

Bright Ideas Have a Bright Future Workshop Report

Monday 8th- 9th October

Bailbrook House, Bath

An Engineering Theme Event for the
Civil Engineering Research Community



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Attendees List

Attendees were selected to attain coverage of Bright Idea Award principal investigators, Network grant principal investigators, and EPSRC programme grant holders in the Civil Engineering community (including Water, Ground and Structural Engineering).

Al-Tabbaa, A	University of Cambridge
Broyd, T	University College London
Giaralis, A	City, University of London
Jefferson, T	Cardiff University
Lorenzo, R	University College London
Lunn, R	University of Strathclyde
Markham, A	University of Oxford
Neumann, A	Newcastle University
Overend, M	University of Cambridge
Pavic, A	University of Exeter
Pearce, C	University of Glasgow
Pelecanos, L	University of Bath
Ramage, M	University of Cambridge
Rossetto, T	University College London
Savic, D	CEO, KWR Watercycle Research Institute
Tizaoui, C	Swansea University

Introduction: Motivation, Aims and Objectives of the Workshop, Background

As part of our strategy development for the Civil Engineering portfolios, EPSRC engaged with a cross-section of the community to establish their perspective on past portfolio research investments and the future research landscape. The workshop stimulated a wide ranging strategic discussion and thus provide the community with an opportunity to voice potential directions for the future.

The workshop had multiple focuses including:

- Reflection on the recommendations from the 2009 EPSRC Review of UK Academic Research in Ground and Structural Engineering, and the progress that has been made since.
- 2011 Network Grant Call outcomes, and the 2013 Large Scale Proposal investments, fuelled by ideas coming from the Network grants
- Celebrating the successes of the 2015 Bright IDEAS Awards: The Big Pitch Call outcomes, and reflecting upon The Big Pitch scheme.
- Outlining the 2018 ISCF UKRI Transforming Construction Challenge investment of £170 million

It is intended that the outputs of this workshop will be shared with the Engineering community including the Strategic Advisory team, and used as an input into our strategy, including Balancing Capability.

Desirable Skills Collaboration Resource

The workshop included an icebreaker where attendees sketched portraits of one another, and presented a 1 minute 'elevator pitch' about themselves and their research. They were then given an opportunity to highlight the skills they would find most desirable in a collaborator, and those possessing these skills were encouraged to introduce themselves and discuss the possibility for future collaborations. The portraits, and a table outlining the desired skills of potential collaborators can be found at the end of this document in the Appendix 1 & 2.

Recommendations and Reflections of Past Investments

Attendees were asked to briefly reflect on the recommendations from the [2009 EPSRC Review of UK Academic Research in Ground and Structural Engineering](#), and the progress that has been made.

Recommendations that were considered to have been achieved were:

- R1) EPSRC should continue to support ground and structural engineering research in the areas where the UK has established international leadership.
- R3) the UK academic community should explore opportunities to disseminate to and collaborate with researchers overseas, particularly in the US.
- R6) EPSRC should look to promote a stronger fellowship culture among the UK ground and structural engineering community.
- R12) EPSRC should look at funding mechanisms to encourage international collaboration.

Recommendations that were considered to need more work and attention were:

- R4) The academic community and EPSRC should look to identify the potential research areas in which the UK can establish future international leadership (also see R1)
- R7) EPSRC should look at the process of how research feeds into the production of design guidance and standards, and look at ways in which this can be facilitated.
- R8) EPSRC should encourage industry to strengthen its involvement with academic research beyond a culture based on letters of support and attendance at steering group meetings.
- R11) EPSRC should look at new peer review mechanisms to support and encourage multi-disciplinary working.
- R14) EPSRC should look to encourage greater creativity and ambition in ground and structural engineering research.
- R16) The academic community should continue to undertake, and EPSRC should continue to support, research to support the innovative part of the construction industry.

Working with Industry Panel Discussion

This session was intended to make further progress in addressing the 2009 Review recommendation 8; EPSRC should encourage industry to strengthen its involvement with academic research beyond a culture based on letters of support and attendance at steering group meetings. The session promoted discussions around how to manage relationships and secure meaningful contributions, as well as to cover any other questions from the floor. The panel members consisted of Sam Stacey,

Tim Broyd and Tracy Hanlon. The questions asked to the panel and their responses are outlined below.

How can you work with industry to get meaningful contributions and good project partner letters of support?

The emphasis of discussion around this question appeared to be not on forming relationships with organisations, but instead individuals. Advice was given on how to forge these relationships, including starting early and seeking opportunities to network, such as attending forums and evening lectures. The importance of maintaining these relationships through dialogue even when it is perceived that industry have nothing to contribute was highlighted.

In terms of good project partner letters of support, the need for an initial understanding of how the industry functions and its challenges was considered an important factor. It was also recommended that industry partners focus their contribution on aspects such as resources and staff time, and cash. The letters of support in these cases should specifically capture why these contributions are important to the business.

It was later raised that industry support is now beyond letters of support and the perception that EPSRC expect cash contributions. The panel emphasised here that regarding contributions, expertise are often more important than cash. It was also later asked whether it is currently easier to have project partners as sub-contractors as the commitments on letters of support are above and beyond everyday work. In response to this, it was highlighted that co-funding calls with Innovate UK have attempted to create an equal playing field here, however this does not happen frequently.

How can academics determine the challenges that industry face? Are academics misplacing their time when there is no opportunity for open dialogue?

The need for academics to understand whether they can satisfy the needs of industry was central to discussions. This again emphasised the importance of building relationships, particularly due to the unexpected opportunities that they can provide. In terms of methods of highlighting challenges to industry, it was specifically discussed that most companies interested in research publish annual reports which typically outline what they are aiming for and what they want to develop. A combination of annual reports and building relationships with industry should enable an understanding of the challenges that industry faces and what academia could do to help.

Will Transforming Construction become static due to the fact that the economics of the industry do not favour innovation? Large scale infrastructure procurement processes often promote the cheap and dirty. Is there a parallel track for making government think about how they procure in the construction sector?

The need for a continuous learning approach was highlighted here and specifically that learning and continuous improvement should become the focus of the industry. It was acknowledged that the drivers and potential to innovate are not currently present but that the current focus on life cycle costing is promising. It was also discussed that traditionally manufacturing has been considered as product led and construction considered project based, and that there appears to be change coming in terms of this tradition.

There is a perception that EPSRC are a catalyst, not an investor. What could EPSRC do to help change current culture as the industry is considered backwards with regards to R&D?

Central to discussions was the potential opportunity for R&D tax rebates to positively influence industry. A slight amendment to the current system so that rebates are only received where there is evidence of promoting innovation could have a profound impact. It was also highlighted that a Catapult in infrastructure could be valuable, particularly in terms of promoting engagement between

academia and industry.

Are there difficulties around industry/academia being able to monetise aspects which are difficult to protect (in terms of IP)?

The general consensus was that from experience, large companies within the construction industry have a lack of interest in IP. This was attributed to the construction industry instead having a focus on capability. However, it was discussed that the core innovation hub is trying to develop IP and demonstrate that there is value which industry can benefit from. More generally, the importance in having discussions around what companies want to do and where they want to go was highlighted.

There is concern around a potential talent pool of early career researchers and people in industry being burdened with other tasks. How could this talent pool be unlocked so that they can contribute to innovation in the industry and work independently?

It was highlighted that several companies run programmes consisting of ‘future leaders’ who are encouraged to work independently. There is also opportunity for consultants to encourage creative work from engineers as consultants are well aligned with client needs. It was acknowledged that this opportunity is not always present for engineers working for main contractors.

Does a forum exist for R&D directors to gain more power and re-structure how R&D is done?

Previous forums have operated including the National Platform of Construction Researchers and the Modern Built Environment Knowledge Transfer Network. A criticism of previous forums was that each forum could potentially be a regeneration of a previous forum, resulting in the same people mixing. This was considered potentially negative as challenges begin to be ‘massaged’ rather than solutions sought.

How long constructions will last for presents a challenge and innovation in the types of materials used can be difficult as they may not be as resilient and durable as current materials. Is there potential to reduce the amount of reinforced concrete in constructions?

Bespoke designing presents an opportunity to reduce the amount of structural steel and concrete in structures. This is something that can be considered difficult as there is currently uncertainty around the lifetime requirement of infrastructure, such as bridges, due to aspects such as changing climate. It was however noted that ISCF research is particularly focused on materials research. On a different note, there has been a clear shift within the industry as there is now more focus on the construction process due to acknowledgment of the amount of waste construction produces.

Should more thought go into the design of structures?

The focus on platform based approaches has meant that it is more important to spend time designing. There is an opportunity for timber to be better utilised as there are profound benefits in terms of sustainability. There is also confidence around the lifecycle of timber structures.

[The Big Pitch Scheme Analysis](#)

In 2015 a call was launched within the Ground, Structural and Water engineering named [Bright IDEAS Awards: The Big Pitch Call](#). This was to address the 2009 EPSRC Review of UK Academic Research in Ground and Structural Engineering recommendations, specifically recommendation 14; *EPSRC should look to encourage greater creativity and ambition in ground and structural engineering research*. The Call document specified that the Big Pitch scheme was being employed in this instance to stimulate and encourage individuals to express their creativity and develop transformative research, with a high degree of risk. To do this the Big Pitch scheme type utilises unconventional

features to achieve specific aims:

- Single investigator only. One application per investigator.
- No industrial collaborators and/or Letters of Support allowed.
- Staff, equipment, consumables and travel allowed.
- £250K budget.
- Short in duration.
- Non-standard, two stage format: 1st round applicants are anonymous, EOI sift panel. 2nd round interview panel, 15 min pitch + 30 min Q&A
- Aims to support pioneering, creative, potentially transformative research.

During the workshop attendees were asked to analyse this call and the type of scheme utilised, and the raw outputs from the three groups at the workshop can be found in Appendix 3.

The consensus from the session was that the Big Pitch Scheme is excellent and should be utilised again as a funding mechanism. Reasons for this included that it encouraged truly blue skies, speculative research ideas that would be difficult to fund via standard mode peer-review, due to risk aversion of current processes. It was also thought that the scheme enables PI's to move into a different field of research, and to foster new collaborations.

To summarise the workshop session, aspects that were commented on as being particularly good were:

- 2 page EOI stage
- The EOI is Anonymous
- No project partners
- Accessible to any career stage
- Efficiency of review process
- Funding amount is limited

Some aspects of the Big Pitch Call were seen as limiting which could be potentially changed to improve the scheme:

- No follow-up funding to date
- No joined up approach – could have launch event to kick start projects
- No ability to have Co-Is from a complementary research area
- Not used as a funding mechanism often enough by EPSRC

During the workshop EPSRC posed a question to the attendees regarding a restrained budget scenario; if there was only budget for either a new Big Pitch Call, or a mechanism for follow up funding, what would be the preferred investment – another call or follow-on funding? The attendees came to a consensus that a new call should be prioritised, and that follow up funding could be sought by PIs via standard mode, but that EPSRC could, if appropriate, highlight to the panel/reviewers that the research followed on from a Big Pitch award.

[Adapting to the Changing Landscape: SWOT Portfolio Analysis](#)

This session focused on the future of research in the Ground, Structural, and Water portfolios in the context of a changing research landscape. The outputs are specific to each of the portfolios, as specified in the heading on each output sheet (see Appendix 4 for raw outputs), however particular congruence was apparent across the research areas:

- That non-specialists perception of research area could be improved upon and is currently a weakness.
- More clarity over UKRI remits would be helpful for researchers.
- The UK has a high quality research base to nurture and utilise, and this is a strength.
- There are vast opportunities in tackling the challenges of the UK aging infrastructure.

Conclusions and Next Steps

The workshop achieved its overall objectives by:

- I. Engaging with a cross-section of the community to gain their perspective on past portfolio research investments and reflection on progress towards the recommendations from the 2009 EPSRC Review of UK Academic Research in Ground and Structural Engineering, which is helpful in clarifying future portfolio management needs.
- II. The Big Pitch scheme attributes were analysed and the success of the 2015 Bright IDEAS Awards call celebrated. Outputs from this session will be useful in the planning of future calls.
- III. The workshop stimulated a wide range of discussions including a panel discussion focused on working with industry and the 2018 ISCF UKRI Transforming Construction Challenge investment thereby informing the community of recent events, and making progress towards the 2009 Review recommendation 8 (*EPSRC should encourage industry to strengthen its involvement with academic research beyond a culture based on letters of support and attendance at steering group meetings*).
- IV. Attendees were given the opportunity to network, discuss ideas for new projects, and were encouraged to advertise the skills they require in a potential collaborator.
- V. The SWOT Portfolio Analysis session was of use for horizon scanning of the future research landscape, and outputs will feed into balancing capability.

Next steps to take workshop outputs forward constructively:

- I. Discussions at the workshop proved useful for researchers and have initiated some ideas for research projects. EPSRC would be happy to open discussions with researchers for how we might support development of these or other ideas for new and emerging areas.
- II. This report will be shared with the EPSRC Engineering Strategic Advisory Team to determine any further action or interventions to be considered by EPSRC.
- III. The report will be published on our website to ensure full dissemination to the whole of the community.
- IV. The report outputs will be utilised to inform Balancing Capability (particularly for the ground,

structural and water engineering research areas), and the formulation of potential Calls utilising the Big Pitch scheme.

Appendixes

Appendix 1. Portraits of attendees generated during the Icebreaker session at the workshop (see Appendix 2 for table with identification key).



Appendix 2. Desirable skills of potential collaborators outlined by workshop attendees.

Name	Affiliation	Desirable skills of potential collaborator wanted	Portrait referen
Al-Tabbaa, A	University of Cambridge	<ul style="list-style-type: none"> AI applied to infrastructure materials. Academics at the interface between science and engineering. 	A,2
Broyd, T	University College London	<ul style="list-style-type: none"> Digital transformation. Infrastructure resilience. Holistic sustainability assessment. Working with ICE. 	C,3
Giaralis, A			A,1
Jefferson, T	Cardiff University	<ul style="list-style-type: none"> Applied mathematician that speaks engineering. Fluid power. 	D,2
Lawrence, A	Head of Engineering EPSRC		D,4
Lorenzo, R	University College London		A,4
Lunn, R	University of Strathclyde		C,1
Neumann, A	Newcastle University	<ul style="list-style-type: none"> Pilot scale/ full scale modelling. Scale up. Membrane design. High resolution compound analysis. Speciation analytical capability for metals/metalloids. 	C,4
Overend, M	University of Cambridge	<ul style="list-style-type: none"> Embodied energy for whole-life assessment. Human/occupancy physiology/psychology. 	N/A
Pavic, A	University of Exeter	<ul style="list-style-type: none"> Vibration. Lightweight sustainable materials. 	D,1
Pearce, C	University of Glasgow	<ul style="list-style-type: none"> Smart technology. Material performance. 	A,3
Pelecanos, L	University of Bath	<ul style="list-style-type: none"> Infrastructure resilience. Life cycle analysis/economics. Social impact/public acceptance. 	C,2
Ramage, M	University of Cambridge	<ul style="list-style-type: none"> Timber Towers. 	B,3
Rossetto, T	University College London	<ul style="list-style-type: none"> Infrastructure resilience. Infrastructure in extreme environments. Interdependence in lifetimes and infrastructure. 	B,2
Savic, D	CEO, KWR Watercycle Research Institute		B,1
Tizaoui, C	Swansea University	<ul style="list-style-type: none"> Water treatment process (materials, process). Advanced oxidation processes, separation technologies, catalysis, process upscaling 	B,4

Big Pitch experiences and model

What has its support enabled? How has it provided benefit?

- New collaborations
- Adventurous research
- Proof of concept leads to industry engagement
- An attractive, pragmatic, efficient process so easier to engage academics

What are the pros and cons of the Big Pitch key features?

- Open minded approach
- Diffused funding (more grants available)
- Proof of concept
- No requirement for partners
- More time to build relationships
- 2 pages a positive (concise)
- In general more efficient
- Potential to replace internal university research funding
- 2 years needed to recruit post doc... but keep low
- Efficiency of review process very good

How may the Big Pitch approach be enhanced or

- Broaden engagement
- 2 years potentially too short – need for follow up funding opportunities (not responsive mode)
- Networking event at beginning or throughout (E.G YR 1). This could negatively impact innovation however. Could be focused on MGMT rather than technical aspects
- Need for more big pitch style funding in general

Big Pitch experiences and model

What has its support enabled? How has it provided benefit?

- Allowed research maybe not fundable through standard mode
- Moving to a different field. Freedom to innovate
- Credibility to go for larger things later
- Research hypothesis emerged as the project progressed
- Do 'weird' things

What are the pros and cons of the Big Pitch key features?

- Long enough to get into detail + anonymous – EOI for responsive mode?
- Relaxed nature stimulated new ideas
- Secured, catalysed follow – on funding – resulted in more projects
- PI – only one – gives indifference
- Not too regular
- Accessible to any career stage

How may the Big Pitch approach be enhanced or improved?

- No overall changes needed – maybe more of them, more often
- Long term structure. Provide follow – on funding, other funders? Innovate UK?
- Run alongside responsive mode. Encourage B.P to result in larger standard move
- Two kinds of responsive mode. High risk – small, exploratory. Normal – larger, long-term
- Adding co-I's - explore across boundaries, transformation. (MAX 1) if added value, completely different area.

Big Pitch experiences and model

What has its support enabled? How has it provided benefit?

- What about views of unfunded people – were there good ones not funded?
- Responsive mode – ideas + objectives can get diluted by project partners; this is truly blue skies
- Not writing level of detail important – if truly speculative. You won't know detail.
- List of projects looks exciting + breath of fresh air.
- Could case be supported so that track record assessed separately + reminder anonymised.

What are the pros and cons of the Big Pitch key features?

- Anonymous. Cash committed confidence to go for riskier
- Keep cash limit, but review level
- Blind & cash limited – encouraged everyone to think they had a chance
- Pull-through + impact really good
- Initial two pages – flexible format is good.
- Keep project partners away at first stage
- Different demographic shows this works

How may the Big Pitch approach be enhanced or improved?

- Need enough for 2 year post-doc + consumables + other costs. Perhaps £300K? £350K
- Follow up funding – would EPSRC consider flagging options or ring-fencing budget.
- Give a larger proportion of budget to it
- Follow on – could some of the panel be used?
- Follow on – suggestion through responsive mode, but separate list with panel + reviewers briefed. Theme lead to tension across lists.

The Future of <i>Ground</i> research in a Changing Landscape	
Strengths	Weaknesses
<ul style="list-style-type: none"> • Wide fundamental knowledge, can benefit many different areas • International leaders / leadership – research & users of research • impact 	<ul style="list-style-type: none"> • Concentrated expertise – operating in a closed environment? – explore more ideas/communities • Different priorities – in EPSRC / ESRC (social side in engineering projects) • Traditional branding too narrow – wrong perception • Lack of systems approaches between different infrast, silos (Governance) • “hidden” infrastructure – lack of appreciation
Opportunities	Threats
<ul style="list-style-type: none"> • Uncertainty modelling • Soil structure interaction • Emphasis on infrastructure as an area of research • UKRI value – valley of death • Climate change – change of chemistry materials & physical properties • Unify areas across research councils (water/ground/environment/biology) & social science • Multidisciplinary approach • Increasing amount of public infrastructure • Enhance flexibility – new applications • Identify long-term opportunities that will make us internationally competitive. – place in the future challenges • Increasing resilience of ageing infrast 	<ul style="list-style-type: none"> • Fundamental problems still not covered. • Different cultures across different disciplines / research councils • Loosing ground (whole portfolio) EPSRC postdoc fellowships • UKCRIC – restricting/selective/narrow/creative - forced to join them

The Future of <i>Water</i> research in a Changing Landscape	
Strengths	Weaknesses
<ul style="list-style-type: none"> • It’s everywhere, needed by everyone • Reflectively well-defined industry • Huge high-quality UK research base • Worldwide recognition of high-quality UK research base, people want to collaborate • Fairly good consensus on future needs medium + long term • Good public perception of research – eg. Flooding + contamination • ICT fluid dynamics – aero, health process industries into water 	<ul style="list-style-type: none"> • Conservative industry • Heavily regulated through 5 year asset • Management plans (could be a threat for research) • UK industry heavily owned by non-UK companies • Regulations in UK very different to EU – collaboration difficult • Water not considered as important, seen as public right not valued. Clean + waste water • EPSRC water portfolio small (too small) despite being largest process industry • Victorian infrastructure • Large amounts of research sit between EPSRC + NERC
Opportunities	Threats
<ul style="list-style-type: none"> • Developing world • health • Sustainable desalination. Some dependant a de-sol, eg. Cyprus, Singapore • Drinking water + ground water eg. Natural springs • Hydroelectric power generation • Digitalisation • Outreach education of school children using water • SDGG - water +sanitation. Big global opportunity. Many others also relevant • Increasing population size • Climate change – emissions/circular economy • Smart cities – sets forgotten, also implementing ect. • UK has limited innovation in water (reference Cave report) • Nature based solutions, greening cities • Water – energy – food – health nexus • New regulations (emerging contaminants, disinfection by-products) 	<ul style="list-style-type: none"> • Very mature sector • Short termism water industry subcontracting research now + not considering university route • BREXIT – funding sources replicating EU funding (large) – a real challenge. • Impact a regulation – impact research • Supply of skilled people, progression from early career to professors. • Return of water to public ownership (but could be seen as opportunity) • Investment in research and development is low for the sector generally

The Future of your *Structural* research in a Changing Landscape

Strengths	Weaknesses
<ul style="list-style-type: none"> • A strong structural ENG community in the UK • Criticality of structural ENG to society • Computational moving away from civil • More applications • Structural failure more visible • Knowledge transfer to other disciplines – valuable skillset • Scoss (?) near miss mechanism – could this feed in? 	<ul style="list-style-type: none"> • Mismatch between RA size & investment • Research seen as incremental – need for positive publicity (raise awareness) • Are the lack of testing facilities holding things back? Need for access • Disconnect between research communities that have overlap • Considering the discipline in isolation – opportunity to work w/ social scientists
Opportunities	Threats
<ul style="list-style-type: none"> • Aging infrastructure • Research needs triggered through disaster • Identification of challenges • Need better understanding of life cycle costing • Link to IPCE guidelines • Sustainability • Focus on cradle to cradle use (circular economy) • Grounding structural ENG in bigger societal issues – need for multidisciplinary • Need for structural testing facilities in the UK (could UKCRIC help here) – potential for major facility • Opportunity to work with social scientists • Multi-functional structures eg. Store heat & electricity, clean air & harvesting energy • <u>Recycle water, capture & use</u> 	<ul style="list-style-type: none"> • Structural failure – flexibility for innovation threat to life • Labs over seas (also an opportunity, international collaboration) • Structural element not covered under UKCRIC – impact generally on scotish RA's as as not included • Impact of Brexit (will it negatively impact talent pipeline) – British companies being brought out • Design guidelines (ability to influence code) + regulations • Movement to other disciplines that attract more funding.