be directly linked to specific policies:

> *"I think it's quite hard to sometimes pin down a specific result, if you like, the outcome. But I think the opportunity to talk to people is very, very valuable, and even though it's hard to pin down specifically what came of it, normally a lot of useful stuff comes out."*
>
> Professor Anna Vignoles, Professor of Education, Faculty of Education.

> *"It's difficult to point to exactly what changed as a result, but I'm sure it has fed into a number of bits of thinking."*
>
> Stephen Elderkin, Project Director

These sentiments reveal a gap in our ability to measure policy impact. It would, therefore, be very useful to develop better tools and systems that could map interactions and collaborations and link them to actual influence in policy development.

2.2.2. Existing interactions before the Fellowship

Some fellows and academics had collaborated long before the policy Fellowship. In such instances, it is difficult to relate impact to the Policy Fellowship itself. The Fellowship may have created a conduit for further interactions and created a wider network, but it is possible that these interactions and collaborations may have occurred without the programme. For Policy Fellows and academics in similar fields, academic or related conferences and workshops provide an opportunity to meet and interact, and to create possible collaborations.

Perhaps the strength of the CSaP Policy Fellowship programme is that it is a deliberate platform for collaboration and therefore solidifies connections and exchanges which may not always be the case with interactions at events such as conferences and workshops.

2.2.3. Policy is more than government

The research revealed that, although the Fellowship programme is diverse and brings together both industry experts and civil servants, there is a skew towards policy development in government and government departments.

The research participants suggested that there are further opportunities to influence the financial sector, the technology sector, and many other industries by connecting academics to industry experts. Some felt that there is a missed opportunity from not having a wider programme and involving more industry experts:

> *"I always challenged this idea that policy makers mean the civil service and government. Policy is much wider than that, and you can have corporate policy, policy to determine the way that businesses are run. You can have, for example, financial supervision, financial regulation, the rules that govern the way that our financial system works. Policy is wider than just government, and I always encouraged the organisers to cast the net wider, and not just civil servants….I think unlocking scientific knowledge from the academic community to inform policy in that wider sense, is a very valuable objective to have."*
>
> Dr Craig Davies, Head of Climate Resilience Investments, EBRD

Generally, the interactions between Policy Fellows and academics have been positive, as detailed in the rest of this report. However, some participants were unable to recall interactions that occurred too long ago to be able to remember them clearly, and those that had not resulted in any collaboration. Furthermore, some interactions were short and with several people in a compressed space of time, and it was difficult for some research participants to point to specific academics or Policy Fellows that they had interacted with or conversations they had had.

3. Case Studies

This section of the report elaborates further on the findings from the research through four case studies. They show the impacts that have resulted and the benefits that have arisen from the interactions between academics and Policy Fellows.

3.1. Professor Jim Haseloff and Dr Linda Kahl

Professor Haseloff and Dr Kahl have worked together on Open Plant and co-published numerous papers, an opinion piece, and a widely influential commentary in Nature Biotechnology.

Their collaboration has also led to the development of the Open Material Transfer Agreement (OpenMTA) which allows individuals and organisations to share biological materials in an open access manner.

As the project evolved, they established a working group that met periodically to set design goals for materials transfer. The idea was to use a common template that most University technology transfer officers were familiar with. They chose the Uniform Biological Material Transfer Agreement (UBMTA) and developed OpenMTA based on the UBMTA template, whilst also ensuring that it met their own design goals.

Although UBMTA allows research groups to collaborate and directly share materials one to one in institutionally sanctioned platforms, it places restrictions to further sharing and on commercial use. OpenMTA tries to overcome these challenges by providing a second tier of access, which means materials are placed in the public domain, with no constraints to sharing them further on. They can also be used commercially.

To ensure that OpenMTA was not a UK-specific instrument, but applicable in other locations, specifically the United States, they approached the Association for University Technology Managers which had its own MTA Working Group and, through a peer-review process, OpenMTA was published in Nature Biotechnology.

OpenMTA has been available for over a year and currently has over 50 signatories, ranging from academic and research institutions to private companies, community laboratories and individuals.

For Dr Kahl, as a US-based policy professional, the Policy Fellowship offered a formal connection to the UK and she is currently working to develop strategies for the broader

adoption of OpenMTA by institutions such as the National Institution of Health, the Wellcome Trust, and the Gates Foundation.

Professor Haseloff finds his interactions with Policy Fellows useful and continues to work to ensure that there is openness and the capability to share biological materials in order to promote innovation at this stage of the synthetic biology field.

3.2. Dr Kathy Liddell, Dr Jon Liddicoat and Dr Mark Bale

Dr John Liddicoat and Dr Kathy Liddell met with Dr Mark Bale in 2014. Dr Liddicoat has worked with Dr Bale on aspects of patent law and how these interface both with the development of bioresources and biobanks, and the development of molecular tests, in particular, genetic tests. Through their interactions, Dr Bale was invited to a policy workshop organised by the Law Faculty, with support from Genomics England.

At the time, Dr Bale was working on the 100,000 Genomes Project and the discussion centred on approaches to openness and bioresources, and how they could affect the development of follow-on products, especially molecular tests. Dr Bale was able to provide insight to the processes within the Department of Health and the Genomes Project.

The government's perspective on the genomics healthcare and the Faculty of Law's focus on intellectual property was very timely (2015) for considering the emerging policy for the 100,000 Genomes Project. Their interactions informed current and future research at the Faculty of Law, and the published report from the workshop has contributed to policy approaches at Genomics England.

The interactions between Dr Liddell, Dr Liddicoat, and Dr Bale have allowed for the sharing and use of knowledge from both academic and policy perspectives. Dr Liddell and Dr Liddicoat were able to offer Dr Bale a broader view and an academic perspective on the approaches to both the physical access issues surrounding the sharing of information and intellectual property rights.

Their conversations fed into areas of work beyond bioresources. They have worked closely on related projects with regard to patents, including conducting research looking at how often patents interfere with the provision of tests in Europe. Survey questions were collaboratively developed to ensure that they had a more focused policy direction, and the resulting survey of 1,000 laboratories also helped to inform policy on the 100,000 Genomes Project.

They have continued their interactions, with information being shared both ways. For example, papers published by Dr Liddell and Dr Liddicoat on patent-eligible subject matter, with both an academic and industry focus, were sent directly to Dr Bale. These papers were further shared with the OECD through Dr Bale's involvement with the organisation, who are looking to update best practices with regards to the patenting and licensing of biological and genetic inventions.

The interactions between Dr Liddell, Dr Liddicoat and Dr Bale have also allowed academic research from the Faculty of Law to filter through to decision makers in government. For example, their research will help inform the review of the 2006 Genetic Conventions Licencing Guidelines. The research fed into the patenting and delivery of genetic tests by the NHS, and into the approach to intellectual property and inventions adopted by the 100,000 Genomes Project. In addition, making papers directly available to policymakers has created a shortcut to accessing information.

> *"One of the realisations from the Policy Fellowship is that it gives us a conduit. There is this perception that if we publish things, particularly if we publish them open access, then everyone who needs it, finds it. And that's not true from the point of view of a policymaker who doesn't have much time for research, or hasn't thought about key terms, and doesn't even have access to databases. Without something like these Policy Fellowships, they won't have our research."*
>
> Dr John Liddicoat, Senior Research Associate, Faculty of Law, University of Cambridge

> *"Through the three-legged approach – you've got basic research, you've got applied research, and you've got the policy underpinning framework – having a balance of these three things, which CSaP are pretty good at doing, helps us at Whitehall to actually understand where things might be going in the future, and what might be blocking things."*
>
> Dr Mark Bale, Deputy Director in the Department of Health and Social Care

3.3. Professor Jon Crowcroft and Dr Zeynep Engin

Professor Jon Crowcroft and Dr Zeynep Engin met in 2014, and their initial discussion focused on the development of practical studies of where data systems, not just the internet or the cloud, but generally information systems policy, intersect. They discussed how data could be processed to make it better for policymaking, and turned into something that could

provide evidence for policy development, and how to ensure that these data are accessible to policymakers.

Following this initial conversation, they set up the Data for Policy Conference. The first conference was held at the University of Cambridge and was a great success, with several paper submissions received. It was at a time when governments, not only in the UK but also around Europe, were interested in how they could visibly make evidence-based policy decisions. The conference has now been running for five years and has been hosted at both the University of Cambridge and at University College, London. It attracts over 300 delegates and is now a global event, bringing in participants from Europe, Asia and Latin America.

Papers from the conferences were initially published in a policy journal. However, following the success of the conferences and increasing interest, Professor Crowcroft and Dr Engin, in collaboration with Dr Stefaan Verhulst from the University of New York, have begun working with Cambridge University Press to publish a peer-reviewed journal, Data & Policy. This open access journal is dedicated to the potential of data science to address important policy challenges. It aims to promote a new theory of policy-data interactions by publishing work that considers systems of policy and data and how they relate to each other.

3.4. Professor Alan Short and Dr Craig Davies

Interactions between Professor Short and Dr Davies began in 2013 and led to the organisation of a distinguished debate at EBRD in London on the subject of climate resilience in buildings. Professor Short gave a keynote speech at the debate, which was attended by senior decision makers for city and urban investments. Professor Short's technical experience and knowledge on designing buildings to cope with extreme weather conditions was highly relevant and influential for EBRD.

Their exchange was useful in providing input into work on developing a comprehensive approach on sustainable investment in buildings, the Green Cities investment programme. The hundred-million Euro programme is supported by the Green Climate Fund and is a facility for financing sustainability in more than 50 emerging cities. The programme connects cities' environmental challenges with sustainable infrastructure investments and policy measures.

Dr Davies considers the Policy Fellowship to be a useful programme that could influence policy in different fields by unlocking scientific knowledge from the academic community to inform policy in a wider sense:

"There's a lot of incredibly valuable knowledge inside academia, but sometimes it's locked inside academia. And often academics and people in industry and finance speak very different languages. We speak different languages and we use different currencies. So, some of the value of the CSaP Programme, and my personal experience, was breaking down those barriers, and trying to understand how we can unlock this knowledge and apply it in a way that is going to help finance to flow in more positive directions. Or how it's going to help industry and businesses embed sustainability more fully into their operations."

Dr Craig Davies, Head of Climate Resilience Investments, European Bank for Reconstruction and Development.

4. Individual impact

This section of the report provides a summary of key interactions between the Policy Fellows and academics interviewed for this research.

4.1. Policy Fellows

Interviews with Policy Fellows revealed the benefits gained from participating in the Programme. Many Policy Fellows highlighted the unique opportunity to interact with researchers that they would not normally meet and to gain access to information they would typically not encounter. Below are brief profiles of the Policy Fellows and Academics who participated in the research.

4.1.1. Dr Alexander Churchill

Dr Alexander Churchill is the Head of Science and Security at the Government Department for Science. He currently heads a unit that looks at science capability across government departments and is trying to strengthen how government uses science in policymaking. He has previously worked at the Ministry of Defence (MoD) where he was involved in its science programme to support and deliver policy. When he started his Policy Fellowship, he was interested in exploring how the MoD can sustain technical capability, and how to maintain expertise and competence in new and emerging technologies.

In 2012, he met Professor Mike Gregory, whose work on technology roadmaps closely related to work at the MoD, notably on issues around predicting how technologies might advance, and prioritising limited funds against areas where there might be more benefits and returns. Working with Professor Gregory and the team, and seeing how they used techniques to roadmap technologies was invaluable to Dr Churchill's work at the Ministry of Defence. Through a research contract, he co-produced a report, 'The Defence and Security Technology Competency Report: Collaboration and leveraging towards the UK 2035 landscape' that fed into the UK Government's Strategic Defence and Security Review 2015.

4.1.2. Dr Craig Davies

Dr Craig Davies is the Head of Climate Resilience Investments at the European Bank for Reconstruction and Development (EBRD). He leads the EBRD's business operations in the climate resistance area, looking at investing in climate resilience. The interactions between Dr Davies and researchers resulted in collaborations in climate resilience in urban settings and buildings. In particular, he collaborated with Professor Alan Short from the Department of

Architecture on climate resilience in buildings. A case study detailing their interaction is presented in Section 3.

4.1.3. Dr Dudley Hewlett

Dr Dudley Hewlett is an Innovation Partner for the Defence and Security Accelerator at the Defence Science and Technology Laboratory, where he develops networks of innovations in the UK. He identifies people with ideas that can support either the development of new approaches or capabilities in defence and security, or policy. He was previously the Head of CBRN Science within the Department for Environment, Food, and Rural Affairs, where he was involved in counterterrorism planning.

He met Professor David Spiegelhalter in 2017, and their interactions fed into responses to the Novichok Attack in Salisbury, as Dr Hewlett was involved in setting the London-based protocols needed by politicians to take control of the situation. Further discussions were centred on government's maintenance of information to ensure that it can be utilised quickly. Professor Spielgelhalter's expertise and previous work on knowledge maintenance allowed Dr Hewlett to begin generating ideas about putting systems in place for maintaining knowledge in government, and embedding it into processes and learning.

4.1.4. Dr Iain Williams

Dr Iain Williams is the Deputy Scientific Adviser at the UK's Department for Environment, Food and Rural Affairs (Defra). His expertise is in scientific governance and he has spent 20 years in government in a wide range of scientific posts. His interactions with various academics and other Policy Fellows informed the development of an innovation capability programme within Defra.

4.1.5. Dr Linda Kahl

Dr Linda Kahl is a research scientist, writer and lawyer currently working as an adviser to BioBricks Foundation, a non-profit organisation with a mission to ensure that the engineering of biology is open and ethical for the benefit of all people and the planet. In her previous role of Senior Counsel and Director of Ownership, Sharing and Innovation at the organisation, she led the development of the Open Materials Transfer Agreement (OpenMTA).

During her CSaP Policy Fellowship, Dr Kahl met and collaborated with Professor Jim Haseloff and the outcomes of their interactions are presented in the case study in Section 3.

4.1.6. Dr Mark Bale

Dr Mark Bale is Deputy Director in the Department of Health and Social Care, currently seconded to Genomics England, where he leads partnerships around moving genome medicine into practice. He joined the Policy Fellowship whilst he was Deputy Chief Scientific Adviser at the Department of Health and Social Care; this provided him an opportunity to talk about developments in different areas in life sciences and their impact on policy, and what policy might do to improve innovation.

He met Dr Kathy Liddell and Dr John Liddicoat in 2013 and, through a number of workshops, exchanged ideas around intellectual property rights (IP) ownership and how the IP system works to foster research innovation. This is in addition to developing an approach that would encourage research, particularly commercial research, to use the 100,000 Genomes Project. The outcomes of their interactions are further discussed in the case study presented in Section 3.

4.1.7. Stephen Elderkin

Stephen Elderkin is a Project Director for widening the A12, a billion-pound construction project which is part of Highways England's Strategic Road Network. He was previously Chief Analyst at Highways England, where he had responsibility for appraising and valuing investments, and assuring value for money from investment in England's Strategic Road Network. Stephen has an economics background and has previously focused on environmental policy in various central government departments.

At the start of his Policy Fellowship, Stephen was working in planning and strategy, and part of his work focused on the future of thinking about what would be required of the road network, transport infrastructure, how that might change, and what would be required to improve the network, planning, and the changes going on in technology.

He met Professor Nick Kingsbury and Dr Amanda Prorok in 2018 whilst working with a team of about 70 data analysts, economists, statisticians, operational researchers, evaluators and transport planners. The team had a richness of data on traffic flows on the network, and their work focused on how to use these data in real-time to better manage the road network, increase capacity and smooth flow. Professor Kingsbury's work using these data to predict problems that would be occurring in half an hour's time was similar to work going on in Highways England. As a result, Stephen put Professor Kingsbury in touch with people in Highways England.

Dr Prorok's work on improving the efficiency of automated transport and logistics was relevant to the debate around these subjects within Highways England. Their conversation centred on debates around the feasibility of controlling future road networks in a similar manner to air traffic, and reinforced his view that total central control would be impractical.

In addition, as part of a Highways England's project on building a model of land use and the economy, Stephen met up with other academics who helped respond to challenges on the project. This shaped some of the thinking going into Highways England's strategy and master planning. Stephen says the following about his experience on the Policy Fellowship Programme:

> *"From a personal development point of view, it moved my thinking and gave me some new ideas. It was a chance to step out of the day-to-day work and reflect on what we were doing."*
>
> *Stephen Elderkin, Project Director, Highways England*.

4.1.8. Scott Dennison

Scott Dennison is the Deputy Director in charge of Housing and Planning Analysis at the Ministry of Housing and Communities for Local Government (MHCLG). Scott is an economist and member of the Government Economic Service. He met with Dr Rory Coulter in 2014, whose research on home ownership outcomes of different households informed Scott's questions on ways to increase the supply of housing and broader issues relating to public policy on housing supply, home ownership, equal opportunity to housing, and access to benefits in the housing system. Dr Coulter invited Scott to be a part of an advisory board for his work, which allowed Scott to have access to and provide feedback on Dr Coulter's results and reports. This work was then shared with colleagues working on developing policy on home ownership at MHCLG.

Scott and Dr Coulter continued to have annual phone meetings and discussions on Dr Coulter's projects for three years, which Scott consistently gave feedback on.

4.1.9. Dr Tim Whitley

Dr Tim Whitley is the Managing Director for Applied Research at BT. He is a physicist by background with a particular interest in optical physics. He previously worked as Group Strategy Director where his work focused on how to roll broadband out across the UK, and how to get faster broadband speeds over copper wires.

Dr Whitley is also the Managing Director for Adastral Park, BT's research and development campus, which is home to about 3,000 BT staff and 1,000 other people who work for a number of other companies ranging from large companies, like Huawei, to smaller start-ups. Dr Whitley met Professor Andy Parker in 2013 and, over the years, has exchanged various emails and ideas regarding their areas of mutual interest.

4.1.10. Dr Zeynep Engin

Dr Zeynep Engin is based at the University College London's Computer Science Department where she is a Senior Research Associate in the Urban Dynamics Laboratory. Through her interactions as a CSaP Policy Fellow, she established the International Data for Policy Conferences in 2015 and the Data for Policy Journal, in collaboration with Professor Jon Crowcroft at the Computer Laboratory, Cambridge.

Dr Engin's research interests are in data science for public policy and government, particularly digital ethics. The outcomes of her Policy Fellowship are presented in more detail in the case study in Section 3.

4.2. Academics

Academics who participated in the research also pointed to gaining access to a network of senior contacts in a range of organisations, including government, as one of the benefits of the Policy Fellowship Programme. The meetings allow them to have one-on-one conversations which have, in many cases, led to collaborations on a wide range of subjects.

Below are the biographies and the experiences of academics who participated in the research.

4.2.1. Professor Andy Parker

Professor Andy Parker is a Professor of High-Energy Physics at the Department of Physics, University of Cambridge. He is a founder of the ATLAS experiment for the Large Hadron Collider at CERN, and has over 500 publications on aspects of particle physics and other topics. His current research interests involve experiments to reveal new physics, such as extra space dimensions, quantum-sized black holes, and supersymmetry.

Professor Parker met Dr Tim Whitley in 2013 and put him in contact with his colleague, Dr Austen Lamacraft, which in turn led to a workshop with Cavendish academics and technical researchers from BT. The workshop considered new ways of applying fundamental physics to delivering faster speeds over copper.

4.2.2. Professor Anna Vignoles

Professor Anna Vignoles is a Professor in Education in the Faculty of Education at the University of Cambridge. She has research interests in equity in education, economic and social outcomes from education, improving students' academic achievements and helping develop skills needed in the labour market, school choice, school efficiency and finance, and the economic value of schooling. Her research interests in improving participation in education for people from low-income backgrounds closely related to those of CSaP Policy Fellow Dr Jane Kennedy, who she met in 2013. Dr Kennedy's extensive operational experience in trying to make better use of data as part of local government was relevant to Professor Vignoles' use of administrative data in her research.

Professor Vignoles shared various papers with Dr Kennedy, many of which talked specifically to Dr Kennedy's work in policy development. Dr Kennedy also gave a seminar, at Professor Vignoles' invitation, to undergraduates on her professional role and the different kinds of data she uses in her work.

4.2.3. Professor Franz Fuerst

Professor Franz Fuerst is the Professor of Real Estate and Urban Economics in the Department of Land Economy at the University of Cambridge. He is interested in real estate as an investment, both at the building level and as part of larger investment portfolios, such as real estate investment trusts. He was previously a Reader in Real Estate Economics at the University of Reading, Research Associate at the City University of New York, and Lecturer at the Technical University of Berlin.

He met with Policy Fellow Paul Crawford in 2014 and their mutual interest in cities, regions and what determines city development led them to discussions centred on the role of culture and sports events, and everyday events like physical activity in an everyday setting, and how these relate to cities and urban development. Paul's practical industry experience enabled Professor Fuerst to think beyond his desk-based research and gain insights from an industry and practical perspective.

4.2.4. James de Winter

James de Winter is a Senior Teaching Associate in the Faculty of Education at the University of Cambridge. His main role is leading the secondary Physics PGCE, in addition to teaching on the primary PGCE courses. He also leads the countrywide teacher fellow and educational research programmes for the charity, Ogden Trust, which promotes the learning of Physics.

James has developed various materials, including textbooks for science education, schemes of work, science class readers and teacher guides to support A-level physics practical work, GCSE textbooks, and TV programmes.

James met CSaP Policy Fellow Paul Kett, a Director General at the Department for Education (DfE), in 2016 and shared his perspective on teacher education, particularly in physics, a difficult area in terms of recruitment and retention. He also shared various reports with Paul after their meeting. Through this interaction, James was able to access the Department for Education's perspectives on teacher education.

4.2.5. Professor Jim Haseloff

Professor Jim Haseloff is a Professor of Synthetic Biology in the Department of Plant Sciences at the University of Cambridge. He is also the Head of Synthetic Biology for engineering plant growth at the Department. Prof Haseloff explores the area of biology that impinges on engineering, broadly termed synthetic biology. This involves synthesising biological systems, existing biological knowledge, and using engineering principles to build systems that can manipulate them in a more rational way.

Prof Haseloff's laboratory pioneered the application of synthetic biology approaches in plants, including new quantitative imaging techniques, genetic circuits for cell to cell communication, and the adoption of lower plants systems for bioengineering. This kind of technology underpins the future use of biological systems in sustainable technology and the bio economy.

Professor Haseloff's interactions with CSaP Policy Fellow Dr Linda Kahl have focused on materials transfer in the field. This led to collaboration on Open Plant to provide access to materials by putting it in the public domain without constraints and allowing them to be shared further on and used commercially. More details on the impact of Professor Haseloff and Dr Kahl's interactions are presented in a case study in Section 3.

4.2.6. Dr John Liddicoat

Dr John Liddicoat is a Senior Research Associate at the Law Faculty at the University of Cambridge. He is interested in the development and use of new technology, and focuses his research on the ability of patent law to meet its welfare-enhancing goal of incentivising the creation of new technology. He is currently working on a project that focuses on repurposing drugs from a patent law perspective and intellectual property more broadly.

Dr Liddicoat works closely with Dr Kathy Liddell, who is the Herschel Smith Senior Lecturer of Intellectual Property Law and Founding Director of the Cambridge Centre for Law, Medicine and Life Sciences. Together, they have collaborated with CSaP Policy Fellow Mark Bale on biobanks and molecular tests. Dr Bale participated in a policy workshop which aimed to identify and influence key issues on IP affecting the development of genome medicine. Further detail on their interactions are presented in a case study in Section 3.

4.2.7. Professor Jon Crowcroft

Professor Jon Crowcroft is the Marconi Professor of Communications Systems in the Computer Laboratory at the University of Cambridge. His main area of interest is internet communications and systems that use the internet, such as cloud computing. He works in software systems that implement the communications and services of the network. Professor Crowcroft was previously a Professor in the Department of Computer Science at the University College, London.

He is a Fellow of the Royal Society, a Fellow of the ACM, a Fellow of the British Computer Society, a Fellow of the IET and a Fellow of the Royal Academy of Engineering, as well as a Fellow of the IEEE.

Professor Crowcroft met CSaP Policy Fellow Dr Zeynep Engin in 2014 and engaged in discussions on information systems and where they intersect with policy. The outcomes of their interactions are discussed in a case study in Section 3 and show an ongoing collaboration that has spanned over five years.

4.2.8. Dr Rory Coulter

Dr Rory Coulter is a Lecturer in Quantitative Human Geography at University College London. He was previously a Research Associate at the Department of Sociology at the University of Cambridge. His research looks at how, why, when and where people transition between different kinds of housing and neighbourhoods.

Dr Coulter met with Scott Dennison in 2014 with whom he shared information on young people and home ownership, and ensuring equal opportunity in housing. Their discussions also centred on the role of government policy in helping young people to buy housing through the help-to-buy schemes.

In addition to his interactions with Scott, Dr Coulter collaborated with another Policy Fellow, Roger Wilshaw, with whom he jointly hosted a workshop in September 2017, bringing academics and policymakers together to discuss the housing challenges facing young

people. Through this collaboration, Dr Coulter was able to draw on Roger's expertise in policy practice, and Roger was able to gain academic insights on housing research.

5. Conclusion

CSaP's Policy Fellowship Programme has pioneered new ways of bringing together academia and public policy. The Programme has been running since 2011, and to the end of July 2019 has connected 360 Policy Fellows with over 1600 academics and other experts. The aim of this research was to identify examples of impact resulting from the interactions between Policy Fellows and academics.

Interviews were conducted with 10 Policy Fellows and 8 academics in order to gain insight into their experiences on the Fellowship Programme and to quantify the results of their interactions. The interviews revealed mutual benefits for both Policy Fellows and academics. The initial exchange of ideas has, in many instances, resulted in further collaborations, allowing for a continuing transfer of knowledge and resources across the academia-policy divide.

The establishment of OpenMTA by Professor Haseloff and Dr Kahl has wide-reaching implications not just in the UK, but in the United States, Europe and Africa. This pioneering work has allowed the sharing of biological materials without legal constraint or restrictions on commercial use.

Academic research has filtered through to decision makers in government and international organisations, for example, through interactions between Dr Liddell, Dr Liddicoat and Dr Bale. It has contributed to the OECD's work on updating best practices with regards to the patenting and licensing of biological and genetic inventions. It has also informed the review of the 2006 Genetic Conventions Licencing Guidelines, and fed into patenting and delivery of genetic tests by the NHS, and the approach to intellectual property and inventions by the 100,000 Genomes Project.

The Data for Policy conferences and Data & Policy journal which have been developed as a result of interactions between Professor Crowcroft and Dr Engin are indicative of the benefits of academia and policy interactions as they provide an opportunity for knowledge generation and sharing across disciplines.

Finally, the CSaP Policy Fellowship programme has allowed for technical expertise and experience from academia to inform policy making, as is evidenced by the Green Cities investment programme. The programme benefitted from Professor Short's international influence as a leading expert on designing buildings to cope with extreme weather conditions. The interactions between Professor Short and Dr Davies have contributed to the Green Cities programme which finances sustainability in cities.

The research has, therefore, revealed the significant benefits of the Policy Fellowship programme for both academics and Policy Fellows, and the impact that interactions resulting from the programme have on policy.