

EPSRC Review of the SUE and ARCC Programmes

Summary

The SUE (Sustainable Urban Environments) and ARCC (Adaptation and Resilience to a Changing Climate) programmes supported interdisciplinary research to address emergent social challenges concerned with the effect of environmental change on the UK infrastructure and urban environment. An expert panel was convened by the Engineering and Physical Sciences Research Council (EPSRC) to consider and review available evidence from investment in these programmes, to provide independent advice on the effectiveness and impact of the programmes, and particularly to identify transferable lessons. This report sets out the Panel findings and recommendations.

The brief for the Panel is attached at Annex A: in summary this was to examine how the two programmes contributed to:

- Maintaining and enhancing international excellence in UK research in the fields targeted by the programmes;
- Identifying and nurturing high quality current and future research leaders in the fields addressed through these programmes; and
- Generating impact of this research activity for the UK in broadly defined economic and social terms.

Overall, the Panel concluded that in both programmes EPSRC had:

- Embarked on investments that sought to address emergent, complex, and multifaceted challenges;
- Recognised and actively fostered interdisciplinary approaches in recognition of the complex nature of these challenges and the fact that solutions required research that crossed boundaries, for example, between engineering and social science; and therefore that new approaches to research and building research skills were needed; and
- Identified a need to build a cadre of researchers with the requisite skills and competencies who could work flexibly and across disciplines as an investment for the future.

On this basis, the Panel concludes that:

- Both programmes were (and in the case of ARCC, are) at the 'cutting edge' nationally and internationally in terms of adopting innovative and experimental interdisciplinary approaches, and that part of the value

that they have delivered is in cumulative learning, with an attendant challenge around whether this learning and the people within whom it resides, will remain accessible and active in the future;

- There are lessons and good practice which we hope will be translated into future practice, both through Research Councils, and in other research funders, and the research community and institutions more widely, and in particular concerning the coordination of programmes to enable capacity building and impact;
- The 'programmes address emergent challenges that will face society for many years to come, so whilst it is timely to review them now, the Panel believes that the investments should continue to yield impact and value over time. The implications of this are followed through in our recommendations; and
- The Panel concludes that the two programmes have built capacity, competencies and a valuable legacy of research and research derived knowledge vested in a cadre of researchers, but identifies questions about sustaining and benefitting from these beyond the life of the programmes concerned. Assessing impact is therefore work in progress. Our recommendations address some of the challenges in achieving the necessary sustainability.

The main text explores these challenges, programme delivery and our conclusions and recommendations. In summary, Panel recommendations are as follows:

International Excellence in UK Research

R1 Research programmes in the SUE and ARCC subject areas should continue to be framed around problems and challenges rather than specific single-sector domains, with interdisciplinary approaches an integral part.

R2 EPSRC and other research councils should take steps to capture, develop, and publish learning about interdisciplinary methodologies and programme management approaches from SUE and ARCC and from other relevant activity, in the form of good practice for interdisciplinary working.

R3 Dedicated programme coordination with associated specific resourcing is essential for complex, interdisciplinary problem focussed programmes for these to be successful.

R4 EPSRC should consider further developing and encouraging interdisciplinary research potential through responsive-mode funding channels and through strategic cross-council programmes/initiatives.

Attracting and Developing Talented People

R5 Future programmes should include incentives, resources and success criteria for building interdisciplinary research capabilities and delivering sustainable cohorts of researchers with transferable skills at the end of

programmes.

R6 Career development for junior researchers should be an explicit part of future interdisciplinary research programmes and their career paths should be subsequently monitored to record and learn from their experience.

R7 Specific learning and experience in approaches to supporting career development from the ARCC programme should be captured and applied to other areas.

R8 Good practice in the delivery and management of interdisciplinary research programmes should be identified and the research councils should play an active role in driving culture change in academic publishing, and academia more widely, to support interdisciplinary agendas and careers in these areas.

Impact

R9 To enable and optimise impact and added value, future programmes should include dedicated coordination capacity in programme design for stakeholder relationship management and knowledge exchange.

R10 The future design, management and delivery of interdisciplinary programmes should reflect the lessons from successful co-ordination activities such as the ARCC Coordination Network in achieving impact.

R11 EPSRC should continue to use pathways to impact funds to sustain impact from SUE and ARCC investment beyond the life of the formal programmes, and universities should recognize the value of, and support, researchers in impact activities post programme funding.

R12 Programme design should include arrangements to consolidate the outputs of programmes to ensure that they continue to be accessible as a legacy, and to maximise return on investment, beyond the formal life of the programme, by providing a robust and long-term evidence base that is available and accessible for those seeking to inform policy and practice.

R13 Evaluation of knowledge exchange and impact should be regularly reviewed for complex problem-focussed programmes such as SUE and ARCC and monitored through a structured evaluation framework as part of programme design and implementation.

R14 The academic community and EPSRC should look to identify good practice in establishing collaborations and impact activities, and publish and promote widely, drawing upon the experience of the ARCC Coordination Network.

R15 EPSRC should require that coordination, monitoring and evaluation are carried out using the same or consistent approaches & methodologies throughout the lifetime of programmes, including where programmes are renewed or

extended.

Review panel

The Review Panel was supported by EPSRC staff and comprised:

Tim Allen (Chair) - Director and Owner Policy Research and Analysis Consultancy Services Ltd

Dr Ian Cooper – Partner, Eclipse Research Consultants

Professor Katie Williams – Director of the Centre for Sustainable Planning & Environments, University of the West of England

Mr Jeremy Phillipson – LWEC Land Use Fellow and Director of Research in the School of Agriculture, Food and Rural Development at Newcastle University

Additional advice and input was provided by Professor Tim Broyd - Chair in Built Environment Foresight, University College London

1 Introduction

This review, commissioned by EPSRC's Living with Environmental Change (LWEC) partnership, looks at 49 projects totalling nearly £65M funded by EPSRC over the last 13 years. The review focuses on the Sustainable Urban Environment (SUE) and Adaptation and Resilience to Climate Change (ARCC) programmes. A summary of the programme phases and timelines is shown in **Figure 1**.

The **Sustainable Urban Environment (SUE)** programme was launched in 2001 aiming to improve the quality of life of UK citizens, support the sustainable development of the UK economy and meet the needs of users of EPSRC funded research in industry, commerce and the service sector. The Programme was a successor to the EPSRC's Towards the Sustainable City Programme, which in turn built upon the SERC's Clean Technology Programme. Besides engineering and physical sciences, these successive programmes, although almost wholly financed by the EPSRC, have funded research collaborations involving a range of social and environmental sciences.

The programme supported over 400 researchers across a wide range of disciplines including engineers, social scientists, environmental scientists, planners, architects and urban designers. Consortia were funded in different areas including waste, water management, transport planning and strategy, spatial planning, regeneration and stakeholder engagement.

The first call supported twelve large consortia--based projects focussing on specific sectors of the urban environment within four defined clusters (Urban and Built Environment; Waste, Water and Land Management; Transport; and Metrics, Knowledge Management and Decision Making).

The second round of funding was intended to build on the earlier work and to take a more holistic view of sustainability across the sectors, and funded projects with themes such as high density living and working; decision support; and health implications.

The final round of funding looked to seed and support significant new research directions by tackling the grand challenges associated with integration and connectivity across different spatial and temporal scales. Projects explored: the transition from current to future desired infrastructure; adaptive cities; integration of utilities; and interactions and flows in and between cities.

The **Adaptation and Resilience to a Changing Climate (ARCC)** programme built upon previous work supported through the Building (and Sustaining) Knowledge for a Changing Climate initiative (2002/04), some responsive mode activity (2006), the Probabilistic Climate Scenarios in Adaptation Decisions within the Building Sector projects (2008) and an Ideas Factory sandpit on Coping with Extreme Weather Events (2007). The objectives of the ARCC programme were: to better understand potential impacts and adaptation measures for climate change on the built environment, transport and the utilities; inform stakeholders on how to adapt successfully to impacts of climate change; and to inform the research community on the research challenges in implementing adaptation strategies.

A £6M call for consortia, to be channelled through the Living With Environmental Change programme, was launched in 2008. It supported interdisciplinary projects that addressed research gaps, integrated with existing programmes, linked to adaptation and mitigation, and involved a wide range of stakeholders. Further projects were also supported including a number of energy-related projects in 2011 (ARCC Energy) and a programme grant to Prof Jim Hall at University of Oxford, to build a portfolio of 19 projects totalling over £19.7M.

Given the ongoing importance of research in the areas addressed by SUE and ARCC, and the need to encourage collaboration across disciplines, and between researchers, practitioners and policy makers, it is now timely to evaluate the outcomes from these significant EPSRC programmes. It is also timely to seek to learn from the experience of designing and delivering such research programmes, both of which had a strong focus on stakeholder engagement and practical outputs.

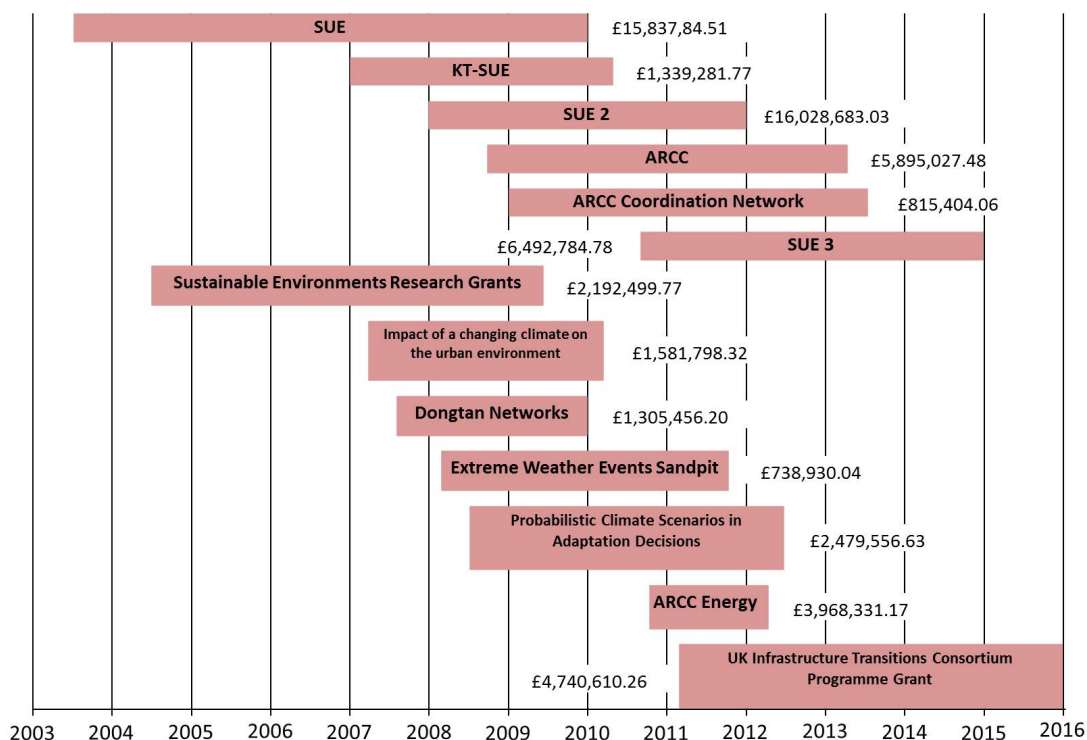


Figure 1: Grant calls under review with their respective values and timescale. Project details are shown in Appendix I.

2 Objectives and Methodology

Objectives

The Panel was tasked with looking at available evidence and taking an overview on the basis of EPSRC's brief attached at Annex A, which in summary had three objectives:

Have the Programmes delivered international excellence in research? For example, what is the quality of research in the UK and how does it compare internationally?

Have the Programmes attracted and supported talented people? For example, what does the future look like in terms of researchers and research leaders? Did the programmes successfully build a research community? Has a sustainable research capacity been built?

Have the Programmes delivered impact from research activities? For example, have the programmes influenced local, regional and national policy debates? In what spheres have the projects had an influence e.g. policy, environmental, economic, societal etc.?

The panel was also asked to look at the design and delivery of the research programmes.

Methodology

The brief to the Panel was that the Review should examine available evidence, take an informed overview and consider lessons learned that might inform future programmes and arrangements. The Review explicitly was not commissioned as a full evaluation with the accompanying resource requirement that such an approach entails.

The review panel used a number of sources of evidence as outlined below to jointly frame their consideration of the programmes, which included virtual exchanges and teleconferences, and two separate review days to formulate conclusions and recommendations.

The following data and information was supplied to the panel by EPSRC, and is included in the appendices to this report.

SUE and ARCC facts and figures (Appendix I)

A funding analysis of the programmes was presented to the panel. This included lists of relevant grants and their value, leveraged funding levels, collaborator analysis, institutional success across the programmes, age breakdown of principle investigators and co-investigators and EPSRC research areas covered by the projects. This information was based, in part, on a data extraction exercise from the “Research Outcomes System” on 14 June 2013.

Online community survey (Appendix II)

The survey consisted of three separate tailored questionnaires developed by EPSRC staff aimed at extracting relevant information from principal investigators, non-academic partners and stakeholders and international academics. Furthermore the principal investigators were asked to provide international contact names that EPSRC could send the survey to. In total 44 responses to the survey were received, the results and summary narratives (supplemented by the ROS data) are given in Appendix II. The Panel were disappointed by the comparatively low overall response rate.

Reports, Reviews and Case Studies (Appendix III)

A wide range of reports and web-based resources were used to inform Panel conclusions and recommendations. These included the SUE Research Dialogues, the ARCC CN learning documents, and a number of reports collected directly from the Principle Investigators on the grants. These included 10 impact case studies prepared for the Research Excellence Framework (REF) exercise as well as a number of policy documents and project reports, including, for example, material from the Implementation Strategies for Sustainable Urban Environment Systems (ISSUES) Project, a knowledge exchange project funded under the SUE programme. The collated reports and responses are summarised in Appendix III.

Stakeholder Interviews

The material listed was supplemented and informed by interviews conducted by Panel members with a number of key informants involved in the two programmes to explore their perspectives and responses to Review questions.

Interviewees were:

Roger Street - Director for the UK Climate Impacts Programme

Vicky Hayman – Science Officer for the Adaptation and Resilience to a Changing Climate Coordination Network (ARCC CN)

Peter Guthrie – Professor in Engineering for Sustainable Development, Cambridge University

Heather Cruickshank – Co-founder of the Centre for Sustainable Development, Cambridge University

Rachel Cooper - Professor of Design Management at the University of Lancaster

Chris Rogers - Director of the Birmingham Centre for Resilience Research and Education

3 Conclusions and recommendations

3.1 International excellence in research

Research projects funded by EPSRC under the SUE and ARCC programmes have generated a significant number of publications. Data taken from the EPSRC Research Outcomes System (ROS) suggested a minimum of 538 from 121 different journals as of July 2013 (p24, Appendix I). There were some limitations to this approach due to gaps in the data and the fact that many of the earlier SUE grants would have issued final reports not captured in the ROS system. Despite these caveats a number of themes could be drawn from analysis of the data. For example, a high volume of publications has been published in internationally recognised journals such as *Energy and Buildings*, *Urban Studies* and *Building Research and Information*.

The breadth of publication across disciplines and at the boundaries is also apparent with publications in *Health and Place*, *Clean Technologies and Environmental Policy*, *Theoretical and Applied Climatology* and the *Journal of Mountain Science* as well as some well used and cited cross-disciplinary books including *Designing Sustainable Cities*¹ and *Dimensions of the Sustainable City*².

The Panel identified that particular areas where the programmes have explored new ground are in the integration of different spatial scales, integrating different sectors, and in methodologies for socio-technical research. The array of innovative outputs, e.g., tools and models such as those developed by the CLUES³ and CREW⁴ projects are also highlighted as an area of strength,

¹ Cooper, R, Boyko, C 2009 *Designing Sustainable Cities* (Wiley-Blackwell, Oxford).

² Jenks, M, Jones, C, (eds.) 2010 *Dimensions of the Sustainable City* (Springer, London).

³ Urban energy - Looking into the Future. A tool for strategic planning, available at http://www.academia.edu/2067215/Urban_energy_-_Looking_into_the_Future._A_tool_for_strategic_planning

⁴ Pryce, G., and Chen, Y. 2013 An extreme weather event socio-economic model (EWSEM) to identify the social and economic impacts of climate change. In: Hallett, S. (ed.) *Community Resilience to Extreme Weather – the CREW Project Final Report*. CREW Consortium, pp. 39-51.

although the Panel was less able to identify the extent to which these tools and models are being adopted and applied.

Insights from key observers suggested that the programmes had led the way globally in terms of holistic systems thinking and in interdisciplinary working across socio-technical boundaries, in this regard describing the programmes as 'revolutionary', 'perspective changing', and 'internationally ahead of their time'. For example, it was noted that similar programmes are now being developed in China and the USA, and that, American and Dutch organisations are seeking engagement and learning practices from ARCC.

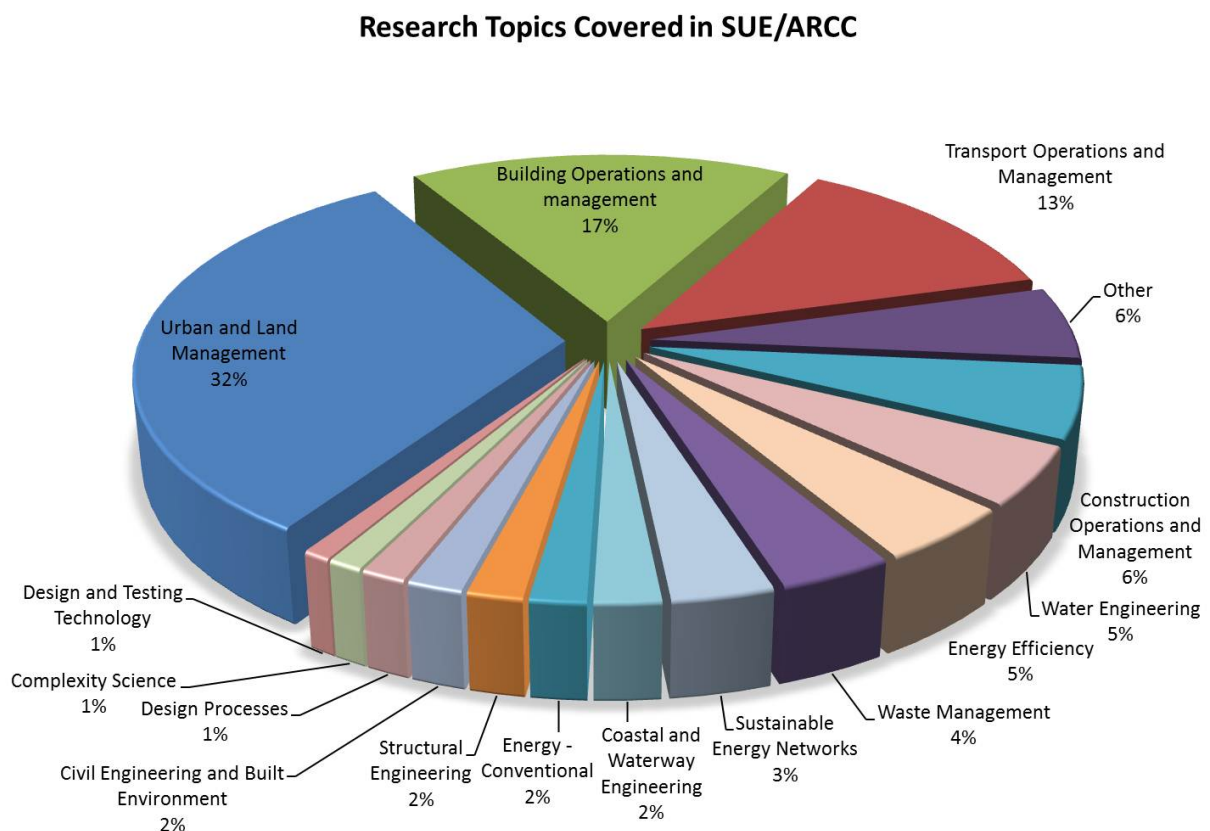


Figure 2 - Research areas covered by all projects within the three SUE calls as well as the ARCC projects.

The Panel concluded that the interdisciplinary contribution of the programmes is recognised as a central feature of their international excellence. EPSRC is to be commended for fostering ground breaking interdisciplinary work and collaboration spanning the engineering, social and environmental sciences.

The panel makes the following recommendations:

R1 Research programmes in the SUE and ARCC subject areas should continue to be framed around problems/challenges rather than specific single-sector domains, with interdisciplinary approaches an integral part.

R2 EPSRC and other research councils should take steps to capture, develop, and publish learning about interdisciplinary methodologies and programme management approaches from SUE and ARCC and from other relevant activity, in the form of good practice for interdisciplinary working.

R3 Dedicated programme coordination with associated specific resourcing is essential for complex, interdisciplinary problem focussed programmes for these to be successful.

R4 EPSRC should also consider further developing and encouraging interdisciplinary research potential through responsive-mode funding channels and through strategic cross-council programmes/initiatives.

3.2 Attracting and developing talented people

Both SUE and ARCC have facilitated the coming together and building of cross-institution, interdisciplinary teams. This has allowed principal and co-investigators and research post-docs to significantly broaden and develop their expertise.

The programmes have provided continued support for academics in these fields with multiple PIs and Co-Is being funded through SUE and ARCC calls over several years, building on research findings through active interchanges between teams to match required capability. There are examples of junior researchers in the early phases of SUE who have gone on to lead – or take senior roles in - projects later on in either the SUE or ARCC programmes, or winning funding in these or related areas.

The programmes have also offered a large group of researchers an opportunity to work in interdisciplinary teams early on in their career. This has generated a cohort of young researchers who are more experienced and open to working collaboratively in a variety of interdisciplinary areas, although the Panel also expressed concerns about the need to ensure that these benefits (both to interdisciplinary working and for the researchers involved) are sustained in future. Career development opportunities and future interdisciplinary funding prospects are particular areas of concern in this regard.

The ARCC programme, launched later than SUE, had community building designed into its programme coordination with an explicit model of knowledge exchange that was pursued and valued. The programme clearly demonstrates the valuable role of a coordination network in building an interdisciplinary research capacity and pursuing proactive relationship management with stakeholders through events and activities.

In comparison, researchers supported by the SUE programme only came together for the first time as a cohort under the SUE name, towards the end of

the programme, in 2010. No sustained resources were provided for cross-SUE community building and changing requirements and focus throughout its phases meant cohesion in the community was not built as the programme developed.

The Panel concludes that:

- Despite differences, both the SUE and ARCC programmes have generated capacity for interdisciplinary research, which has helped to create a body of researchers better equipped to operate in interdisciplinary settings and communities of researchers and practitioners with the capability to push boundaries and work with other disciplines.
- The ARCC coordination network has demonstrated its role in adding value to a large programme by actively facilitating and building a community of researchers and effective links to stakeholders in a coherent way, as well as building and promoting a knowledge base of expertise.
- There is concern expressed by the researchers involved in the programmes around the prospect for future interdisciplinary funding and career development opportunities to build on the work of SUE and ARCC
- The Panel concludes that action is needed through the design of future research council programmes and funding to continue to, and more explicitly support, interdisciplinary early career researchers.

The panel made the following recommendations:

R5 Future programmes should include incentives, resources and success criteria for building interdisciplinary research capabilities and delivering sustainable cohorts of researchers with transferable skills at the end of programmes.

R6 Career development for junior researchers should be an explicit part of future interdisciplinary research programmes and their career paths should be subsequently monitored to record and learn from their experience.

R7 Specific learning and experience in approaches to supporting career development from the ARCC programme should be captured and applied to other areas.

R8 Good practice in the delivery and management of interdisciplinary research programmes should be identified and the research councils should play an active role in driving culture change in academic publishing, and academia more widely, to support interdisciplinary agendas and careers in these areas.

3.3 Delivering impact from research activities

The evidence reviewed suggests that projects funded under the SUE and ARCC programmes have had impact in a range of circumstances, including public policy including national guidance, impact on industrial processes, and regional planning impacts. This is evidenced by published reports and outputs submitted to the review panel including a number of case studies prepared for the Research Excellence Framework exercise (seen in confidence by the panel and summarised in Appendix III).

Examples of international outputs include input into the IPCC 5th Assessment; the European Bank for Reconstruction and Development (EBRD), and the OECD's Green Growth Studies (p1, Appendix III). On a local or national level outputs have contributed to policies such as: the UK Climate Change Risk Assessment; Foresight on Future Cities; London climate change adaptation strategy; national adaptation programme (p1, Appendix III); multiple reviews on infrastructure; and various inputs related to the built environment, chemical hazards & poisons, health, energy and transport sectors. In addition to direct impacts there are secondary influences, which are harder to measure. For example, it is generally believed that the programmes have influenced thinking about city governance, infrastructure, the future of cities and the incorporation of health and wellbeing considerations into infrastructure. Impacts on working across sectors and spatial scales are also evident, including inputs to spatial and strategic planning in cities, for example in Cardiff⁵, London⁶ and Newcastle⁷.

Further evidence comes from sources of leverage from collaborators on these projects as shown in **Figure 3**.

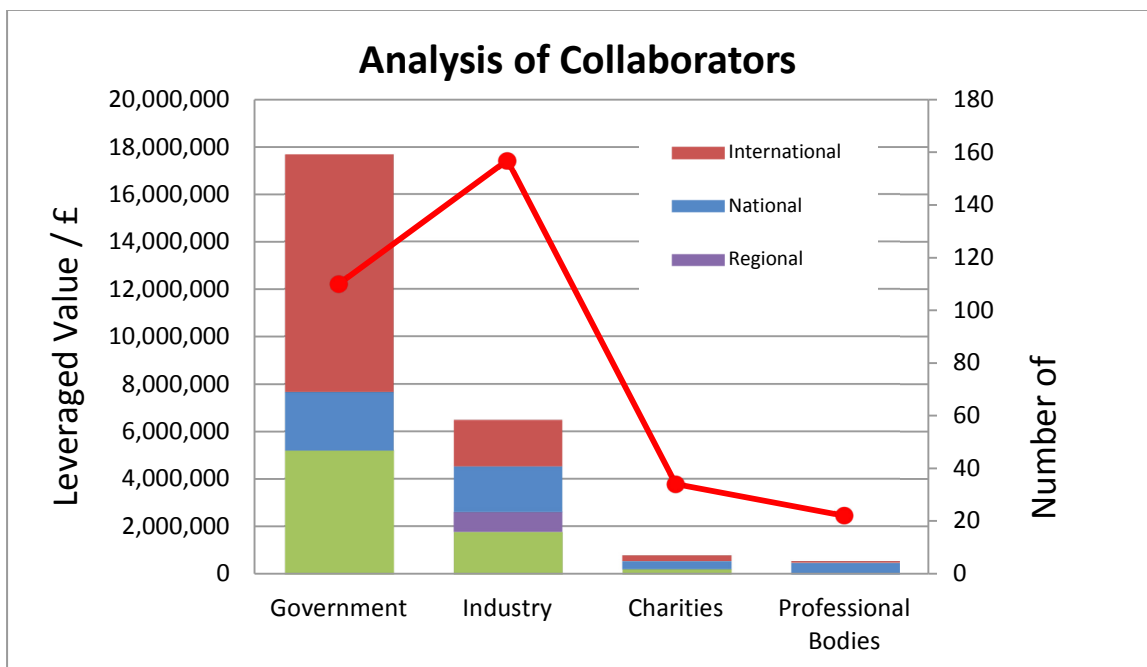


Figure 3 - Breakdown of leveraged funding on the projects covered in this review by sector and scale of organisation.

⁵ Eames, M, Scenario Foresight and the Retrofit 2050 Backcasting Process, available at <http://www.retrofit2050.org.uk>

⁶ Arup, Heat Thresholds – London Climate Change Partnership, available at <http://climatelondon.org.uk/>

⁷ <https://www.secure-project.org/>

However, the Panel also acknowledged that:

- Both programmes address areas that will continue to challenge and require research and research knowledge, so that the full value of the investment in impact terms will only become evident over time, and it is not realistic to assume it will all be fully delivered during the life of these programmes; and
- That despite this, some opportunities for what is now described as impact were not fully exploited (particularly in the earlier SUE), and the analysis conducted by the SUE Implementation Strategies for Sustainable Urban Environment Systems (ISSUES) Project highlighted this⁸

The Panel concludes that:

- Given the impacts achieved, there are lessons to be learned from the programmes in terms of optimising the impact of future activities.
- The first SUE calls identified the need for collaboration with industry but there was less emphasis on public policy engagement and understanding of science. Impact and the pathways to impact were still to fully emerge as a priority within the research funding system.
- Individual projects within the SUE programme have led to many formative impacts but these could have been greater, and the programme could have led to more collective impacts and added value, if there had been more sustained coordination of knowledge exchange for the portfolio of projects. The SUE ISSUES project, which was funded between 2007 and 2011, played this role in part. But it did not cover the whole life of the SUE programme. Nor was it funded to undertake the broad knowledge exchange and relation management activities pursued by ARCC's Coordination Network.
- The existence of the ARCC Network on the other hand facilitated sustained engagement in multiple phases with stakeholders across projects that provided a basis for programme level impacts through a number of mechanisms. These include strategic level engagement with stakeholders in ways tailored to their needs to facilitate co-creation of proposals, refining of bids after they've been awarded, periodically feeding project results through to stakeholders, and strategic events and presentations and synthesis of project outputs for stakeholder audiences. This ARCC focus on programme level impact also allowed greater leverage than individual projects and demonstrated added value of a coordinated programme/network approach.
- The lessons from these programmes point to the value of a specific focus within programmes on sustained engagement and relationship management and on active knowledge exchange with stakeholders. This needs to recognise that impact requires:

⁸ <http://www.urbansustainabilityexchange.org.uk/media/ISSUES%20Outputs/KE%20Landscape%20v3.pdf>

- Conscious management of research knowledge so that it is accessible to and generated with stakeholders;
 - Action to ensure that stakeholders are effective 'clients' for research, for example, using memorandums of understanding with key stakeholders to help to mitigate the turnover of staff in industry and public bodies that can otherwise hinder knowledge exchange
 - Efforts to build capacity and skills for effective front-end co-creation of bids and then knowledge exchange and agility within research programmes capable of responding to opportunities to engage in policy and practice.
- Assessing impact in programmes that are innovative and addressing emergent and complex challenges requires a timeline that will extend beyond the life of the programmes: both ARCC and SUE address areas that will continue to challenge for years to come. As a result, one mark of programme success will be the availability of a body of research, and research knowledge and expertise, that is available – and flexible enough – to inform and support policy and practice over time.

The panel made the following recommendations:

R9 To enable and optimise impact and added value, future programmes should include dedicated coordination capacity in programme design for stakeholder relationship management and knowledge exchange.

R10 The future design, management and delivery of interdisciplinary programmes should reflect the lessons from successful co-ordination activities such as the ARCC Coordination Network in achieving impact.

R11 EPSRC should continue to use pathways to impact funds to sustain impact from SUE and ARCC investment beyond the life of the formal programmes **and** universities should recognize the value of, and support, researchers in impact activities post funding.

R12 Programme design should include arrangements to consolidate the outputs of programmes to ensure that they continue to be accessible as a legacy, and to maximise return on investment, beyond the formal life of the programme, by providing a robust and long-term evidence base that is available and accessible for those seeking to inform policy and practice.

R13 Evaluation of knowledge exchange and impact should be regularly reviewed for complex problem-focussed programmes such as SUE and ARCC and monitored through a structured evaluation framework as part of programme design and implementation.

R14 The academic community and EPSRC should look to identify good practice in establishing collaborations and impact activities, and publish and promote widely, drawing upon the experience of the ARCC Coordination Network.

R15 EPSRC should require that coordination, monitoring and evaluation are carried out using the same or consistent approaches & methodologies throughout the lifetime of programmes, including where programmes are renewed or extended.

4 Overall Conclusions

The EPSRC is to be commended for treating the SUE and ARCC programmes as long term investments. Both programmes have produced internationally recognisable research outputs. Both have successfully promoted interdisciplinary working, changing the way research is done across disciplines in these areas. Effort will be required by EPSRC to ensure these approaches are maintained for cross-cutting problems and best practice learning captured.

Cohorts of researchers have been developed that are more capable of working across disciplines. Academic career paths for these researchers need to be nurtured in order to maintain the flow of leaders in these cross-cutting areas and opportunities for interdisciplinary research need to be generated and supported.

A number of significant impacts have resulted from the programmes and the body of work has helped shape the agenda in these research areas.

The presence of an independent funded (and evaluated) coordination network within the ARCC programme highlights the potential benefits from building and sustaining coordination capacity into programme design. The non-academic partner engagement with projects and subsequent impact due to that engagement is an area that should be promoting widely as good practice.

ANNEX A - Terms of Reference for SUE & ARCC Review

An Expert Panel has been established to oversee a review of the Sustainable Urban Environments and Adaptation and Resilience to a Changing Climate programmes.

The Panel's main role will be to draw on their expertise to provide independent advice on the strategic direction of the project, advising and challenging the EPSRC programme team on the data and information generated by the review, and developing recommendations and conclusions.

The specific objectives to be considered by the Advisory Group:

1. To determine the extent to which the UK is **maintaining international excellence in research** related to making infrastructure, the built environment & transport systems resilient to environmental change, more sustainable, less energy intensive and more socially acceptable, economically advantageous and environmentally harmonious.
2. To determine the extent to which **high quality current and future research leaders** are successfully identified and supported in the area of making infrastructure, the built environment & transport systems resilient to environmental change, more sustainable, less energy intensive and more socially acceptable, economically advantageous and environmentally harmonious.
3. To determine the extent to which **research activities have delivered impact** for the UK economy and society in absolute terms and relative to the maximum possible, including fostering global performance, economic competitiveness and enhanced quality of life, health and creative output.

It is envisaged that the meeting on the 30th July will be the main opportunity for the panel to comment on the data obtained by the EPSRC review team. Conclusions and recommendations should, where possible, be made then. A draft of the report will be shared with the panel by email for comment before publication.

Terms of Reference

The terms of reference for the Expert Panel are to:

1. Provide expert advice and strategic direction for the project, agreeing the overall priorities and timeframes for delivery;
2. identify any gaps in the analyses and proposing areas of work to strengthen the evidence base;
3. Consider the need for recommendations arising from the report and identify target organisations for these recommendations;
4. Discuss and agree the development of a final draft report for publication.