Enhancing the Recognition of the Contribution of Engineering and Physical Sciences to Achieving a Resilient Nation: Summary highlights report

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Introduction

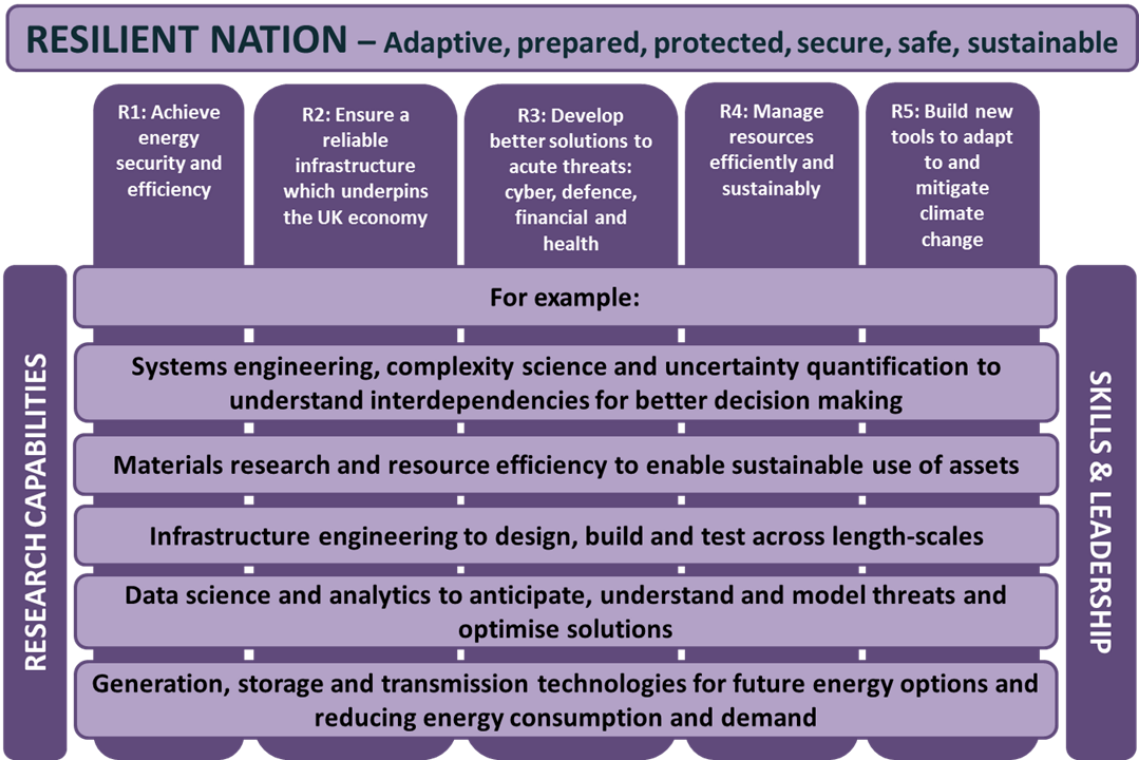
The Adaptation and Resilience in the Context of Change (ARCC) network, working with EPSRC, undertook a short scoping study (Nov 2017 – July 2018) focusing on understanding the recognition within the resilience community (researchers, stakeholders and research funders within the UK) of the contributions of engineering and physical science (eps) research and innovation to achieving UK resilience. A second aim of this study was to engage representatives of the UK resilience community to consider options that would enhance that recognition and the benefits of the investments that are being made. As a scoping study, the emphasis was on breadth rather than depth.

This summary report highlights the messages and implications arising from evidence gathered from those with whom we spoke. These messages suggest that there are challenges and opportunities that should/could be considered in future EPSRC and eps research community activities to promote the recognition, and communicate and demonstrate the added value in the context of enhancing the Resilient Nation outcome. In addition, among these messages are those that deserve further consideration within UKRI. As this is a summary highlights report we have not explicitly identified to whom the points are directed. In addition, we have not purposely ordered the points in terms of prominence as we believe that all are salient and deserve consideration.

We appreciate the time and genuine effort that those we contacted gave in providing their perspectives and insights. For the sake of this summary report, these contributors will remain anonymous, but hopefully each will see their contributions reflected in this report.

Background

As one of the four Prosperity Outcomes, achieving a Resilient Nation is being used by EPSRC to provide a strategic expression of how investment in eps research and skills adds value to the nation. In this context, a Resilient Nation reflects the ability of the UK to provide all citizens with sustainably-managed resources, reliable infrastructure and the ability to combat both natural and man-made threats.
Within the Resilient Nation Prosperity Outcome, five Ambitions are listed (R1 to R5) together with a number of cross-cutting research capabilities and areas where skills and leadership are recognised:



Key Points from the Evidence

Prosperity Outcomes Framework

- The framework provides a useful and valuable structure into which EPS research can be placed to demonstrate its impact and value to the UK. This demonstration is highly valued by researchers and those wanting to use the research results.
- The connection between the framework and other UK (e.g., Industrial Strategies, Clean Air; 25 Year Environment Plan) and International (e.g., UN Agenda 2030 SDGs) strategies and goals need to be more clearly made.
- The value of the framework is not uniformly recognised between researchers working at the 'fundamental' end and the 'applied' end of the EPS spectrum of research, and this needs to be addressed by enhancing its value to those undertaking fundamental research.
- Some researchers working in more fundamental areas of EPS feel detached from the Ambitions – the Ambitions need to ensure that the breadth of EPS research is captured and SEEN to be contributing to the ambitions.
- Some EPS areas, in particular the areas of remote sensing, sensor development, status monitoring and robotics are not perceived as fitting comfortably with the Ambitions as they are currently expressed.
- In addition to the current Ambitions, it was suggested that the Resilient Nation outcome should also clearly focus on translating and achieving the application of research findings supporting policy and practice.

The value of EPS Research in understanding Resilience

- There is a need to demonstrate that in terms of supporting resilience:
  - EPS research is beginning to provide valuable insights into developing understanding of inter-dependencies and complexity that are critical to understanding and enhancing resilience.
  - EPS research is fundamental to providing reliable infrastructure, ensuring energy security and in responding to acute threats.
- Although delivering potentially valuable results for policy, practice and science, effectively contributing to the Resilient Nation outcome means that EPS research should be:
  - More adventurous and less risk adverse
  - More ambitious and far sighted and look to be more disruptive.
  - Taking more of a system and 'system of systems' perspective. The tendency for study and funding to be siloed leads to a poor understanding of the cross-cutting nature of the issues around resilience, potentially leading to less effective solutions.

Challenges to Achieving Resilience

- Valuing resilience
  - There is an urgent need to develop a means of valuing resilience, including in the context of making the business case.
  - The accepted approaches to economic modelling, and valuation are not fit for the purpose of valuing resilience.
  - Critically, they are far too focussed on short term returns on investment especially when considering very long life assets.
  - Resilience needs to be linked with a clear financial and social benefits, as opposed to being seen as a short-term cost.
  - UK infrastructure, particularly that which that has existed for a long time, does not seem to be sufficiently valued both socially and politically, with the result that in terms of investments other sectors being given higher (political) priority.
- Planning and resilience
  - The current (Land Use) Planning system, and its rules, is seen as a barrier to resilience.
  - It is unclear how the planning system is able to consider resilience, including how it deals with potential conflicts and trade-offs in both time and space.

The Understanding of Resilience

- The nature of Resilience is not consistently understood or elucidated. This can lead to a situation where it can be confounded with resistance.

- The richness of (or what some consider a more comprehensive) understanding of resilience needs to be exploited if we are to truly be a Resilient nation.
- Resilience is strongly recognised as a 'socio-technical' issue that cannot be solved by engineering solutions alone.
    - It was strongly suggested that more cross-disciplinary working, including with social and natural scientists, could help to address this.
- In order the demonstrate leadership in developing the understanding of Resilience it is recommended that a Fellow (or Fellows) be appointed for a period of at least five years. It would be advantageous if they were supported from across the Research Councils with a mutually agreed mandate.

Behavioural and Social Sciences

- There is broad and strong support of the need for a much more significant element of the behavioural and the social sciences to be included in both research and innovation activities focusing on enhancing resilience.
- The links between resilience and social and economic well-being need to be strengthened, with particular reference to the role of health systems in achieving resilience.
- Traditionally academic study has tended to be 'narrow and deep', whereas the optimum approach to the study of resilience needs to also take a much broader perspective.

Training, Development and skills

- There is a need for more and better training at both doctoral and post-doctoral level into the nature and breadth of resilience (i.e. supporting the Resilient Nation outcome). Note the EPSRC Resilient Infrastructure priority area in the 2018 CDT call.
- Training on Resilience could / should be extended to Master's level programmes.
- The understanding of systems engineering and complexity science needs to be improved, in order to be able to grasp the breadth and inter-dependent nature of resilience issues and solutions.
- There is a need to enhance the flow of EPS research on resilience into Continuing Professional Development programmes for the professions.
    - It was not clear how the best current research on Resilience, or how leading academic practitioners, feed in to these (CPD) programmes.
    - EPSRC, possibly through UKRI, should reappraise the appropriateness of the level of their practical input into CPD across a broad range of professional disciplines.
- A shortage of resources and skills (on resilience issues and in generating solutions) were noted that presents a wide range of challenges. Included among these is the loss of experienced and skilled civil (and other public) servants who were able to provide advice and guidance to politicians and who could also engage with researchers to co-design, co-develop, co-evaluate and implement solutions.

Changes required in research evaluation/assessment practices

- The current Peer Review process is seen to be a barrier to cross-disciplinary proposals. The inclusion of a greater number of practitioners / non-academics, and multi-disciplinary reviewers on panels operating within EPSRC and across Councils, and demonstration of the multidisciplinary success stories may help to reduce this barrier.
- Greater effort is needed in the translation and dissemination of research outputs to the practitioner and policy making community. The 'traditional' academic publication route, including open access is very poor at informing and engaging these communities.
- The length of time between which academics typically (actively) engage with Research Councils (3-5 years when submitting proposals) presents a challenge for the Research Councils.

Next Steps

- In the short term, a scoping workshop to explore some of the challenges arising from this research should be held with a view to developing a pragmatic way forward on resilience within engineering and physical sciences, but also across UKRI.