

Looking Through the Lens of Shock: Exploring Opportunities for Learning and Innovation for Adaptable Infrastructure

E. Dewberry, S. Glendinning, V. Castán Broto, C. Walsh and M. Powell
The Open University, UK

The integration of infrastructure offers opportunities to develop more sustainable systems of service provision such as electricity, water, waste and transport using fewer resources. However, these utilities are currently run, managed and regulated in silos. Achieving integrated infrastructure requires thinking about systems of provision as something more than the mere addition of independent systems. Integrated infrastructure needs to be thought of as a “system of systems”. This relational perspective challenges existing organizational and operational arrangements and requires different thinking to enable the development of new operational practices capable of delivering adaptable infrastructure. Adaptability, in this context, is the need to respond to issues of supply such as increasing resource scarcity, and to the challenges of demand such as our expectations of levels of service provision. Thus creating new systems of adaptable infrastructure will present opportunities to learn and innovate for a sustainable future.

The briefing statement for this conference suggests that times of crisis offer opportunities for doing things differently. An EPSRC funded project, *Shock (not) Horror*, uses this concept to explore shocks as key moments to learn about infrastructure and to create the potential for long-term innovation, particularly in response to complex issues such as sustainability. In this context shocks are heavy and potentially fatal disturbances whose consequences transcend the infrastructure system in which they occur. They may be caused by external events such as natural catastrophes and climatic events, radical institutional changes or economic crises.

This paper describes the outputs of two workshops held with a range of representatives from different infrastructures. Participants were tasked with mapping elements of different infrastructure systems (water, energy and transport) across a framework representing a multi-level socio-technological system. The framework comprised different levels of a system: the *niche* level where new interventions and interfaces reside (technological fix, product innovations); the *regime* level structures that guide the processes and responses in the system (market drivers, economic policy, regulation); and the elements of the system *landscape* that constitute the operating context and appear remote and difficult to change (climate change, economic collapse, trends in material consumption). These maps, representing the socio-technical frame for each infrastructure, provided useful insights into current thinking and practice in infrastructure provision. Subsequent activities centred on the relationships between shocks and levels of learning. An allegory of medical trauma was used to understand the potential of different types of learning from accident and emergency staff experiencing different shocks in a different system. A number of attributes of dealing with shocks emerged from the medical case and other narratives from past infrastructure shocks. These included: flows of resources and expertise; mechanisms that are both formal and informal; professionalism; effective teamwork; cross-sector/discipline relationships; understanding relationships between physical ‘stuff’ and people; the limits and opportunities of rules and regulation; and education and knowledge. Shocks provide a transitory window to see integrated infrastructure in action. These different responses to, and learning from shock, begin to illustrate the nature of the processes required to create the integrated infrastructure necessary for the adaptability of systems in the future.