

Extracted from:**The Intelligent Organisation: Driving Systemic Change with Information**

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UKCRIC: All About the Future

Increasingly, organisations do not respond to the traditional and formal structures of ownership but, unincorporated, emerge as more or less formal collaborations between legally bounded entities. When that happens the bureaucracy of conventional organisation needs to become subordinate to the fluidity of the intelligent organisation. In the case of UKCRIC (The UK Collaboratorium for Research on Infrastructure and Cities), that need is further amplified by the recognition of it as an organisation whose present is only about creating the future.

UKCRIC is an unincorporated organisation that brings together academia, industry, government and end users to improve the nation's infrastructure. It was founded by 14 universities, which represent the UK's academic experts in infrastructure, civil and construction engineering these included the University of Birmingham, University of Bristol, University of Cambridge, University College London, Cranfield University, Imperial College London, University of Leeds, Loughborough University, University of Manchester, Newcastle University, University of Oxford, University of Sheffield and University of Southampton). The vision is to create, operate and coordinate a national and international multidisciplinary research programme that addresses strategic infrastructure needs and the societal benefit arising from research informed innovation.

UKCRIC offers:

- Leadership and support for the development and growth of a coordinated and coherent, world class, UK-based national infrastructure research community;
- Collaboration and engagement with government, local authority and commercial policy makers, investors, citizens and academia. A joint venture that drives innovation and value creation in the exploitation of services provided by national infrastructure;
- Central coordination to drive knowledge transfer, UKCRIC supports a step-change in the nation's approach to infrastructure investment.

The first step has been enhanced capital investment of £276 million in a portfolio of state-of-the-art research and innovation facilities which include:

- a set of interlinked national facilities;
- a network of ‘urban laboratories’;
- a modelling and simulation environment (Figure 6.4);
- a Co-ordination Node (CN).

In the 2015 Autumn budget HM Treasury announced public funding of £138 m to support this investment. This funding was allocated to UKCRIC facilities on a matched funding basis through a suite of research grants awarded by UKRI and EPSRC. Research work commenced through two initial collaborative research grants. UKCRIC is developing a wide range of multidisciplinary research and teaching programmes alongside the convening function hosted by the Co-ordination Node to help create, build and strengthen new and existing collaborative partnerships.

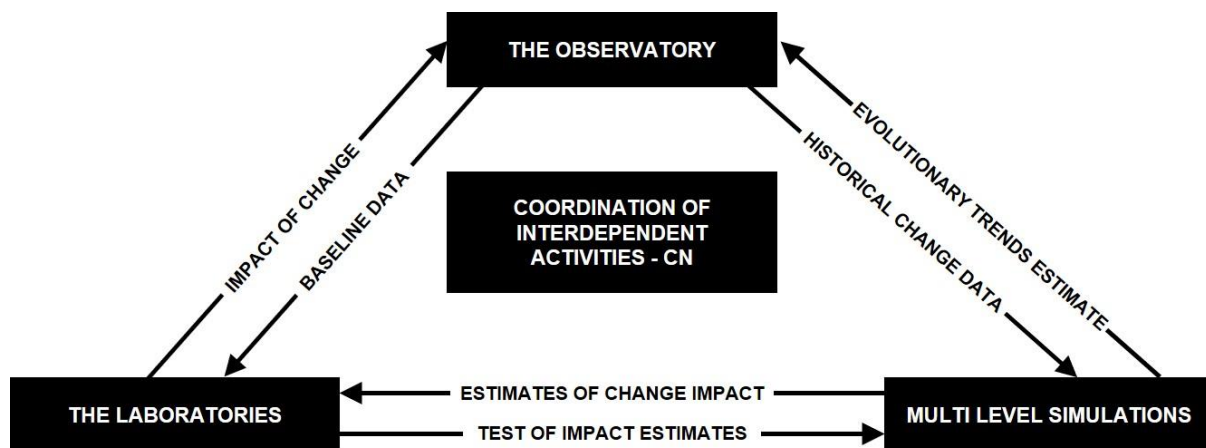


Figure 6.4. Overview of UKCRIC facilities and founding partners

Strategic Need

All societies and economies are enabled by economic infrastructure systems. *The purpose of that economic infrastructure* is to enable the production of the goods and services needed to underpin the normal operations of society and to act as a catalyst for growth by enabling wider economic and social activity. Effective economic infrastructure investment supports a ‘multiplier effect’ in enabling societally beneficial outcomes that simply would not occur in its absence. Given this purpose, economic infrastructure systems are essential to delivering social outcomes such as the quality of life, social cohesion, economic prosperity and productivity, sustainability, resilience and inclusiveness of our societies.

A number of factors combined to make a compelling case for the creation of UKCRIC, these include:

- The Council for Science and Technology (CST) warning that current approaches to infrastructure are allowing systemic resilience to decline:

“we do not believe national infrastructure can continue on its current trajectory... Delivery and governance are highly fragmented and resilience against systemic failure is significantly weakening” (CST, 2009)

- The cost of ownership of the infrastructure in developed countries is unaffordable;
- It is expected that the UK will Invest at least £400bn in economic infrastructure over the next 20 years;
- The value extracted by services using national infrastructure is insufficient and unsustainable.

HM Treasury have acknowledged the importance of infrastructure systems to the UK economy and now advocate a systemic approach to infrastructure, stating:

“Ultimately, it is infrastructure networks and systems as a whole that underpin the effective operation of our modern economy, and infrastructure spend should be valued and considered within this system-wide context.”

Alongside this, the UK Industrial Strategy (BEIS), acknowledges the role of infrastructure systems in supporting industrial strategy priorities (ref). It has outlined four industrial strategy grand challenges and 4 societal missions, and committed to funding investment in research priorities through the Industrial Strategy Challenge Fund (ISCF).

Nations, including the UK, need infrastructure systems that are resilient to the disruptive impacts of future systemic challenges such as climate change, natural hazards, malicious manmade hazards, digital transformation (or system transformation of any form), demographic transitions, aging infra-structure, greater demand on existing capacity, changing patterns of regional population growth, global demand for scarce resources and urbanisation. These are a pre-requisite for wider societal or economic resilience.

Organisation

UKCRIC's purpose, expressed through its missions, is to align infrastructure research with societal needs, where a step-change in the nation's approach to infrastructure thinking is required as a central component of a wider portfolio of actions to support an overarching societal change.

UKCRIC has no legal existence, it is a distributed virtual organisation, an emergent product of the interactions of the representatives of its founding partners and their funding bodies. All physical research facilities belong to the institutions from which it emerges. Taking the idea of UKCRIC to incorporate all of the relevant research activity of the partner institutions then all of the activity that constitutes 'value generation,' that is research activity leading to new discoveries, new science and the evidential output in the form of papers, products and other publications, is undertaken by those partner

institutions and their resident researchers either alone or in other collaborative arrangements. The tasks of UKCRIC itself are to:

- comprehend societal needs and expectations;
- develop a research agenda to address those needs;
- act as a linking device to create the systemic mindset;
- synthesise the outputs of discipline-based research activity to deliver societal outcomes.

UKCRIC must respond to the principles of intelligent organisation or else it will cease to exist. In the absence of intelligent behaviour and processes and the use of shared information it will simply collapse back into the partner institutions. UKCRIC is an enabling device which recognises that the systemic benefits of inter-disciplinary infrastructure research, ultimately embracing both engineering and social sciences, also requires sustained disciplinary expertise at the level of individual researchers. It requires institutions with a common understanding of and commitment to shared mission. The interaction of the partners is facilitated by a 'co-ordination node' physically present (for convenience and low cost) at one of the partner institutions. It is not purposeful in itself but is a pure enabling function supporting two sets of interactions, those of the research leaders and those of the researchers undertaking synthesising activity on behalf of the partners. UKCRIC uses the co-ordination node to creating the 'tight-loose' control of a 'virtual intelligent organisation'. This work of coordinating the research and arranging for the synthesis of outputs is of a logically higher order than the individual research projects, it is of no greater or lesser importance but provides the research architecture from which UKCRIC outcomes can emerge.

UKCRIC has not started from scratch. All founding partners were already active in the field of infrastructure research prior to its emergence and many of the collaborative relationships on which it builds emerged through earlier grants. The Research Grants to support the investment are individually granted to partner institutions. Therefore, it neither owns nor operates the research facilities. Rather it is constituted through a suite of research grants supported by matched funding from UKCRIC founding partner universities. The initial Grants awarded to partner universities were capital grants to create the facilities rather than fund research itself. UKCRIC aims to create open access to all its research facilities for all founding partners and collaborating Communities of Interest.

Value Enabling

The UKCRIC value generating system, requires support from a value enabling system if it is to generate value as effectively as possible. Therefore, it needs a value enabling system that is fit for purpose for a virtual organization comprised of a portfolio of research facilities distributed across the UK, and a convening function which brings

together the partners to discuss and develop the research agenda, engage with advisory boards and disseminate findings.

Developing a dynamic value enabling system capable of this has been, a strategic priority. It recognizes that it needs a value enabling system that is inclusive and in the first instance draw on the skills, knowledge, experience, relationships, strengths and goodwill of all participants at the founding partners.

Additionally, the organisation recognizes the need to continually adapt and update this value enabling system if it is to successfully draw on and be shaped by the skills, knowledge, experience, relationships, strengths and goodwill of all future participants and collaborating communities of interest.

The Value Enabling System for UKCRIC is largely based on the work of the Co-ordination Node (CN) (Figure 6.4). The CN is working to ensure delivery of emergent synergies between research facilities and outputs and that they are appropriately exploited. Through integration of resources and robust mechanisms for cooperation and collaboration UKCRIC will enable all relevant academic and user communities to work together on the challenges of current and future generation infrastructure in complex urban and non-urban environments. The CN is also driving and supporting the overall direction of the co-developed UKCRIC strategy, governed and steered by national and international public and private sector experts and 'future leaders'.

However, the purpose of the CN is to co-ordinate not direct. Therefore, it is recognised that the value enabling system will be insufficient if solely comprised of the CN, and that complementary elements of the valuing enabling system are provided by each UKCRIC facility and research grant as well as a number of advisory bodies which have taken the form of an International Advisory Board (IAB) and a Management Board (MB).

Value Generating

Value generation is primarily undertaken by the various partner institutions. Value Generation at the level of UKCRIC as a whole consists in individual researchers and research groups collaborating to synthesise research outputs into societal outcomes. This means that individuals and research groups at partner universities undertake much of their research in the traditional manner, but they come together to derive additional value from that research by synthesising and integrating research outputs to provide higher order outcomes to society. Such work is undertaken on behalf of UKCRIC as a whole even though the individuals contributing will continue to be employed at their individual institutions. In this instance they are generating value at a meta-level to their own institution, working on behalf of the whole and giving 'ownership' of the outcome to UKCRIC as opposed to that individual partner.

Information

An Information System is needed to facilitate the flow of information between the value enabling and value generating systems and to support UKCRIC engagement and collaborations. The Information system is supported by a number of formal structures such as the Coordination Node, the IAB, the Management Board, as well as a number of electronic tools for communicating information internally and externally, and very significantly by all individuals involved.

The element of the information system supported by UKCRIC individuals is to a large extent organic, spontaneous and informal. It is based internally on relationships between individuals and externally on the established networks of UKCRIC individuals. Informal does not however imply insignificant or unsupported. Because of the scale, and distributed structure of UKCRIC as well as its multidisciplinary, multi-institution focus and the large range of potential partners, the informal information system is an essential complement to the information system as a whole.

Furthermore, the creation of regular opportunities, to enable the interactions required by the informal elements of the information system is a key component of the value enabling system. Opportunities for information flow are enabled through regular meetings of the formal devices and through the convening function which collaboratively hosts workshops, events, and conferences, and seeks to have UKCRIC represented on external groups, at external meetings, workshops and conferences.

Additional elements designed to maximize opportunities for flow through the informal information system include:

- the Co-ordination node being populated by individuals involved with one or more of the research and innovation facilities (Figure 6.4);
- a number of research grants held in collaboration between multiple founding partner;
- the creation of two pump-priming grants to promote collaboration between different labs (PLEXUS) and urban observatories (CORONA);
- an intentional overlap between the individuals named on the suite of UKCRIC grants to ensure it has multiple people engaged simultaneously with either:
 - one or more activity at a single tip of the triangle (Figure 6.4);
 - or multiple tips of the triangle (Figure 6.4);
- UKCRIC CDT (Centre for Doctoral Training) grant applications developed involving multiple founding partners;
- plans for an additional collaborative grant to extend the number of Urban Observatories.

Moreover, the efficacy of this informal element of the information system must be underpinned by a shared sense of identity amongst the UKCRIC community that is nurtured through UKCRICs identity system

Nurturing Identity

For UKCRIC long term and short term success are different concepts. It will have succeeded in the short-term once the initial facilities are constructed. However, for UKCRIC to be a successful organization in the long term it must consistently enable value generation over and above that which could otherwise be enabled if the research facilities were to operate on an independent basis. To do this it must nurture its identity, a critical component for ensuring its long-term success.

This has two significant components, internal identity and the ability to meaningfully use that identity to engage with its environment. UKCRIC as an unincorporated, intelligent, virtual and distributed organization must develop identity through a shared sense of purpose and a collaborative culture. Pragmatically, this must be supported by an evidence base to demonstrate to all involved the benefits to their research, their research facility and their host institution of being an active member.

Engaging with the environment depends on the ability of UKCRIC to project its internal generated identity, purpose and potential value to those outside in order to raise awareness of the advantages of collaboration. Demonstrating the actual benefits of engaging with UKCRIC will help to establish a reputation as an invaluable collaborative partner for all communities of interest involved with infrastructure.

Two complementary tasks have recently been undertaken to stimulate development of a sense of shared identity amongst those already involved with it and how it should project itself.

The first task was to work with independent branding experts to develop a value proposition. The exercise produced a set of succinct statements to describe UKCRIC, its purpose, its proposition, its values and how it would like to be perceived by those not already involved with UKCRIC. The task served a number of purposes in nurturing shared identity between members. Moreover, the statements themselves serve a number of purposes:

- to succinctly communicate UKCRICs purpose and priorities;
- to communicate the values driving UKCRIC;
- to frame the value proposition for collaborating with UKCRIC.

The second task, led by an external convener, drew on the mission-oriented approach advocated by Mazzucato (2018). The objective was to develop a set of succinct clearly stated missions. The process again nurtured shared identity while the missions themselves serve a number of purposes:

- to succinctly communicate UKCRICs purpose and priorities;
- to emphasise that infrastructure systems have a pivotal role to play in addressing societal grand challenges;
- to explicitly link UKCRICs purpose and priorities to the Grand Societal Challenges, Missions and objectives stated by other influential communities of interest;



- to create a basis for future collaborations.

The two exercises were conducted independently. Both sought input from as many connected UKCRIC connected individuals as possible and followed a clear process prompting discussions, that might not have otherwise taken place.

The value enabling success of these activities to create the internal shared identity and purpose will directly shape the success with which UKCRIC projects its identity to all communities of interest (the environment of UKCRIC). It is these Communities of Interest that will shape UKCRIC value generating activities to the achievement of the intended outcomes.