INFRASTRUCTURE GOVERNANCE FOR THE 21ST CENTURY

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Who Should Read This White Paper?

This White Paper should be of interest to policy-makers, decision-makers and practitioners in the planning, delivery and operation of infrastructure in the UK and internationally, and researchers and commentators interested in infrastructure governance. The Paper adopts an inclusive understanding of infrastructure planning, and so is applicable across the whole of the UK despite the increasing divergence between statutory planning processes in the different nations within the UK. This White Paper aims to review some of the key themes in the governance literature and highlight their potential relevance to thinking about infrastructure governance in the twenty-first century.

Key Messages from the White Paper

- The concept of reflexive governance provides a framework, drawing on systems thinking, for thinking about governance processes that engages squarely with questions of problem framing and purpose, competing values and their deliberative alignment, and ongoing processes of external and internal learning during development, delivery and termination of infrastructure systems.

- Application of reflective governance in the context of infrastructure interdependencies opens up question of collaboration at scale and of effective and inclusive institutional design. It keeps broader questions of purpose, value and benefit in play alongside more detailed questions of delivery and financing.

- Drawing insights from the literature on transition management and governance can help us map out a course to establishing and more firmly embedding new approaches to infrastructure.

Abstract

Existing approaches to delivering infrastructure are no longer sufficient to meet contemporary challenges. To be able to gain the best value from infrastructure systems, the understanding of infrastructure delivery needs to continue to evolve. The discussion often focuses on the need for new business models, but this White Paper seeks to examine some of the issues through the lens of governance. It argues that placing the issue of infrastructure futures in dialogue with broader governance debates can assist in ensuring that the infrastructure conversation retains the necessary breadth and depth. Thinking in governance terms is one way of keeping some of the broader questions of purpose, value and benefit in play alongside more detailed questions of delivery and financing.

The principal aim of this White Paper is to review some key themes in the recent governance literature and highlight their potential relevance to thinking about infrastructure governance in the twenty-first century. It notes, in particular, that reflexive governance offers a broad and inclusive framework to which learning processes are central. It also argues that the transition management debate can provide insights regarding effective approaches for moving towards embedding new infrastructure understandings.

Key Words
Governance thinking, reflexive governance, learning, transition management

Connections to Other ICIF White Papers

This paper makes reference to

- WP E: Emerging Approaches and Issues in Regulation and Governance of Infrastructure Based Services
- WP F: Evidence for the Value of a Systems Approach to Infrastructure Planning, Delivery and Operation
- WP I: Learning Journeys and Infrastructure Services: A game changer for effectiveness
- WP N: Understanding the Value of a Service-oriented Approach to Infrastructure Management

Where Can I Find Out More?

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Infrastructure Governance for the 21st Century

1 Introduction

Infrastructure is fundamental to our quality of life. It is the foundation upon which we build vibrant communities. It is a key driver of economic growth and innovation. Infrastructure protects and enhances our natural environment. In economic terms, the existing global stock of infrastructure has an estimated value of about £50 trillion (WEF, 2015, p.10). But much of this stock is aged and in need of renewal. In addition, global trends in population and urbanisation mean that substantial further investment in infrastructure is required. At the same time, we face a series of pressing long-term challenges with profound implications for infrastructure provision, such as those associated with addressing climate change and maintaining competitiveness in a globalised economy.

Infrastructure has therefore come to be seen more clearly as part of national long term investment strategies. Ensuring that the right infrastructure is in place to maintain competitiveness, meet citizens' needs and maximise well-being, while at the same time providing effective environmental stewardship, is a key governance challenge for the twenty first century.

It has been recognised that existing approaches to delivering infrastructure are no longer sufficient to meet the challenge. Governments are interested in exploring alternative instruments for financing and investing in infrastructure. We are also experiencing a period of regulatory reflection and evolution in regulatory practice: the ways in which the UK government seeks to achieve oversight of infrastructure provision and operation adapt as thinking evolves.

To gain the best value from infrastructure, our understanding of infrastructure systems needs to continue to evolve. It can then better serve and engage individuals, communities and businesses, while contributing to effective responses to major societal challenges. While this issue is often discussed in terms of the need for new infrastructure business models, this White Paper seeks to examine some of the issues through the lens of governance. It argues that placing the issue of infrastructure futures in dialogue with broader governance debates can assist in ensuring that the infrastructure conversation retains the necessary breadth and depth. Thinking in governance terms is one way of keeping broader questions of the purpose, value and benefit of infrastructure in play alongside more detailed questions of delivery and financing.

The principal aim of this White Paper is to review some key themes in the recent governance literature and highlight their potential relevance to thinking about infrastructure governance in the twenty-first century. It starts by briefly reviewing the development of governance in UK infrastructure sectors and then draws out some key points from the current strategic infrastructure thinking of the UK government. Section four notes some key contemporary developments in infrastructure delivery. In section five we briefly review the governance literature. We identify some of the prominent ideas from the current literature, and note some of their points of connection with infrastructure development. Section six argues that if we are looking to move towards more innovative, inclusive models of infrastructure delivery then the transition management literature has some insights to offer regarding process. In conclusion we argue that viewing the debate over infrastructure futures through the lens of governance brings a valuable additional dimension to the conversation.

2 Development in the UK Infrastructure Sectors

A long term perspective on the structure of infrastructure governance in the UK indicates that it has gone through several distinct phases. During the nineteenth century infrastructure ownership and investment decisions were highly decentralised. Local councils took lead responsibility for putting in place key infrastructure systems. The growth of other systems – most notably the railways – rested on private initiative and enthusiasms.

National governments subsequently realised the potential of infrastructure sectors and perceived benefits in integration and planning infrastructure provision at scale. Following the Second Word War there was a big shift towards the nationalisation of key infrastructure sectors (Table 1a and Table 1b). The 1980s saw a major reorientation in government approaches to infrastructure development and delivery. Government privatisation programmes transferred state-owned infrastructure assets to the private sector (Hall et al., 2012), while creating regulatory bodies charged with ensuring that public purposes continued to be served. While regulatory regimes differed between sectors they typically included attempts at market liberalisation and manufacturing competition through, for example, unbundling services or challenging prevailing conceptions of natural monopoly. The extent to which competitive markets were achieved post-privatisation differed sharply between sectors. The extent to which competitive private markets are compatible with strategic infrastructure investment is debatable.

Infrastructure governance in the post-privatisation era continues to evolve. Governance structures are subject to a range of influences, including regulatory requirements emanating from supranational tiers of government. It is clear that increasing co-ordination between sectoral regulators is a significant characteristic of the evolution of the contemporary regulatory landscape (see White Paper E). An important question is the extent to which governance

structures that became flatter and more polycentric post-privatisation are able to deliver public goods effectively. Toke and Baker (2015), for example, have recently argued that Electricity Market Reform represents a partial return to hierarchical regulation, because that gives government more leverage in delivering the public goods of energy security and climate change mitigation.

	Decentralised governance (pre-WWII)	Centralised/state control (1940s-1980s)	After privatisation (after 1980s)
Energy	• Dominance of coal • Mix of public and private provision at municipal levels • Unregulated – no regulatory obligation for the network owners	• State ownership and guidance in electricity and gas – the nationalisation of electricity in 1947, gas in 1948 (discovery of natural gas in the North Sea in the late 1960s) • State control on investment strategies • Shift towards alternative sources of energy after the global oil crises of 1973 and 1979	• All the sectors passed to private ownership (in most cases became parts of foreign controlled corporations • Offer (electricity regulator) and Ofgas (gas regulator) merged as Ofgem in 1999 as one unit • Reliance on the previous investments – 'sweat the assets' of the network companies
Water	• Low profile of water in comparison to energy and transport • Little involvement of higher government levels • Varied mixes of public and private control	• Increased national and regional attention (Water Act of 1963, the establishment of 10 Regional Water Authorities -RWAs- in 1974, Central Water Planning Unit, National Water Council) due to the growing economic importance of water • 'Supply-fix' mentality to meet the rising water supply for British industries and households through new water schemes	• 100% asset ownership was given to 10 private regional monopolies –previously known as the unitary RWAs (except Scotland and Northern Ireland) following the 1987 election • Creation of three regulators: Drinking Water Inspectorate, National Rivers Authority – currently known as the Environmental Agency, and OFWAT
Transport	• Little government involvement • Amalgamation of parishes into highway districts • Local government was reorganised to create a unified system in 1888	• State controlled – setting up the British Transport Commission in 1947, proposed Town and Country Planning Act 1947 for the first time • Redistributive 'one-nation' policy to overcome regional inequalities in the use of a north-south divide narrative • Major investments in rail and road infrastructure	• Privatisation of rail, buses, ports and airports (not roads) accompanied by environmental and consumer regulators as well as the Civic Aviation Authority in 1971 • Emergence of strategic integration across various modes of transportation • Market-led competitiveness agenda to improve the economic performance of city regions

Table 1a: Government approaches of the key infrastructure sectors in the UK until the 21st century (adopted after Marshall, 2010; Hall et al., 2012; and other sources)

	Decentralised governance (pre-WWII)	Centralised/state control (1940s-1980s)	After privatisation (after 1980s)
ICT	• Decentralised municipal level in the mid-1880s • Nationalisation of telephone under the control of Post Office in 1912	• Continued to operate as a Government department under the Postmaster General until 1969 when the Post Office became a public corporation • Became responsible to the Secretary of State and Industry	• British Telecom was sold under the 1984 Telecommunication Act • Ofcom as the independent regulator for the UK communications industries, with responsibilities across telecommunications, wireless communications services, television and radio
Waste	• Decentralised in the 18th century • Landfills were the preferred options to get rid of waste	• Still delivered locally • Increased awareness of the toxic mix and hazard of the nature of the waste after post-war industrial development	• Change in the policy and institutional context (the publication of the UK waste strategy by DoE in 1995, and then by DETR in 2000) • Hugely driven by EU Directives (move towards reduced landfill, recycling, composting, recovery) • Combination of public-private partnership

Table 1b: Government approaches of the key infrastructure sectors in the UK until the 21st century (adopted after Marshall, 2010; Hall et al., 2012; and other sources)

3 Recent Policies on the UK Infrastructure

In recognition that UK infrastructure requires substantial new investment and that there are benefits in greater co-ordination, the Government has sought to adopt a more strategic approach to infrastructure planning and delivery.

Since 2010, the UK Government has for the first time brought together the key economic infrastructure sectors – transport, energy, flood defences, water, waste, communications and science – in its annual National Infrastructure Plans (NIPs), The UK NIPs move beyond thinking in sectors and silos. The aim is to ensure that the Government's approach in individual sectors is transparent and coordinated. NIPs provide a single point of reference for potential investors and the supply chain: they set out how the infrastructure needs of the economy are expected to be met (NIP, 2014, p. 18). Alongside the NIPs, the new national planning policy framework - which consists of National Planning Policy, Nationally Significant Infrastructure Projects, Local Plans and Neighbourhood Plans (Box 1) - has been influential in shaping the contemporary development of UK infrastructure.

The Government has promoted a range of private and public ownership models to fund national infrastructure. In addition to existing models, new financial schemes have been created. These included the UK Guarantees Scheme, the Green Investment Bank, the Insurers' Infrastructure Investment Forum, the Pensions Infrastructure Platform, and drawing on the European Investment Bank. Such models involve new stakeholders in infrastructure provision, or involve established stakeholders in new ways. In 2011, two major models for engaging private finance were examined as part of the NIP: the Regulated Asset Base (RAB) model and concessions such as toll roads. While the RAB model mainly applied in the water, energy transmission and distribution, rail and aviation sectors, the Government has considered the extension of the RAB

model to sectors with an established asset base and reliance on constrained public financing. Sectors such as the strategic roads network and flood defences both meet these criteria. The Government also attempted to explore the use of concession models, which attempted to provide a similar degree of long term commitment to investors as the RAB model, for new infrastructure. For instance, the Government successfully completed the sale of the concession to run the High Speed 1 line. These models require the introduction of new sources of revenue to support investment, such as tolling or user charges (NIP, 2011, p. 101).

In the NIP 2011, the UK Government carried out a small number of pilot projects examining existing infrastructure projects to capture additional value through the appropriate management of interdependencies and to share any early lessons learnt with project teams. In June 2012, the UK Government initiated a research programme led by the University of Bristol and University College London to develop an Interdependency Planning and Management Framework that would be compatible with HM Treasury's Green Book processes to ensure that interdependencies in infrastructure projects can be properly identified, valued and taken advantage of at the very inception of major infrastructure investments. Moreover, in the NIP 2012, the Government published full details of a new approach to public private partnerships: PF2. Under the new approach the private sector would continue to be responsible for designing, building, financing and maintaining an infrastructure asset over a defined period, typically between 20-30 years (PF2, 2012, p. 27). The private sector's importance as a funding resource for the development of UK's planning policy framework is further emphasized.

Box 1: Planning Policy Framework in the UK

National Planning Policy
In March 2012, the UK Government published the National Planning Policy Framework. This provides a balanced set of national planning policies for England covering the economic, social and environmental aspects of development. The policies in it must be taken into account in preparing Local Plans and neighbourhood plans and it is a 'material consideration' in deciding planning applications. However, it does not dictate how Local and neighbourhood plans should be written or planning outcomes but is rather a framework for producing distinctive Local and neighbourhood plans and development orders which meet local needs.

Nationally Significant Infrastructure Projects
There is a separate planning policy framework and legislation for nationally significant infrastructure projects such as power stations and major transport schemes. The process aims to streamline the decision-taking process for these major and complex schemes, making it fairer and faster for communities and applicants alike. The Planning Inspectorate is responsible for the administration of applications for nationally significant infrastructure projects on behalf of the Secretary of State.

Local Plans
Local Plans are the key documents through which local planning authorities can set out a vision and framework for the future development of the area, engaging with their communities in doing so. Local Plans address needs and opportunities in relation to housing, the local economy, community facilities and infrastructure. The Local Plan provides a degree of certainty for communities, businesses and investors, and a framework for guiding decisions on individual planning applications. The Local Plan is examined by an independent inspector whose role is to assess whether the plan has been prepared in line with the relevant legal requirements.

Neighbourhood Planning
Neighbourhood planning is a new right for communities and gives them direct power to develop a shared vision for their neighbourhood and shape the development and growth of their local area. For the first time communities can prepare plans with real legal weight and can grant planning permission for the development they wish to see through a 'neighbourhood development order'. All neighbourhood plans and orders are subject to an independent examination and a vote by the local community in a referendum.

Source: Department for Communities and Local Government, 2015

In NIP 2013, the Government brought together analysis of the UK's infrastructure needs across different sectors. The plan articulated the Government's approach, sector by sector, and set out new ways in which the government can drive the delivery of the Top 40 investments (NIP 2013, p.8). In the most recent NIP (2014), the government provided details of specific publicly-funded capital projects and programmes being taken forward as a result of the commitments made at Spending Round 2013. NIP 2014 also set out a detailed, cross-cutting approach to infrastructure finance and delivery. In addition, the document started to address some of the

longer-term challenges that UK infrastructure would have to address in the 2020s and beyond (NIP, 2014, p.18).

4 Emerging Themes in Infrastructure

Alongside the increased recognition of the importance of infrastructure and the greater emphasis upon co-ordination we are also witnessing the emergence of new ways of conceptualising infrastructure and new funding and financing practices. The most prominent change regarding the conceptualisation of infrastructure is the move towards thinking of infrastructure as a service rather than a capital asset (see White Papers E and N). With respect to practices, Pike and O'Brien (2015) identify 11 dimensions across which emerging approaches can differ from traditional approaches in governance terms. These dimensions are: rationale, focus, timescale, geography, scale, lead, organisation, funding, process, governance, and management and delivery. In this context, it can be argued that infrastructure investment requires attention to more than hard measures such as contracts and financial instruments.

Pike and O'Brien argue that traditional approaches focus on economic efficiency, market failure and regeneration as the main stimuli behind infrastructure provision. On the other hand, the main triggers behind emerging approaches are unlocking economic potential and capturing value. Individual infrastructure items such as roads, bridges, rail lines are the main preoccupations under traditional approaches to governing infrastructure. Emerging approaches speak to infrastructure systems, interdependencies and the systems thinking (see White Paper F). In comparison to traditional approaches, emerging understandings of infrastructure funding and financing have longer timescales and target larger scales. Projects operate over larger geographical areas so multiple local authorities, city-regions or local area partnerships are involved as administrators. Moreover, the private sector, including international companies and

consortia, is more interested in leading infrastructure projects at scale. Since the size and the scale are larger, emerging approaches tend to be managed as packages of projects.

Funding mechanisms are increasingly investment-led. Borrowing, revenue streams, leasing, value capture, and leveraging existing assets are major parts of the emerging approaches, as opposed to grant-based mechanisms of taxes, fees and levies. While traditional approaches have systematic, formula driven processes, emerging approaches are based on negotiation and are open to competition.

In terms of governance, infrastructure projects operating at increased scale are likely to involve a wider variety of stakeholders from the public and private sectors. Compared with traditional approaches, which may have been overseen by a single public body or arms-length agency, emerging approaches are more likely to be managed and delivered through joint ventures or special purpose vehicles.

In addition to the involvement of the public and private sectors there is an increased expectation or requirement that a range of civil society stakeholders are involved in the development and ongoing delivery of infrastructure. While this type of involvement has been well-established regarding certain policy areas and types of infrastructure – for example, Integrated Water Resource Management – the broader move to thinking about infrastructure in service terms opens up greater scope for deliberation over service aspirations, goals and standards.

Box 2: Examples of Multi-stakeholder Dialogue Beyond Specific Projects

The Hydropower Sustainability Assessment Protocol
The Protocol was launched in 2011, followed discussions between the hydropower industry, banks, governments, academia and non-governmental organizations on sustainable ways of delivering hydrodam projects. Governed by a multistakeholder council, it provides a tool for reviewing and benchmarking projects with respect to their environmental, social, technical and financial implications. As of late 2014, more than 15 assessments had been conducted across five continents, and the EU has decided to adopt the protocol to assess European hydropower projects.

The World Economic Forum's Business Working Group
This Group's work on African infrastructure brings together private companies, multilateral development banks, NGOs and regional experts to promote developing the region's infrastructure. The initiative's focus is on creating a replicable acceleration process that meets the needs and constraints of both public and private stakeholders. In 2013, the group devised a methodology for selecting projects for acceleration. A pilot programme was selected – namely, the Central Corridor,118 which comprises 121 individual projects. In subsequent dialogue sessions, the group identified 18 of the projects for presentation at an investor forum in March 2015.

(World Economic Forum, 2015, p.37)

It has been suggested that in this context there is a need for a multi-stakeholder dialogue where new practices, instruments and governance arrangements can be constructed (Box 2). The variety of emerging infrastructure mechanisms and the examples of multi-stakeholder dialogue indicate that the development and delivery of infrastructure can increasingly be characterised by greater complexity, uncertainty, risk and diversity. We need to think carefully about how we can involve different stakeholders in complex situations such the development and implementation of infrastructure. To do so effectively will require changes in the relationship between government, industry and citizens. In the next section, we will examine how insights from governance studies can help us develop our understanding of infrastructure governance in the twenty-first century.

5 Approaching governance

The term 'governance' is used in multiple ways – with more or less precision - to refer to a range of different social phenomena. There are several strands of governance thinking in the social sciences. The two most prominent are associated with economics and political science.

The economics strand encompasses the narrow issue of models of corporate governance and the broader question of how markets or hierarchies, hybrid or network forms of organisation can be used to govern transactions. The relevant new institutional economics literature comprises a number of separate but interrelated theoretical frameworks. Corporate governance has drawn the attention of principal-agent theory and the property rights school, while the broader question of the "mechanisms of governance" is the focus of the comparative institutional analysis of the transaction cost economics approach initiated by Oliver Williamson.

The governance strand of the political science literature was instigated by the claim that we have witnessed a move from "government" to "governance". That is, there has been a reconfiguration of the role of state and non-state actors in the regulation of society. The early literature referred to the hollowing out of the state and debated the rise of the regulatory state, where markets-plus-regulation substituted for public provision. It has been claimed that the output of governance structures is not different from the output of government, i.e. both aim to maintain public order and facilitate collective action. But governance is seen as representing a decentring of the state and a move away from hierarchy: its outputs are the result of the interaction of many different actors.

The relationships between these actors can take a variety of forms: it could be about partnerships, contracting, franchising and new forms of regulation. It can also take the form of formal or informal networks, in which the state is only one among several actors. The governance debate has many dimensions and the concept itself is subject to competing definitions. There are significant differences in the extent to which the state is seen as having the capacity to act to orchestrate a move towards governance and to engage in 'metagovernance' ie. shaping networks and governance structures (eg. Kooiman, 2003, cf

Jessep, 2002). Some authors see the state as one actor among many, which does not occupy a position of especial strategic significance. Others see relationships between actors and sectors as rather more asymmetric.

Box 3: Five Governance Propositions

Governance refers to a set of institutions and actors that are drawn from but also beyond government: Governance challenges conventional assumptions which focus on government as a stand-alone institution divorced from wider societal forces. It draws attention to the increased involvement of the private and voluntary sectors in service delivery and strategic decision making. This brings with it increased complexity.

Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues: Governance can signal disruption and a change in the longstanding balance between the state and civil society. It is connected to the concern about social capital and the societal underpinnings or 'social economy' that has emerged between the market economy and the public sector.

Governance identifies the power dependence involved in the relationships between institutions involved in collective action: From a governance perspective the process of governing is always interactive because no single actor has the knowledge and resource capacity to tackle problems unilaterally. It can involve various forms of formal or informal partnership.

Governance is about autonomous self-governing network of actors: The formation of self-governing networks relating to policy communities or interest groups represents the ultimate partnership activity. "Actors and institutions gain a capacity to act by blending their resources, skills and purposes into a long-term coalition: a regime".

Governance recognizes the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide: Governance involves thinking and acting beyond the individual sub-systems, avoiding unwanted side effects and establishing mechanisms for effective coordination. New tools can involve new forms of participation and consultation to identify desired outcomes. But equally governance can be about recognising the implications of complexity for steering social systems towards delivering successful outcomes.

(Stoker, 1998, p.18)

The breadth of the governance debate is well illustrated by the contributions brought together in two major handbooks (Bevir, 2011; Levi-Faur, 2012). Here we simply summarize some of the key issues by drawing on Gerry Stoker's five governance propositions, which are presented in Box 3.

With the reformation of state structures and the increasing influence of the private sector, arguments about the move to governance have started to resonate in the infrastructure sector.

Control and ownership of infrastructure have become more fragmented. We have witnessed processes of innovation in managing and regulating infrastructure. As our conceptualisations of infrastructure and its nature evolve so we need to reflect on its governance.

The governance literature offers a range of concepts with which to interpret changing social arrangements. Some of this governance debate has yet to impinge significantly upon thinking about infrastructure. Some of the concepts are familiar in debates about developments in particular infrastructure sectors but not in relation to infrastructure more broadly.

In this section we want to consider four key governance concepts: network governance, collaborative governance, multipolar governance and reflexive governance. We also note the importance of issues of scale and power and the role of institutions and intermediaries. At the core of the governance discussion is a reorientation in thinking: to what extent should we understand policy, value and service outcomes to be coproduced by the interaction of the various stakeholders, rather than being driven from a single authoritative source.

The key point is not that explicitly deploying governance concepts necessarily takes the debate in new directions, but that governance provides a framing of the debate that can help maintain the breadth and coherence of the discussion.

The idea of network governance refers to the coordination of interdependent actors from public, private and non-governmental organisations for the purpose of developing public policy. The concept has been referenced widely. It is argued that networks can draw on diverse perspectives and knowledge to deal better with complexities and uncertainties. Sorensen and Torfing (2009, 236) offer the following generic definition of a governance network:

> A stable articulation of mutually dependent, but operationally autonomous actors from state, market and civil society, who interact through conflict-ridden negotiations that

> take place within an institutionalized framework of rules, norms, shared knowledge and social imaginaries; facilitate self-regulated policy making in the shadow of hierarchy; and contribute to the production of 'public value' in a broad sense of problem definitions, visions, ideas, plans and concrete regulations that are deemed relevant to broad sections of the population.

Central to the discussion of network governance is the role and scope of network management, alongside questions of how governance networks relate to core issues of representation and democracy (Sorensen and Torfing, 2009; Torfing et al, 2009).

This definition highlights the notion that 'public value' is produced during the governance process. This is a move away from the idea that value should be understood on the basis of financial appraisal or purely in market failure terms: that value can be 'read off' the aggregation of individual preferences in the presence of externalities and public goods, uncertainty and information asymmetries. Rather it advocates the recognition of a range of - mutable - individual interests and implies a continuous process of learning through interaction, which is flexible and shaped according to problems and issues raised by the actors involved (see also Brousseau and Glachant, 2010).

By putting more emphasis on the broader public interest, governance debates call attention to a series of issues: efficiency, accountability, responsiveness to public needs and gaining trust (Cosgrave et al., 2014). This is a marked change from making a decision based on economic appraisal, which can struggle to account adequately for the intangible benefits of infrastructure and the potential innovation that investment can unleash. The governance literature gives some indications of how we can engage with infrastructure in alternative and more pluralist ways.

In the context of infrastructure, Hendriks (2008) explores the concept of network governance from the perspective of inclusion in the Dutch energy infrastructure. He argues for more

proactive interventions to ensure legitimacy and accountability, even if some of the democratic aspirations of network governance are difficult to realise in practise. Maggetti (2014) and Nissen (2014) refer to network governance by using examples from energy and water infrastructure. They call for more accessible and accountable strategies for broader democratic engagement.

Overall, the concept of network governance tends to encourage thinking in terms of horizontal relations. Analyses drawing on the concept frequently start from a pluralist model of the state where power is fragmented and dependent on competition amongst interest groups. Empirical work concludes by recognising the challenges in realizing this model: the 'shadow of hierarchy', and of structural inequalities in resources, looms large.

This is a characteristic shared with the concept of collaborative governance (Ansell and Gash, 2008). Collaborative governance means bringing together public and private stakeholders in collective forums with public agencies to engage in consensus-oriented decision making. The term has been applied in a range of literatures, and has been deployed effectively in analysing the development of water infrastructure. Tan et al. (2012) explore collaborative water planning in Australia and they propose a management framework which calls for a more integrated and adaptive approach to environmental water management. Naustdalslid (2015) gives an example from Norway and illustrates the success of multi-level water governance on the basis of openness of practices and active involvement of key actors. Conrad (2015) explores collaboration at a watershed scale in California and the role of managers in bridging collaborative and hierarchical modes to support learning. She argues that stakeholder interaction and collaboration create cross-scale linkages. She highlights, in particular, the positive effect that designating a lead agency can have in facilitating collaborative governance.

This points to the way in which hybrid governance structures can better support the management of multi-layered environmental problems. Conrad's conclusion regarding lead agencies is one instance of a broader point about the pivotal role of intermediaries in governing and shaping infrastructure networks (eg. Guy et al, 2011), particularly in contexts where governance requires an ongoing process of reconciling competing priorities originating in different sectors at different spatial scales. The issue of scale – and scalability - is at the centre of current debates over the possibilities and potential of collaborative governance (Ansell, 2015).

Multipolar governance is a characterisation of an increasing segmentation of horizontal layers and groups of actors that are positioned between supranational, international, national and subnational layers of authority, i.e. multilevel governance. Ponte (2014) uses the notion of multipolarity to talk about the explicit strategic actions of powerful actors such as developers, international NGOs, social movements, labour unions, certification agencies and consumer associations. In his example, he explores the infrastructure needed to support the production, distribution and consumption of a global biofuel value chain. He argues that all those actors should be examined as possible governing actors as a part of global value chains. Similarly, Kuzemko and Bradshaw (2013) use this framework in the context of British energy infrastructure and argue that multipolarity not only signifies shifting economic positions but also the emergence of a wider variety of capitalisms. Overall, this understanding of governance can lead to specific forms of networks between lead firms and their suppliers in the context of infrastructure management and global value chains.

Reflexive governance is a theoretical framework for understanding a learning-based approach to governance. In this respect it can provide an overarching framework for key points about learning in relation to infrastructure made elsewhere (see White Paper I). De Schutter and

Lenoble (2010) use 'reflexive governance' as an umbrella term for a range of governance perspectives, drawing from different theoretical traditions including institutional economics, collaboration governance, and philosophical pragmatism. Their framework makes the key distinction between external and internal learning. They argue that institutionalist perspectives tend to focus upon external learning – involving contracts, benchmarks, performance indicators – rather than fostering more effective internal learning.

De Schutter and Lenoble argue for the need to create the background conditions necessary to ensure that individuals' preferences are not rooted in context-dependent baselines. There is a need to broaden political imagination by encouraging diverse actors to think about acting collectively, without being constrained by the existing institutional frameworks, and engage in internal learning throughout the process. Voss et al. (2006) have previously used this type of framework to explore the concepts, practices and institutions by which societal development is governed. This framework has been picked up by scholars and applied in the context of infrastructure. While Prosser et al. (2010) applied the framework to the evolution of energy governance in the UK and Germany, Halbe et al. (2015) use it in the water-energy-food nexus by exploring systematically the responsibilities of different stakeholders for the implementation of innovations in the context of Cyprus.

One of the most effective discussions of infrastructure development framed around the concept of reflexive governance is offered by Deakin and Koukiadaki (2010). They draw on the case of Heathrow Terminal 5 to demonstrate the way in which BAA put in place a genuinely reflexive governance process which engaged a broad range of stakeholders in deliberation in such a way that construction was able to proceed more effectively and with less conflict that is typically the case. The key contribution Deakin and Koukiadaki make, however, is to highlight the fragility of the conditions needed for the success of this approach. They delineate the

particular combination of regulatory and market institutions which allowed this model of development to be adopted, and illustrate the way in which institutional change frustrated future adoption.

While these governance concepts have been put to work in the context of infrastructure, as we have illustrated, there is still a limited number of studies which place the issue of infrastructure futures in dialogue with the broader governance debate. Some of the key lessons in relation to challenges of stakeholder engagement in infrastructure services come from the water sector, for example, but, with due regard for contextual differences, they can sensitize us to the challenges likely to be faced elsewhere. Equally, framing the discussion in terms of coproduction requires a reorientation of thinking and embeds the idea that deliberation is integral to infrastructure processes, rather than a desirable add-on.

Much of the governance debate is analytical rather than prescriptive, but aspects of emerging infrastructure policy and practice give greater resonance to some of the key insights from the governance literature. Indeed approaches that we would characterise as forms of reflexive governance are prescribed as representing more effective mechanisms for developing and delivering infrastructure. A key question is therefore, assuming reflexive governance models represent an effective basis for future infrastructure delivery, how do we move to that future?

6 Lessons from transition management

The governance literature discussed in the previous section points to the importance of inclusion, collaboration, democracy and learning in the context of infrastructure delivery. This represents a step beyond models of infrastructure provision in which a regulator is allocated the responsibility for ensuring that private infrastructure providers are incentivised to operate with reference to some conception of the public interest. In the post-privatisation era the direct

participation of consumers or the representatives in regulatory processes has been rather unstable and precarious.

Moving to reflexive governance systems in which internal learning is integral to infrastructure delivery is a process that is more likely to succeed if it is based upon incremental moves that built momentum towards further transformation. The question is whether these are best achieved through existing structures or whether the primary role for existing structures is to make space for, and tolerate, experimentation that will lead to small-scale learning that can then be scaled.

The latter approach is characteristic of the reflexive governance method of transition management (eg. Loorbach, 2010). Transition management aims "at long-term transformation processes that offer sustainability benefits" (Kemp and Loorbach, 2006, p. 103). Central to transition management is the idea that transition spaces are created in which 'frontrunners' are able to explore options and articulate a long-term vision, as well as identifying short-term arenas and experiments that can be enacted to move the system towards the realisation of the vision. This process typically operates in parallel to existing institutions but with a view to their ultimate transformation.

The transition management approach was developed as a means of facilitating the movement of socio-technical systems on to a more environmentally sustainable basis over the long-term. But it has also been applied to thinking about how to transform processes so they are more effective and inclusive. While recognising that transition management runs some serious risks with respect to encouraging an inappropriately depoliticised vision of social change (Meadowcroft, 2009; Shove and Walker, 2007), it has more to offer in terms of thinking through processes of change in infrastructure delivery systems.

7 Conclusion

To be able to gain the best value from infrastructure, our understanding of infrastructure systems needs to evolve. This is often discussed in terms of the need for new business models, but this paper has suggested that framing the conversation in governance terms is one way of keeping some of the broader questions of purpose, value and benefit in play.

We have argued that using the concept of reflexive governance offers a more holistic understanding of infrastructure purposes and processes. Reflexive governance provides a framework for thinking about governance processes that engages squarely with questions of problem framing and purpose, competing values and their deliberative alignment, and ongoing processes of external and internal learning during the development, delivery and termination of infrastructure. Reflexive governance highlights the challenge of collaboration at scale and of ensuring that governance institutions are effective and inclusive.

We have also suggested that as we seek to move towards new ways of thinking about and delivering infrastructure the literature on transition management could offer useful insights. The literature on transition management and governance is concerned with the process of reconfiguring the underpinning logics of complex social systems over the long term, particularly but not exclusively in respect of moves towards greater sustainability. This reflexive governance approach needs to be treated critically, but it offers insights into methods for developing innovative and more inclusive approaches to infrastructure delivery.

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