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Reflections on Infrastructure Policy and Institutional Developments in the UK

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Reflections on Infrastructure Policy and Institutional Developments in the UK

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Executive Summary

This paper describes and reflects on the evolution of the UK's approach to infrastructure policy and planning. The purpose is to help inform the development of Irish infrastructure policy as we return to higher levels of investment. The paper focuses on institutional and governance issues: how infrastructure plans are formulated, and how policy decisions are made, responded to by stakeholders, implemented, maintained and evaluated.

Understanding the infrastructural policy challenge

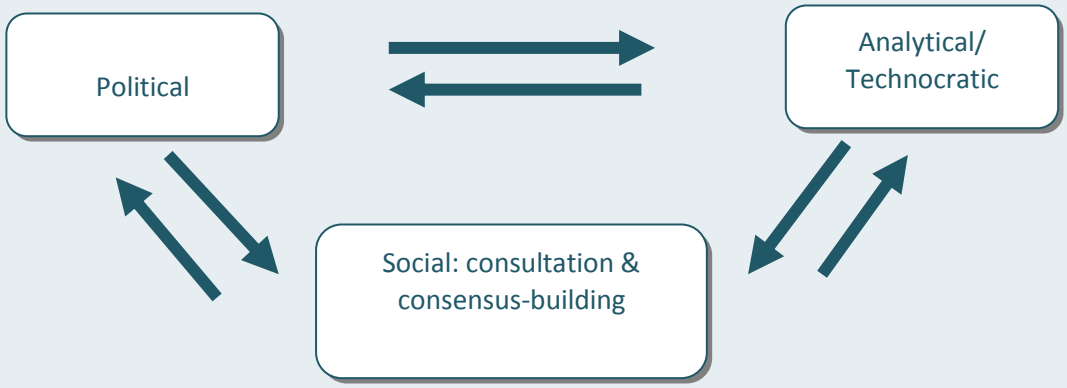
Investment in infrastructure is increasingly seen as critical to sustainable economic, social and environmental development. Across the world, the institutional landscape has become more complex because of privatisation, internationalisation, technological innovation and changes in finance. While the state remains a key actor in infrastructure, it faces a more challenging policy task. All this is reflected in the growing emphasis on infrastructure as a 'system of systems' and recognition of the complexity, uncertainty and ambiguity that are inherent in infrastructure policy.

As a result, there is growing interest in examining the way in which political actors make decisions on strategic and critical infrastructure; the limitations of standard analytical techniques and the need for new ones, and the importance of societal engagement and support.

Internationally, one of the most prominent responses to these challenges is a call for the establishment of an independent infrastructure advisory body or commission to undertake analysis and depoliticise infrastructure policy—an idea that has also been advanced in Ireland. Analytical and empirical considerations suggest that this call often reflects a 'naïve institutionalism' which assumes that a new institution could provide a totally objective assessment of infrastructure needs and projects, insulated from political and societal pressures.

The report focuses on the challenge of combining the three elements—political, analytic/technocratic and social—in effective approaches to infrastructure policy and planning (Figure 1). This framework reflects the fact that infrastructure decision-making cannot be depoliticised.

Figure 1: Understanding the Infrastructural Policy Challenge



To help thinking about these relationships, the report draws on international research on the relationship between knowledge, expertise and policy. This highlights that, as the degrees of complexity, uncertainty and ambiguity increase, it becomes less feasible to formulate expert advice in isolation from stakeholders, practitioners and political actors. The relevant data and cause-effect relationships become more uncertain, subject to divergent understandings, and contested. Consequently, effective expert analytical work requires a careful combination of 'boundary work' and 'coordination', suited to the nature of the policy area being addressed (Bijker *et al.,* 2009). This includes identifying areas of analysis that can be effectively undertaken by those with technical expertise and areas where involvement of various sets of stakeholders is necessary, as well as coordination between the two.

The changing institutional, policy and analytical landscape in the UK

Over the last eight to 10 years, the question of how to do infrastructural policy has received considerable attention in the UK (Chapter 5). This reflected an increasing consensus that the approach to infrastructure policy and investment was problematic in a number of important ways. In response, there has been a number of developments in the landscape of UK infrastructure policy. Among these are:

- devolution to city-regions and Scotland linked to infrastructure planning and investment (described in Chapter 6),

- the execution of major infrastructure projects, such as the Channel Tunnel, Crossrail, Heathrow Terminal 5 and the London Olympics (described in Chapter 7),

- changes to the technical, analytical and contractual approaches created in the heyday of privatisation and New Public Management—which did not succeed in passing risk to the private sector and which was vulnerable to litigation—moving to a more collaborative partnership approach (described in Chapter 7),

- institutional change *within* the government system, including the creation of the Infrastructure and Projects Authority within the Treasury and, in 2016, the establishment of the National Infrastructure Commission (NIC) (described in Chapter 8), and

- debate on and adaptation of methods of infrastructure appraisal, reflecting the limits of conventional cost-benefit analysis of individual projects, consideration of wider economic impacts, and framing technical work as an input to deliberation, consensus and decision-making (described in Chapter 9).

Reflections on the UK approach

These changes have greatly altered the policy landscape in the UK. The establishment of the NIC is certainly an important development, and some would place most emphasis on it. However, our analysis underlines the degree to which the establishment of the commission should be seen in the context of a wider set of changes in the overall system of infrastructure governance. Indeed, the NIC itself does not fit the standard characterisation: independent from political influence and solely reliant on objective analytical tools. The NIC would seem to be combining analysis, engagement and political decision-making, or links to decision-making, attuned to the complexity, uncertainty and ambiguity that characterises infrastructure policy.

The NIC's approach begins from a strong statement of the power of analysis that is both rigorous and independent. Its analytical work includes a number of somewhat different analytical methods and orientations: preparation of a National Infrastructure Assessment, High Priority Policy Studies and Annual Monitoring. Indeed, it is possible that its comprehensive assessment of infrastructure needs will be less significant than its studies of particular infrastructure challenges. In addition, despite its technical and analytical starting point, the NIC places emphasises its links

with political actors, aiming to build high-level consensus on infrastructure issues. Meaningful engagement with the public is a key consideration for the NIC, though this area seems underdeveloped relative to both analytical work and political engagement.

Implications and challenges for Ireland

The analysis of the UK story, using the analytical framework set out above, helps us to identify the right questions about Ireland's approach—although we do not answer them here. To what degree does Ireland effectively combine technical analysis, political decision-making and societal engagement? To answer this requires some detailed discussion of the current policy approach, the degree of coordination among key public bodies, the analytical techniques, and the means of engaging experts and societal interests. Infrastructure cannot be fully depoliticised, but neither can the risks associated with political decision-making be ignored. As well as having an unavoidable political and societal dimension, infrastructure must be the subject of sophisticated analysis.

The issue, then, is how relations between the political, the analytic/technocratic and the societal are structured, institutionalised and conducted in Ireland and how they might be reconfigured and enhanced.

Further discussion is required to flesh out key aspects of how the Irish system works in practice. This would help identify the type of institutional, policy and procedural changes that would contribute to enhancing the quality, effectiveness and efficiency of the decision-making process.

Chapter 1: Introduction

This paper focuses on infrastructure policy with a view to prompting reflection on Ireland's approach to infrastructure. It is designed to inform discussion of whether certain changes in process or institutions might support a more ambitious and integrated approach to identifying Ireland's infrastructure needs in the coming decades, devising integrated programmes, funding and delivery, and building societal engagement and support.

Chapter 2 outlines the changing institutional and policy landscape of infrastructure internationally, and the challenges associated with infrastructure policy. It highlights the temptation to see the establishment of an independent infrastructure commission or body as a panacea, allowing an untrammelled application of technical analysis and a depoliticisation of decision-making on infrastructure. The complexity, uncertainty and ambiguity of infrastructure policy casts doubt on the wisdom—and, indeed, the feasibility—of that approach. It is more productive to focus on the configuration of relationships and how this achieves a balance between analytical, political and societal dimensions and capabilities. To help thinking about this, we summarise some international research on the knowledge/policy relationship and the role of expert advisory bodies.

In Chapter 3, we provide a brief synopsis of the evolution of infrastructure policy and thinking in the UK. This is a summary of what is detailed in five chapters in Part II.

In Chapter 4, we offer a tentative interpretation of the UK story, complex though it is. We see it as a reconfiguration of the relationships between the three dimensions: analysis, political decision-making and societal engagement. We argue that its most obvious feature, the establishment of the 'independent' National Infrastructure Commission, should be seen in the context of a wider set of changes, including significant institutional and procedural innovations within the core executive of the UK. Drawing on this reading of the UK story, we identify some of the questions that arise for discussion in Ireland.

Part II provides a more in-depth exploration of the evolution of the UK approach to infrastructure.

1.1 Why the UK?

It is important at the outset to consider why we should look in detail at the UK. There are a number of similarities and differences between the UK and Ireland. One similarity, of relevance to infrastructure policy, is that the UK shares with Ireland a number of basic institutional characteristics, such as a common-law system and a parliamentary form of government in which the executive is dependent on ongoing parliamentary support. A third common characteristic is that both the UK and Ireland have traditionally been relatively centralised states.

The most prominent difference is the size of the two countries. Other differences in the politics and policy of the two countries that are relevant to infrastructure policy also need to be taken into account in reflecting on the UK story. One is the scale of defence spending, which accounts for a much greater share of public capital investment in the UK, a factor that is significant in periods of fiscal retrenchment or constraint.

In considering the interesting and complex evolution of the UK approach to infrastructure over the past decade or so, it is worth noting the background against which this occurred. Three related features of UK politics, policy and administration in the period from the late 1970s to the mid-1990s are relevant:

- fiscal conservatism, reflecting a desire to limit the role of the state, which saw UK investment in infrastructure fall below the levels in key comparator countries,

- widescale privatisation of public utilities, which constitute major spheres of infrastructure investment, and

- adoption of the New Public Management approach, characterised by separation of purchaser and provider, contractualisation of relations between entities (public or private) performing public functions, and a more rules-based approach to both *ex ante* and *ex post* assessment of public expenditure programmes and proposals.

As we will see, the complex evolution of the UK approach to infrastructure since the turn of the century, and particularly since 2010, involved a substantial modification of the regime created in the previous two decades.

Reflecting these factors, the policy landscape for infrastructure in the UK became considerably more complex over the last three decades. The strong privatisation agenda pursued since the early 1980s contributed to the emergence of a more heterogeneous network of public and private actors—government ministries, local government bodies, executive and regulatory agencies and private companies—involved in the planning, delivery and regulation of key infrastructure services.

1.2 Part II

Chapter 5 provides an overview of the changing institutional and policy landscape in the UK, and a summary of the sequence of reports, analytical contributions and institutional changes that drove and characterise the evolution of UK policy.

Chapter 6 describes a particular aspect of the evolution of UK infrastructure policy: the process of devolution through City Deals, devolution agreements, the devolved assemblies and the Northern Powerhouse agenda. We focus particularly on the Greater Manchester Combined Authority (GMCA), since it has played a strong role in both the formation and delivery of a city-region development plan in which new urban transport infrastructure has been a central feature. The UK devolution story is an interesting example of the reconfiguration of the conduct of technocratic analysis and planning, political decision-making and social engagement.

In Chapter 7 we summarise interesting developments in the way in which the UK organises the planning and delivery of major infrastructure projects. These developments are, in large part, a response to increased complexity and some disappointment with the approaches put in place in the heyday of neo-liberal privatisation and New Public Management. Those methods—sometimes characterised as 'hands off, eyes on'—were intended to pass a significant portion of risk to the private sector, via contracting and outsourcing, and create a more rules-based public-sector decision-making system. We draw heavily on a paper by the Infrastructure Projects Authority to outline changes in the way the UK public sector plans, commissions and monitors the delivery of infrastructure projects. This highlights the need for enhanced public-sector capabilities and the creation of partnership arrangements to ensure a collaborative, rather than a litigious, approach.

Chapter 8 describes the recently established National Infrastructure Commission (NIC). Its two core functions are to produce a National Infrastructure Assessment, the first by 2018, and to prepare reports on specific high-priority infrastructure projects and challenges. But, in addressing these two tasks, the Commission would

seem to be creating an interesting combination of a more sophisticated and integrated analytical approach to identifying long-term infrastructure needs, networking with the core government system, regional entities and sectoral regulators, and, to some degree, communication with, and engagement of, civil society.

In Chapter 9 we report on some interesting and influential UK thinking on the way that technical appraisal of infrastructure projects has been carried out and the relationship between this and the processes of public consultation and political decision-making. Some experienced and respected British economists have been critical of conventional economic models and cost-benefit analysis, and the way in which these are used in the overall decision-making process. Indeed, they see this combination as an important factor in the UK's under-investment in infrastructure. An interesting insight is that the attempt to make 'objective' technical economic analysis the key determinant of decisions on infrastructure has the paradoxical effect of making decisions more political (Rosewell, 2010). This reflects the complexity, uncertainty and ambiguity discussed above. Related to these critiques, a number of British economists have done innovative work on developing analytical approaches that can go some way to taking account of the wider economic, societal and environmental costs and benefits of infrastructure investment. Another influential analytical development in the UK can be found in work inspired by the 'system of system' concept. The IRTC, based in Oxford University, has designed a process for identifying long-term cross-sectoral infrastructure needs using scenario-based modelling and expert stakeholder dialogue. To some degree, this is informing current work on the UK's infrastructure needs, as undertaken by the Institute of Civil Engineers and the National Infrastructure Commission.

1.3 Methodology

The research for this paper included desk research and interviews with stakeholders in the UK. These included NIC commissioners, academics, senior officials from central and local government, and senior decision-makers from the infrastructure policy community.

Chapter 2: The Changing Context and Nature of Infrastructure Policy

2.1 Introduction

This chapter outlines the changing institutional and policy landscape of infrastructure internationally. It is structured as follows:

- Section 2.2: International trends in infrastructure thinking and policy
- Section 2.3: The challenge of infrastructure policy
- Section 2.4: The lure of independent infrastructure bodies
- Section 2.5: The relationship between analysis, societal engagement and politics in the real world

2.2 International Trends in Infrastructure Thinking and Policy

Internationally, there are important trends in thinking about infrastructure and the understanding of the infrastructure policy challenge.

These changes are characterised, first and foremost, by a renewed recognition that investment in infrastructure is critical for economic, social and environmental development. This is reinforced by the strengthening commitment to making the transition to a low-carbon economy and society.

Second, the institutional landscape for the planning, delivery, financing and operation of infrastructure has become much more complex and involves multiple actors and multiple-levels of governance (WRR, 2008). One reason is the privatisation and unbundling of utilities—such as energy, telecommunications,

transport, water, waste and housing—which are key infrastructural sectors. Another is European integration and globalisation, which has increased the cross-border dimension and brought supranational bodies, such as the EU Commission, EIB and even ECJ, into the picture. As explained well in an important paper for the Dutch government:

> These two developments (change of actor constellation and shift towards multiple decision making levels) taken together result in a splintered transaction chain in the sense that investment decisions are often made in bilateral and discrete relations (for example between the regulator and network manager) and in some cases between actors with quite different interests (WRR, 2008: 2).

A third element of contemporary thinking is increased focus on infrastructure as a system. Each infrastructure—electricity, water, telecoms, transport—is a system. While these were once unconnected structures, they are now interconnected and place demands on one another. Together they are a 'system of systems'—a key concept in infrastructure research and policy, initiated by research at MIT. An increasing body of research in the 'system of systems' paradigm explores infrastructure as a complex network of physical artefacts, processes, resources and services (iBUILD, 2015, Hall *et al.,* 2013). The 'system of systems' characteristic of infrastructure has profound implications for the approaches adopted in planning, appraising, funding and delivering infrastructure.

Related to these perspectives, there is increased recognition of the degree of uncertainty in the area of infrastructure. For example, the economic effects of infrastructure investments are not always clear, especially if we move from the direct effects of single projects towards the systems effects of wider strategies that combine investment projects of various kinds. There are also uncertainties and risk associated with political and regulatory change, potential societal opposition and maintenance costs. Many of the associated benefits and returns are long-term and uncertain in nature.

There is also growing recognition of the dilemmas and challenges associated with how governments and others traditionally make decisions on strategic and critical infrastructure (Anheier & Alter, 2016a, 2016b). To a degree, these reflect the uncertainty and ambiguity associated with infrastructure. The challenges include:

- the misalignment between the long-term horizon of infrastructure planning and the shorter-term nature of the political and electoral cycle (Hammerschmid & Wegrich, 2016),

- the tendency to focus on new, high-profile, highly visible projects over necessary investment in maintaining and/or enhancing existing infrastructure stock (Coelho *et al.*, 2014),

- political prevarication and an unwillingness when faced with highly contentious infrastructure investments, and

- the increased contestation and social opposition that has been a feature of infrastructure developments in many countries.

There is also greater awareness of the difficulties associated with estimating future infrastructure requirements and making robust and climate-resilient investment decisions (Marshall, 2013). Forecasting future need, for example, requires making broad assumptions about economic growth, population change, technology and climate change.

Another significant trend is a renewed recognition, especially in neoliberal countries, that the state has an enduring role since the market on its own cannot be relied on to deliver key public utilities and services (Helm, 2013; WRR, 2008).

Internationally, there is also an active search for alternative and innovative ways of funding long-term investment in public infrastructure. Since the global financial crisis, more attention has focused on attracting increased institutional and capital market resources into infrastructural investment (Department of Finance, 2013; European Commission, 2014).

Finally, as we discuss in more detail in Chapter 9, there is increasing recognition that standard analytical techniques of infrastructure appraisal, such as cost-benefit analysis of individual projects, tend not to take sufficient account of wider economic, social and environmental impacts and the systemic dimension (Brown & Robertson, 2014; Helm, 2013).

2.3 The Challenge of Infrastructure Policy

The trends noted above, particularly the increased number of actors involved, have drawn attention to governance and institutional issues: how infrastructure ideas and plans are formulated, and how investment decisions are made, responded to by stakeholders, implemented, maintained and evaluated.

As Anheier and Alter put it:

> Rather than considering the mobilisation of resources as the primary bottleneck for infrastructure investment, the governance perspective suggests that heightened attention be paid to the decision making and administrative processes involved, and that this be done in the context of macroeconomic conditions that vary across countries and may involve different trade-offs (Anheier & Alter, 2016a: 16).

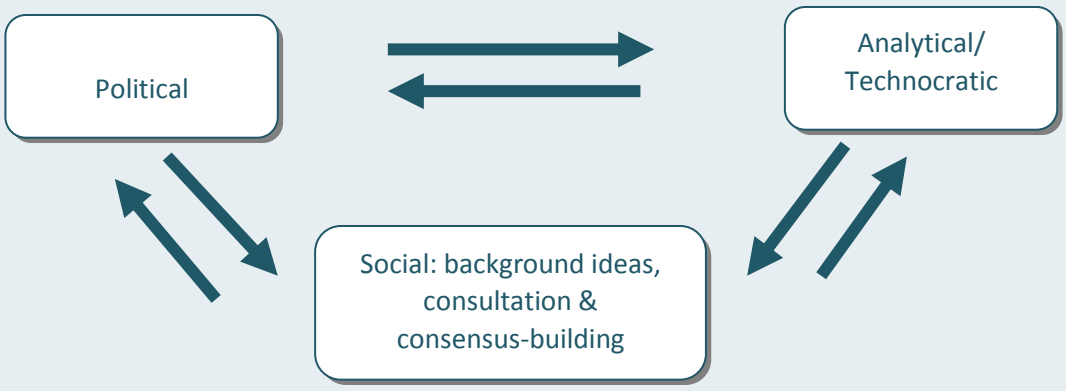
It is relatively easy to identify many of the elements that are necessary for effective design, decision and delivery of infrastructure:

- **Political leadership and coordination:** to create a high-level strategy, underpinned by robust research and analysis.
- **Administrative coordination**: at central and other levels, in particular in the UK with cities.
- **Appraisal**: Systematic macro-analysis of how the individual elements of any capital investment plan fit together.
- **Integrated land-use planning and delivery**: Strategic infrastructure investment embedded within an effective spatial planning framework and settlement pattern, which requires an effective combination of spatial and 'sectoral' perspectives and plans.
- **Financing:** New approaches to financing infrastructure, given the changes in both public finance and the global financial system.
- **Buy-in and conflict resolution:** Successful infrastructure programmes and projects need societal buy-in and support, and mechanisms for mediating conflict and resistance and blockages, which depend on an effective combination of analysis, engagement, consensus-building, problem-solving and revision.

But the challenge is to identify how these elements can be achieved and aligned. What institutional and procedural arrangements are effective in the changed context outlined above?

One way to characterise this challenge is to simplify the six elements identified above into three—political, analytic/technocratic and social—and to think about how these are conducted and combined in effective approaches to infrastructure (Figure 2.1).

Figure 2.1: Understanding the Infrastructural Policy Challenge: An Analytical Framework



What capabilities procedures are required *within* each of these three spheres? What relationships *between* the political, analytical and social dimensions are most effective? Experience suggests that there can be good and bad versions of these interrelationships.

One pattern, observed in the UK over several decades, is a combination that leads to indecision and insufficient investment. Another possibility might be this: infrastructure plans are developed within the technical system but political actors 'interfere' with these in capricious ways. But, reflecting the interplay of the three spheres—and the need to include all three—this political activism might arise partly in response to the fact that technical plans were drawn up with relatively little societal engagement and consensus-building. When one set of actors is excluded from the process of infrastructure policy development in a sustained way, it usually

finds a means to insert and assert itself later in the process. This way of conducting policy seems problematic.

The challenge is clearly a complex one, since the three requirements—analysis and expert administration, societal engagement and buy-in, and high-level political leadership and decision-making—can seem to point in different directions. Additionally, efforts to achieve one can seem to undermine the other two.

2.4 The Lure of Independent Infrastructure Bodies

In recent times, one of the most influential responses to the governance challenge is the idea that governments lack the tools and procedures to make good infrastructure plans and decisions. It is commonly argued that countries need comprehensive cross-sectoral infrastructure strategies and that the key to achieving this and good decisions is the creation of an independent infrastructure advisory body or commission. Such bodies, it is argued, can deliver a combination of independence from political influence and the use of analytical tools such as cost-benefit analysis that allow the decoupling of infrastructure decision-making from short-sighted and politicised decision-making. In other words, the promise of such expert bodies is the depoliticisation and thus rationalisation of decision-making about infrastructure (Hammerschmid & Wegrich, forthcoming 2017: 22).

Reflecting these ideas, a number of countries—such as Australia, Canada and the UK—have established 'independent' infrastructure bodies. The Australian body, Infrastructure Australia, has been praised by international organisations, such as the OECD and World Economic Forum, as a leading example. Marshall notes that the countries most eager to create independent infrastructure bodies tend be those that have been at the forefront of privatisation and liberalisation of infrastructure sectors (Marshall, 2013: 14).

These developments reflect what Roberts calls 'the logic of discipline'—the idea of using institutional design to insulate economic policy-making from political influence (Roberts, 2010). This is evident in the international trend towards independent central banks. As Hammerschmid and Wegrich (forthcoming 2017) point out, in the field of infrastructure governance, the logic of discipline is combined with renewed confidence in long-term planning and related models of decision making.

However, the idea that an independent, expert body would be capable of both producing the integrated long-term strategic infrastructure strategies and

depoliticising infrastructure policy is questionable. It ignores the core characteristics of infrastructure policy: complexity, uncertainty and ambiguity, which severely limit the possibility of generating and relying entirely on objective, independent analysis:

> Basing a strategy for infrastructure investment on a technical analysis of the costs, benefits, and potential side-effects of investments in the different subfields of infrastructure imposes information processing requirements that are extremely difficult to meet. The complexity of the field results in substantial uncertainties in the sense of unknown or incomplete information. For example, the economic effects of infrastructure investments are not always clear, especially if we move from the direct effects of single projects towards the systems effects of wider strategies that combine investment projects (Hammerschmid & Wegrich, forthcoming 2017: 27).

Furthermore, complexity and uncertainty ensure that infrastructure policy challenges are characterised by ambiguity. The goals, evidence and cause-effect relationships relevant to infrastructure policy are the subject of conflicting meanings and equally plausible interpretations. Consequently, although good information is key to good decision-making, it is generally contested or negotiated knowledge that informs infrastructure strategies (de Bruijn & Leijten, 2008).

It is, therefore, not easy to shut out political influence in fields of policy which are contested and have a significant redistributive dimension. The scale of resources associated with infrastructure, allied to the potential benefits and costs associated with major projects, ensures that this is a policy domain in which the primacy of politics is particularly evident. Political actors, especially government ministers with a democratic mandate, will invariably reassert their prerogative, and they are, probably correctly, unwilling to cede decision-making on major economic and social infrastructure to technical bodies or experts.

In short, there is no possibility of depoliticising infrastructure policy. The fact that infrastructure policy is characterised by complexity, uncertainty and ambiguity limits both the scope of purely objective scientific analysis and the possibility of independence from both political contestation in society and the political decision-making of government. Politics is both central and necessary for effective, efficient and good decision-making on infrastructure policy. ‘Complexity is inherent to infrastructure governance and will not cease with the application of more advanced tools of economic analysis or more rational planning cycles. Decision under conditions of complexity and uncertainty require political choices’ (Hammerschmid & Wegrich, 2016: 36).

Reflecting these factors, application of the 'logic of discipline' to policy domains such as infrastructure—characterised by complexity, uncertainty and ambiguity—has been described as 'naïve institutionalism' (Roberts, 2010). Hammerschmid and Wegrich see three major shortcomings or misunderstandings in the dominant debate about independent expert advisory bodies in the field of infrastructure governance:

- The debate frames the challenge of infrastructure governance as a problem of generating knowledge about the costs and benefits of infrastructure investments. While knowledge is important, the high level of complexity will not result in the elimination of uncertainties or the ambiguity that follows from the diverse selective perceptions of a range of equally legitimate political, administrative, and societal actors. More knowledge will not resolve the ambiguity.

- This debate considers formally-independent expert bodies as politically neutral—both by considering formal legal independence as an effective means of depoliticisation and by assuming that the preparation of decisions within expert bodies can be completely separated from a final political decision. However, in a field of (re)distributive policy-making, political influence will not be easily shut out when decisions are about who gets what and when.

- As a consequence of the previous two points, the debate does not explore how political influence would be exerted within a system in which independent expert bodies play an important role (Hammerschmid & Wegrich, forthcoming 2017: 39).

In short, they say, the institutional design debates are limited to the parameters of naïve institutionalism. 'This debate is not trying to make the political process smarter but is rather trying to replace it with analysis—or technocracy' (*ibid.*: 39).

2.5 The Relationship between Analysis, Societal Engagement and Politics in the Real World

If it is impossible to depoliticise infrastructure policy, an important empirical question is: what is the effect of creating an 'independent' infrastructure body such as Infrastructure Australia or the UK's National Infrastructure Commission? Hammerschmid and Wegrich suggest that it depends on 'their fit into pre-existing institutional constellations, and administrative capacities offer a lens to explore this

fit' (*ibid.*: 37). They suggest that four capacities or abilities of the national administrative system are particularly relevant in shaping the impact of the establishment of an infrastructure body:

- the capacities to coordinate actors across boundaries and levels of government,
- the capacity to regulate societal actors,
- the capacity to implement and deliver policies, and
- the ability to deploy analytical capacities for addressing complex policy challenges.

These are all institutional traits of governmental systems, but they also require skills and competencies on the part of the individuals working in government (*ibid.*: 36).

One view—which figures on the British discussion and is discussed in Chapters 4 & 8—is that an attempt to make infrastructure decisions subject to tight technical and analytical rules and procedures, applied by experts, has the paradoxical effect of making actual decision-making *more overtly political* in a narrow sense (Rosewell, 2010). Indeed, in the international literature it is argued that, if the contested character of information is denied, this tends to turn decision-making into a 'straight political fight in which the role of information is devalued rather than strengthened' (de Bruijn & Leijten, 2008).

A cross-country analysis of infrastructure policy approaches suggests that, of the four capacities or abilities listed above, coordinative capability and analytical capability tend to be relatively weak in contrast with regulatory capability:

> Whereas the field of infrastructure seems dense in terms of rules and regulations for procurement, technical specifications and administrative requirements, and over-sight more generally, it seems less populated with institutions that properly address the governance challenge of coordination (Anheier & Alter, 2016b: 179).

Coordination capacity is about mediating and managing different actors, stakeholders and tasks in order to succeed in the kind of collective action required for complex infrastructure projects. Indeed, Anheier and Alter argue that coordination deficiencies stand out so much 'that they seem to be a key determining factor of overall performance'. Arising from institutional weaknesses, 'they not only relate to the relationship between different levels and units of

government but also extend to coordination with business and civil society as well' (*ibid.*: 180).

Analytical capacity, which is also relatively scarce, is closely related to the coordination challenge. Anheier and Alter argue that efficient and effective coordination is more likely to happen if actors have the capacity to provide sufficient data and have adequate knowledge and expertise for project planning, risk assessment and implementation, especially under conditions of political, financial or technical uncertainty. 'Unfortunately, analytical capacity that is both encompassing and strategic, politically savvy and astute, and technically and economically sound seems all too rare' (*ibid.*: 181).

Complexity, uncertainty and ambiguity clearly have implications for how to conduct and combine analysis, societal engagement and political decision-making. In thinking about how these are, and can be, combined in infrastructure policy, we find it helpful to draw on insights in the international research on the relationship between knowledge and expertise, on the one hand, and policy on the other.

This is a huge field, which begins from the finding that the idea of technical rationality, in which expert knowledge informs policy in a linear one-directional way, is rarely an accurate account. Owens argues that within this area of research the most promising framework for the analysis of expert advice would seem to be one that combines the 'cognitive' and 'co-productionist' models of knowledge-policy relations (Owens, S., 2015). The cognitive perspective allows for the possibility that knowledge is sometimes (if rarely) used 'rationally' or strategically, and it recognises that knowledge will have a greater or lesser effect depending on circumstance. But the co-productionist idiom brings much-needed critical attention to scientific/expert knowledge itself and to the possibility (and the practices) of its separation from politics. Consequently, 'combining these perspectives enables us to see how an advisory body might perform different, and sometimes multiple, roles, such that careful examination of its work in specific contexts might help illuminate both the functioning of expert advice and relations between knowledge and policy more broadly defined' (*ibid.*: 17).

Together these approaches help us think about the role of expert advice and advisory entities in policy areas with different degrees of complexity, uncertainty and ambiguity. In policy domains where these three features are limited, and expert views are relatively convergent, advice can be formulated by experts and fed into the policy process (Pielke, 2009). As complexity, uncertainty and ambiguity increase, it is becomes less feasible to formulate expert advice in isolation from stakeholders, practitioners and political actors.

Research in this area shows that effective expert analytical work requires a careful combination of 'boundary work' and 'coordination', suited to the nature of the policy area being addressed (Bijker *et al.*, 2009). This includes identifying areas of analysis that can, to a degree, be effectively undertaken by those with technical expertise and areas where involvement of various sets of stakeholders is necessary, as well as careful coordination between the two. It also involves a skilled combination of 'frontstage' articulation of the state of knowledge among analysts, on the one hand, and 'backstage' generation of useful knowledge in areas where the relevance and meaning of diverse data, as well as key cause-effect relationships, are contested even among experts. But this overall perspective recognises that determining the current level of knowledge among experts is generally a much more complicated matter than is assumed in the standard model of science, the linear-rational concept of the knowledge-policy relationship and conventional perpsective on 'evidence-based policy'. Even in areas of relatively hard science, this perspective 'assumes an advisory process in which the practices to which the advice applies are already taken into account in the process of generating and articulating that particular advice' (*ibid.*: 44). This is likely to be even more so in a policy area, such as infrastructure, where knowledge and cause-effect relationships are contested, and professional and other practices are highly influential.

Similar thinking generated within the study of infrastructure policy specifically leads Anheier and Alter to reject as naive and unrealistic the idea that infrastructure can be 'policies without politics and technocratic implementation without broader political considerations' (Anheier & Alter, 2016b). The focus needs to be on increasing the 'quality' of political decision-making rather than seeking to replace politics with technocratic analysis or expert decision-making (Hammerschmid and Wegrich, 2016.) Translating knowledge and analysis into effective action actually requires political will and authority (NESC, 2016). An effective and ambitious infrastructure strategy requires not 'less' politics but rather different politics in which political authority, energy and commitment are channelled into the pursuit of longer-term public values and goals.

The complexity, uncertainty and ambiguity of infrastructure mean that it needs institutions that 'combine elements of deliberation and inclusion with expert knowledge in terms of macroeconomic framework conditions and finance, administrative-managerial capacities, and technical options and feasibilities' (Anheier & Alter, 2016b). They do not, however, provide a detailed description of institutions that achieve this combination in practice.

Chapter 3: Overview of Developments in UK Infrastructure Policy

3.1 Introduction

The key purpose of this paper is to provide a reflection on the UK approach to infrastructure that can help inform the evolution of Irish infrastructure policy. This reflection is based on a detailed examination of the UK approach (provided in Part II). However, to help the reader this chapter provides a brief synopsis of each of the chapters in Part II. It is structured as follows:

- **Section 3.1** provides an overview of the changing institutional, policy and analytical landscape in the UK over the last decade.
- **Section 3.2** describes the devolution in the UK and, in particular, the City Deals programme and the experiences within the Greater Manchester Combined Authority.
- **Section 3.3** summarises four key insights from a major review of a number of recent high-profile capital projects in the UK.
- **Section 3.4** describes the recently established National Infrastructure Commission.
- **Section 3.5** notes the emergence in the UK of influential ideas about the evaluation of infrastructure projects and assessment of infrastructure needs.

3.2 Changing Institutional, Policy and Analytical Landscape

Chapter 5 describes how, over the last eight to 10 years, the question of how to do institutional policy has received considerable attention in the UK. It shows that this has resulted in two major policy developments: the National Infrastructure Commission and the Infrastructure and Projects Authority. These are summarised below and elaborated upon in Chapter 5 and 8.

These two developments build on a number of earlier ones:

- Infrastructure UK (2010 to 2014): a unit within the Treasury, responsible for National Infrastructure Plans.
- The Major Projects Authority (2011-2016): part of the Cabinet Office, which provides independent assurance and advice on infrastructure projects.
- The Green Investment Bank: providing government funding, with support from the private sector, for green infrastructure.

In 2016, Infrastructure UK and the Major Projects Authority were merged to form the Infrastructure and Projects Authority.

Since 2011, the UK government has overseen a process of devolution. This has meant that responsibility for substantial infrastructure projects was given to devolved bodies such as the Greater Manchester Combined Authority.

The institutional changes underway in the UK have been informed and shaped by a number of key reports. These reports noted the need to increase investment but also ways in which decision-making could be enhanced. The reports include:

- Council for Science & Technology, National Infrastructure for the 21st Century (2009).
- LSE Growth Commission, *Investing for Prosperity* (2013).
- Armitt Review, An independent review of long term infrastructure planning (2013).

The changing landscape also reflects questions raised by economists and planners in the UK about the effectiveness of analytical tools in the face of the uncertainty and ambiguity associated with many aspects of major infrastructural projects—questions that we summarise in Section 3.5 and discuss in more detail in Chapter 9.

3.3 Devolution, City Deals and Greater Manchester

Chapter 6 shows that an important element of UK infrastructure and policy has been the devolution programme, which has been progressed since 2014.

It briefly describes how the evolution of the Scottish devolved administration since 1998 has been characterised by an increased focus on national spatial planning and infrastructure policy. Between 2003 and 2015, three National Planning Frameworks were published, representing the spatial expression of the Scottish government's economic policy and infrastructure investment strategy. The 2015 National Planning Framework included 14 large-scale capital projects identified as being key to achieving economic, social and environmental policy goals.

In parallel, there was significant process of devolution in England. This involved the formulation of 'city deals' between the UK government and regional cities. Thirty-four such deals were agreed between 2011 and 2016. These were introduced to incentivise coalitions of local actors to develop strategies—in the areas of infrastructure, skills and business support—to unlock economic development. Each deal was a negotiated bespoke package of funding and devolved powers. A focus on infrastructure investment, including innovative funding initiatives, and the adoption of a more robust *ex ante* evaluation and appraisal of how infrastructure schemes can contribute to national policy objectives, in particular economic growth, were a feature of some City Deals (O'Brien & Pike, 2015). A number of cities also developed single appraisal frameworks to enable them to more effectively prioritise investments (NAO, 2015).

The UK Government sought to build on the City Deals programme by enabling combined authorities to gain additional devolved powers through the negotiation of devolution agreements. Since 2014, 19 Devolution Deals have been agreed with 11 combined authorities and one unitary authority. The core powers that have been made available to most combined authorities include:

- responsibility for consolidated transport budgets and spatial planning,

- the capacity to facilitate development through the establishment of public land commissions and mayoral development corporations, and

- new revenue-raising powers.

Devolution in England is most developed within the Greater Manchester Combined Authority (GMCA). Chapter 6 shows that the GMCA, through the negotiation of City Deals and devolution agreements, has acquired greater responsibility for aspects of transport, regional spatial planning, housing, business support, business rates, training and public-sector reform. A strong focus on developing 'transformative' transport infrastructure has been a particular feature of the GMCA's integrated economic strategy. The powers given to the GMCA under devolution agreements have substantially enhanced its capacity to plan, finance, fund and deliver infrastructure investment.

The devolution process also includes the UK Government's articulation of the Northern Powerhouse agenda, which aims to create a more innovative and highly productive northern economy centred on the five main cities. Northern Powerhouse is an overarching policy framework incorporating existing and new policy initiatives, with a strong focus on devolution, transport infrastructure and investment in science and innovation.

3.4 Four Lessons from the Delivery of Major Infrastructure Projects in the UK

Chapter 7 draws on a paper by the Infrastructure and Projects Authority (IPA) to highlight four lessons emerging from an examination of recent high-profile major capital programmes and projects. These include: Channel Tunnel, Crossrail, the Thames Tideway Tunnel, Heathrow Terminal 5, London Olympics and London Underground.

The IPA finds that more not less public-sector involvement is necessary to ensure that infrastructure is delivered effectively and efficiently. The paper notes that the largest public-sector capital programmes face a number of challenges: they are 'too big to fail'; they are very expensive, even in the context of public finances, and they have high levels of inherent uncertainty and risk. The examples cited demonstrate the evolution of a programme delivery strategy that has responded to these challenges. Chapter 7 outlines the four key insights:

- **Significant public-sector involvement is needed to enable private-sector delivery:** In recent major capital programmes, the role of the public sector has been substantial, as sponsor, client and sometimes partner in the delivery organisation. Indeed, the public sector has been required to take on some of the roles that, under previous arrangements, it had attempted to transfer to the supply chain. The scale, risk, complexity and danger of supply-side power and the national importance of many projects has meant that deeper public-sector involvement was necessary to create the conditions under which the private sector will deliver effectively.

- **Major capital programmes require new ways of working in the centre of government**: In some cases—notably the London Olympics, Crossrail and HS2—a much more collaborative approach to managing government's role as sponsor has been developed, which has included the Treasury taking a more active approach to project management. This allows the public sector to manage financial risk differently, including assuming ultimate financial liability in a number of projects. There is also evidence of the need for greater flexibility in terms of how decisions are sequenced and in the scope to allow resources to move between years.

- **Collaborative contracting methods help mitigate risk and improve efficiency**: Enabling and incentivising successful private-sector delivery has required the public sector to create and manage a sophisticated commercial and project control environment. This includes more collaborative, alliance-orientated and disaggregated approaches to commercial arrangements, the design of more sophisticated programme control architectures, and the involvement of the public sector in ensuring that private-sector capability and skills are in place. This has helped address some inefficient practices within the supply chain and reduce the costs associated with litigation that arises in traditional approaches.

- Projects and new ways of working require significantly enhanced public-sector capability, in particular, but not only, in the client function: The projects used different combinations of in-house skill development, external support and the tactical or strategic use of delivery partners, in order to develop the required public-sector capability. New bespoke entities and amendments to existing organisations have been used. An additional product of the increased collaboration is increased investment in the private-sector skill base. For example, the High Speed 2 (HS2) railway project (linking London, Birmingham, East Midlands, Leeds and Manchester) includes provision to train engineers with expertise in high-speed rail.

3.5 The National Infrastructure Commission

Chapter 8 focuses on the National Infrastructure Commission (NIC), established in October 2015. It provides an account of its establishment, mandate and functions, including its approach to analysis, its evolving political engagement, its coordinative capacity and its effort to build societal engagement.

The aim of the NIC is to enable long-term strategic decision-making for infrastructure in the UK. The NIC has been formally established as an executive agency of the Treasury and will have close ties with the latter, especially those working in the Infrastructure and Projects Authority.

The NIC is managed by a board of commissioners chaired by Lord Adonis, the former Labour Minister for Transport. Sir John Armitt serves as deputy chair. All the commissioners were appointed by government, and the reputation, status and expertise of this grouping is viewed as a key organisational asset for this newly established body. The NIC has a core staff of around thirty people.

The mission of the NIC is to:

- develop a clear long-term strategic vision, encompassing all infrastructure sectors,
- develop a structured methodology to consider interdependencies,
- consider all potential policy solutions and propose recommendations consistent with long-term objectives and a fiscal remit set down by government,
- have wide engagement and consultation to help capture the expertise and opinions of a wide range of stakeholders,
- work objectively to scrutinise government action, and
- ensure that infrastructure projects are compatible with all legally binding and long-term obligations, including carbon targets.

Chapter 8 provides an overview of the products and services which the NIC has been mandated to provide. These are:

- **Infrastructure assessment**: An analysis of the UK's strategic infrastructure needs and priorities over a long-term time horizon (up to thirty years) and the

publication of a National Infrastructure Assessment (NIA), including recommendations, once in every parliament, the first by 2018.

- **High-priority policy studies**: The NIC has also been given the role of undertaking, at the request of the government, studies of high-priority infrastructure policy issues. These examine pressing and significant infrastructural issues. To date, the NIC has published three reports—'High Speed North', 'Transport for a World City' (London) and 'Smart Power'—and work is ongoing in two areas: 5G deployment and the Cambridge-Milton Keynes-Oxford corridor.

- **Annual monitoring**: The NIC publishes an annual monitoring report taking stock of the government's progress in areas where it has committed to taking forward NIC recommendations.

The Commission will use a range of methodologies, including the development of scenarios, quantitative modelling, evidence-gathering with a wide range of stakeholders, deliberative techniques and survey data, expert roundtables, cost-benefit analysis, commissioned research and international best practice. It will be assisted by two high-level expert advisory groups: a Technical Panel (containing industry actors and academics) and an Analytical Panel (composed mainly of academics).

The UK Government has committed to issuing a formal response to the NIC's recommendations, including reasons and alternatives when it does not adopt the commission's recommendations as government policy.

3.6 New Approaches to Evaluation and Analysis

Chapter 9 highlights that a feature of the UK infrastructure story has been the emergence of influential ideas about the evaluation of infrastructure projects and assessment of infrastructure needs.

Drawing on over twenty years of professional and academic experience, Rosewell, currently a commissioner in the National Infrastructure Commission, highlighted how an overreliance on narrow technocratic analysis interacts with the political and planning systems to constrain the UK's capacity to make decisions on major infrastructure projects. She argued that there are four problems with how conventional evaluation models are used to inform planning and infrastructure development:

- An overreliance on conventional economic forecasting despite the fact that the experience of infrastructure investment and academic analysis challenges the assumptions underpinning these models.

- An overt focus in transport on cost-benefit analysis (CBA) measuring time-based welfare benefits that detaches analysis from the real economic and social impact of infrastructure investment.

- The assumption that economic growth is independent of infrastructure investment—reflected in adopting a projected rate of growth into appraisal calculations—which reinforces the prominence of short-term political considerations.

- The use of technocratic analysis in the political and planning systems, which ensures an inadequate decision-making processes in which there are no mechanisms to debate and resolve differences of opinions and interests.

Rosewell proposes that infrastructure projects should be primarily evaluated on the basis of their contribution to the real economy and that the business case for projects should be articulated in a way that is relevant for businesses and communities. In making the case for a new approach to evaluation, Rosewell stresses the *uncertain* nature of social scientific evidence. The role of evaluation tools in the decision-making process is, therefore, not to provide 'right answers' but rather to generate evidence that can be used to support debate and consensus-building.

Concern over the limitations of the focus on time-based user benefits, in conventional appraisal in transport, has also stimulated attempts to develop an evaluation framework that incorporates a wider set of potential beneficial economic impacts. These wide impacts include enhanced productivity, increased private investment, land-use change and increases in employment.

The debate around the need to move beyond standardised CBA also highlights that certain characteristics of infrastructure investment make evaluations complex and problematic. In particular, the systemic nature of infrastructure implies that conventional CBA, which underpins project appraisal in the UK, is a limited tool for deciding how much (and arguably what kind of) infrastructure should be provided by the state (Helm, 2013). Standard appraisal techniques are not particularly appropriate for considering the non-marginal economic and social impacts of potentially game-changing infrastructure investments. Economics focuses on marginal changes, and its role is to guide the allocation of scarce resources by

comparing the marginal gains or losses associated with a particular intervention. It does not have the tools to assess the overall system—of transport, energy or housing—that a society needs or wants. This is a prior question that requires a much wider tool kit and set of methodologies.

In the UK, the result is a growing sense of the need to embrace a more diverse set of quantitative and qualitative methodologies that would improve the capacity to identify and capture a wider range of economic, social and environmental impacts associated with infrastructure investment. It is recognised that all such methodologies are underpinned by assumptions that are open to discussion (OECD, forthcoming 2017).

The Infrastructure Transitions Research Consortium (ITRC), based in Oxford University, has engaged with the challenge of developing a longer-term perspective on infrastructure provision that incorporates the deepening interdependencies between sectors and also the complexity and uncertainty associated with interconnected systems (Hall *et al.*, 2016). The work programme is focused on showing how infrastructure analysis and planning can be enhanced by adopting a quantified systems-of-systems modelling framework that can assess the future performance of the national infrastructure system under a range of scenarios.

Chapter 4: Reflections on the UK Approach

4.1 Introduction

This chapter sets out our reflections on the UK approach to infrastructure. It argues first that the establishment of the National Infrastructure Commission (NIC) must be placed in context: it is part of a wider set of institutional and other developments. We then analyse how the NIC undertakes its work and seeks to link analysis, political actors and societal interests.

This leads us to argue that how to effectively link analysis, politics and wider stakeholder and societal interests is the key question that must be asked in an Irish context. It suggests that the next steps would be detailed discussion on the current policy approach, the degree of coordination, procedures and analytical techniques and the means of engaging experts and societal interests.

The chapter is structured as follows:

- Section 4.2: NIC as part of a wider set of developments.
- Section 4.3: NIC's approach to lining analysis, political actors and societal engagement.
- Section 4.4: Conclusion (for Ireland).

4.2 The National Infrastructure Commission as Part of a Wider Set of Developments

It would not be wise to offer a definitive interpretation of the changes in the UK and to use this to read off reforms that might be made in Ireland. One reason is that some of the most notable changes, such as the establishment of the National

Infrastructure Commission (NIC), are relatively recent and are still taking shape. Beyond that, the UK evolution—and, indeed, the role and work of the NIC—can be interpreted in a number of somewhat different ways, as discussed below.

One interpretation of the developments in UK infrastructure policy places major emphasis on the establishment of the NIC and its role in preparing an integrated long-term National Infrastructure Assessment (NIA). This interpretation reflects what is probably a dominant view in international commentary and, indeed, popular opinion on infrastructure governance in recent years. As noted in Chapter 2, this view sees as exemplary a combination of independence from political influence and the use of analytical tools such as cost-benefit analysis that allow a decoupling of infrastructure decision-making from short-sighted and political considerations.

In our view, an interpretation that centres on the NIC and its supposed independence is not sufficient. First, it takes insufficient account of changes in the overall system of infrastructure policy in the UK. These changes are substantial, and they have greatly altered the landscape within which the recently created Infrastructure Commission sits. Second, focusing predominantly on the establishment of an 'independent' commission does not fully fit the evidence on the nature and activities of the NIC, as uncovered in our research (outlined in Chapter 8 and discussed further below).

A better first step in interpreting the UK story is to see the establishment and work of the NIC as part of a wider change in the overall system of infrastructure governance. Among the elements of this wider change are:

- A protracted and sustained process of analysis, argument and change reflecting an increasing consensus that the UK's prevailing approach was problematic as regards the scale, sophistication and delivery of infrastructure investment.

- Some major UK infrastructure projects, such as the Channel Tunnel, Crossrail, the Thames Tideway Tunnel, Heathrow Terminal 5, London Olympics, London Underground, and major defence and nuclear projects.

- Institutional change *within* the government system, including the creation of new units in the Treasury and other departments.

- Devolution to city regions and Scotland, linked to infrastructure plans and projects. This has resulted in a focus on infrastructure investment, including implementing innovative funding initiatives, and the adoption of more robust *ex ante* evaluation and appraisal of how local infrastructure schemes can contribute

to national policy objectives, in particular economic growth (O'Brien & Pike, 2015). A number of cities also developed single appraisal frameworks to enable them to more effectively prioritise investments (NAO, 2015).

- Modifications to the somewhat rigid technical, analytical and contractual approaches created in the heyday of privatisation and New Public Management. This has involved enhanced state capabilities, a move from the 'hands off, eyes on' doctrine—with its highly contractual mode of delivery and attempt to transfer bulk risk to private-sector suppliers—to collaborative partnership approaches designed to handle uncertainty and complexity.

- A wider perspective on methods of infrastructure appraisal, moving beyond conventional cost-benefit analysis to consider wider economic, social and environmental effects of infrastructural investment and seeing technical assessment as an input to a more inclusive deliberation on desirable and feasible patterns of development.

- Creation of a new infrastructure institution, the National Infrastructure Commission, which has a strong role in conducting analysis, dialogue and communication.

- Some examples of innovation in funding, such as the Earn Back mechanism used in financing the Manchester metropolitan transport system.

- Recognition of the need to improve the level and quality of engagement of non-state actors, although generating social buy-in and support for infrastructural investment continues to be a challenge.

This set of changes underlines the fact that, prior to the establishment of the NIC, there was evidence of the UK Treasury adopting a more proactive role with regard to infrastructure. This included a willingness to become more directly involved in the policy dialogue between line departments, sectoral agencies and sub-national authorities. Indeed, these prior changes reflect the second point in the above list of changes in the overall system: the fact that, in this period, the UK did undertake some major infrastructure projects. This can be seen as an example of a phenomenon noted by Healey in her overview of the nature and role of spatial planning in the early 21st century, *Making better Places* (Healey, 2010). She observes that, in a context in which comprehensive spatial planning is less possible, and certainly less in evidence, specific ambitious *projects* can be the means through which place-making agendas are often pursued (*ibid.)*.

Within the context of the wider set of changes in the UK approach to infrastructure, it is, of course, important to ascertain the nature and role of the National Infrastructure Commission.

4.3 The Commission's Approach to Linking Analysis, Political Actors and Societal Engagement

The National Infrastructure Commission (NIC) is undoubtedly an interesting institutional initiative. On the surface, its establishment looks like an attempt to create an 'independent' body with the characteristics noted above: independence from political influence and unqualified reliance on objective analytical tools. Indeed, it is undoubtedly the case that, in the UK infrastructure policy debate, there are those who seem to focus primarily on the NIC and the importance of making sure that it is 'independent'. This is reflected in some of the discussion of its statutory status, the status of its recommendations to government and the inappropriateness of it being instructed to do its work within the parameters of a fiscal envelope set by the Treasury.

However, there is evidence that the NIC might not entirely fit this characterisation and, thus, that it may not display the limits of the naïve institutionalist approach noted in Chapter 3. It seems to be helping to create an interesting combination of analysis, engagement and political decision-making attuned to complexity, uncertainty and ambiguity. Its work involves a careful combination of boundary work and coordination. This includes identifying areas of analysis that can be effectively undertaken by those with technical expertise, and areas where involvement of various sets of stakeholders is necessary, as well as careful coordination between the two. It also involves a skilled combination of 'frontstage' articulation of the state of knowledge among analysts, on the one hand, and 'backstage' generation of useful knowledge in areas where the relevance and meaning of diverse data, as well as key cause-effect relationships, are contested even among experts.

The NIC's approach undoubtedly begins from a strong statement of the power of analysis which is both rigorous and independent. Its approach to such analysis would seem to combine a number of somewhat different analytical methods and orientations. These include:

- Rosewell's understanding of the nature and role of technical infrastructure assessment and its place in the overall deliberative and decision-making system (summarised above and outlined in Chapter 9),

- the integrated cross-sectoral scenario-based exploration of long-term infrastructure policy needs, as developed by Hall and others at the IRTC, working within the system-of-systems approach (outlined in Chapter 9), and

- the conduct of detailed exploratory studies of key infrastructure policy priorities identified by government.

Indeed, the approach to each of these types of analysis, and the relationships between them, may warrant more detailed exploration and description. It is too early to say exactly how the types and strands of analytical work listed above will fit together and how each will involve sets of stakeholders. We are of the view that, while the preparation of a comprehensive Infrastructure Needs Assessment for the UK is the most prominent role of the NIC, its conduct of a number of specific studies (such as that on Crossrail 2 and the Oxford-MK-Cambridge corridor) might turn out to be the most influential aspect of its work. There are a number of reasons for this statement.

First, when a particular issue is designated by the UK Government as a priority area for study by the NIC, it creates an opportunity to put in place a process whereby key sectoral players must demonstrate how their specific sectoral strategies relate to the achievement of the goals of the priority area.

Second, in the policy studies work undertaken to date, the NIC is building collaborative relationships with a network of stakeholders and engaging with existing strategies and/or projects. An interesting aspect of the NIC's analytical work is its intention to undertake analysis of how the current infrastructure plans of key sectoral and geographic stakeholders correlate with its own National Infrastructure Assessment. Developing collaborative relationships with (mostly expert) stakeholders is also a feature of its work in preparing studies on the selected infrastructure policy priorities. This collaborative activity can serve to augment the type of horizontal and vertical coordination that is necessary to foster a more robust commitment to an agreed strategy across a diverse network of public and private actors.

Third, engaging with current government policy priorities gives the NIC an 'immediate' role and a degree of relevance within the policy system. It is certainly noteworthy that all of its recommendations in the first three completed reports, and also the interim report on the Oxford-Milton Keynes-Cambridge corridor, have been endorsed by the government.

Fourth, the policy recommendations in the individual reports are effectively the building blocks of the NIC's long-term vision for UK infrastructure and, as such, they may provide a bridge between current and medium-to-long-term policy actions. Overall, requests for NIC reports on specific infrastructure issues, and the commission's preparation and delivery of these, enables the NIC's thinking to be brought to bear on current policy issues and, *vice versa*, brings prevailing concerns into the arena of the commission's longer-term analysis.

However, despite its technical and analytical starting point, the NIC also emphasises links with political actors, aiming to build a high-level consensus on infrastructure issues. The political stature of the commissioners is important, as is their intention to actively network with political actors, and the emphasis on adopting a pragmatic iterative approach and commitment to work through the formal channels into the administrative and parliamentary systems. This includes being given a formal role in monitoring and reporting annually on the government's progress in delivering endorsed NIC policy recommendations.

These analytical and political strengths, if they materialise, are likely to enhance the NIC's ability to perform another critical function in infrastructure policy: coordination. As noted in Chapter 2, international research suggests that the two most scarce elements in infrastructure policy tend to be analytical capacity and 'institutions that properly address the governance challenge of coordination' (Anheier & Alter, 2016b). Indeed, Anheier and Alter see a link between these two, arguing that 'analytical capacity gives the institution the voice needed to discharge its coordination tasks legitimately and with authority in the context of policy decisions made or contested' (*ibid.*, 183).

By contrast with its analytical work, political networking and expert panels with regulatory and regional entities, the NIC's engagement with societal actors may be relatively underdeveloped. The Green Alliance believes that the NIC's approach to engagement is somewhat 'expert-centric' and that its overall approach remains very technocratic. The Green Alliance argues that opening up infrastructure planning necessitates a commitment to better, deeper and more structured public engagement (Green Alliance, 2015). It has outlined a design of new national and regional democratic institutions and processes that would focus on both securing a public mandate for new infrastructure and fostering greater societal consensus

around long-term infrastructure strategy. Senior figures in the NIC have stated that improving infrastructure planning and delivery necessitates deeper and more meaningful engagement with the public. Whether this involves one-way communication with the public or two-way dialogue remains to be seen. The Green Alliance's perspective, however, reaffirms Coelho *et al.*'s view that building greater shared understanding on contentious infrastructure projects requires the establishment of strong deliberative institutions with the capacity to engage effectively with politicians, experts, interest groups and local communities in the policy-making process (Coelho *et al.*, 2014).

Recognising that the NIC will combine analytical, political, coordinative, communicative and deliberative roles—and will display some features of a boundary organisation—still leaves open the question of its overall effect on both the balance of institutional influence and, in the end, the UK's infrastructure performance. Our approach and analysis of developments in UK infrastructure policy confirm the observation of Hammerschmid and Wegrich that, as regards the role of independent expert institutions, the key question is their fit into pre-existing institutional constellations, and their suggestion that administrative capacities offer a lens to explore this fit (Hammerschmid & Wegrich, forthcoming 2017: 37). To assess the likely effects of establishing an 'independent' expert infrastructural body, it is necessary to look in some detail at the existing administrative capacities: capacities to co-ordinate, to regulate societal actors, to implement and to deploy analytical capacities.

Their reading of the pre-existing constellation of capacities in the UK leads them to the following view of the overall effect of the establishment the NIC:

> For example, the UK National Infrastructure Commission is said to be independent—with the statutory basis for this independence expected to follow later in 2016—but 'it also works with HM Treasury' (HM Treasury, 2016b). It is hardly imaginable that this body will not strengthen the analytical capacity and hence influence of the Treasury. Indeed, the current set-up of the NIC's role puts the Treasury in the position to respond on behalf of the government to the recommendations developed by the commission. In other words, the NIC strengthens the analytical capacity of an already very strong player within the centralised governing system of the UK. Given the track record of the Treasury in imposing fundamental policy ideas on other departments (for a case study in the domain of economic policy-making and financialisation, see Davis and Walsh 2015), it seems highly unlikely that this arrangement will be politically neutral (*ibid.*, 37).

This may or may not be accurate; if it is, there will be divergent views on whether strengthening the 'centre' is a good or bad thing.

The devolution process has also served to strengthen local/regional institutional capacity, albeit in a geographically uneven fashion. The NIC, through both the National Infrastructure Assessment and its policy studies, is actively engaging with local coalitions of public and private actors. Devolution has clearly contributed to reworking the role of the state internally through changes in both centre-local relations and relations within city regions. Again, this may or may not be a positive development.

In as much as there are voices emphasising the independence of the commission, we are inclined to see it as possibly problematic for infrastructure policy and, indeed, for the NIC itself. Threats to the NIC itself could arise if, as some involved in the commission suggest, its seeks to achieve and exercise the kind of independence that characterises the Bank of England Monetary Policy Committee. For example, it could be argued that its work on infrastructure might lead the commission to a view on the need for a new approach to capturing the 'betterment' value of planning and infrastructure investment via local taxation. If the NIC was to articulate and strongly advocate a view on such a politically sensitive issue, it might risk making itself a political 'player'. This could provoke responses, from government and non-government political actors, that could undermine the NIC's status. This is not to suggest that a body such as the NIC can play no role in the analysis and discussion of important, politically significant issues and possibilities. But it is unlikely to be able to do so in the manner of the Bank of England.

As noted earlier, the leadership of the commission has placed a strong emphasis on its links with political actors, aiming to build high-level consensus on infrastructure issues. This will, in part, necessitate acknowledging the tensions between analysis and politics while attempting to forge a more constructive relationship (Anheier and Alter, 2016a). In this context, the key issue to consider is not that the UK has established a dedicated arms-length infrastructure institution *per se*, but whether this institution can have a positive impact on infrastructure policy in terms of:

- deliberations and proposals enhancing the quality of political decision-making, and

- contributing to better outcomes by meeting infrastructure needs with the quality intended (Anheier & Alter, 2016b).

4.4 Implications for Irish Infrastructural Policy

This paper presents evidence on the UK's evolving approach to infrastructure governance using concepts from international research on the knowledge-policy relationship and the role of expert bodies. Taken together, these strands of work suggest that, in the first instance, the key question to ask in Ireland is not whether to establish a NIC-type body, but rather to ask to what degree can Ireland develop approaches that link analysis, politics and wider stakeholder and societal interests in an effective way.

To answer this question, there is a need to engage with key policy actors in the area of infrastructure on the current policy approach, the degree of coordination, the analytical techniques and procedures, and the means of engaging experts and societal interests. This paper provides some initial information and insights that will support this discussion. One is that talk of 'depoliticising' infrastructure, and taking politics out of decision-making, is mistaken, or at least over-simplified. The account of recent changes in the UK makes this very clear.

Our overall analysis strongly suggests that there are reasons to believe that infrastructure delivery based primarily on 'objective analysis' and an effort to enthrone purely technocratic decision-making is likely to fail. First, political actors, especially government ministers with a democratic mandate, will reassert their prerogative; they are, probably correctly, unwilling to cede to others decision-making on big-ticket economic and social infrastructure. Secondly, society—in the form of a myriad interests and understandings—is likely to contest the outcome of supposedly objective analysis and the proposals of technocrats. This contestation can take various forms, from planning objections to protest and other forms of resistance. Thirdly, depoliticisation, achieved through strengthening the influence of technocratic actors, can exacerbate tensions on the social front, increasing contestation. Indeed, some observers see a connection between the degree of depoliticisation that has already occurred in countries such as Britain, in the form of unbundling and privatisation, and the decline in legitimacy, evident in increased contestation about infrastructure projects. Consequently, poorly conceived efforts to put analysis and technocracy in sole charge are likely to fail. Indeed, they could create 'the worst of all worlds' as elected political actors and interests in society find ways to thwart that dominance.

That said, the urge to depoliticise does reflect a real problem that needs careful consideration. The paper notes the perils associated with narrowly political decision-making on infrastructure: misalignment of time frames, prevarication on contentious issues and a focus on new projects at the expense of much-needed maintenance. Likewise, making infrastructure decisions in response to arguments

and pressure from uncoordinated lobbies and objectors is unlikely to serve long-term economic and social goals. Problems would also arise if decisions on infrastructure were overly influenced by the interests of the private corporations that have become increasingly powerful actors in some utilities and associated infrastructure areas. The long-term, integrated and technological nature of infrastructure—and its critical role in supporting the achievement of collective economic, social and environmental goals—means that, as well as having an unavoidable political and social element, it must be the subject of sophisticated and far-sighted analysis.

The issue, then, is how relations between the political, the analytic/technocratic and the social are structured, institutionalised and conducted in Ireland, and how they might be reconfigured and enhanced. If any of the three are too dominant, or under-developed, problems are likely to arise. It is likely that achieving the right balance between these three will require new procedures and possibly new institutional arrangements.

However, further work and discussion is required before one could reach a view on the precise institutional changes that are appropriate for Ireland. As happened in the UK, it seems prudent to begin by focusing attention on arrangements within government and to consider how the existing processes and arrangements could be enhanced.

Discussion with key policy actors is needed. This should consider a number of key aspects of our infrastructural system:

- the policy approach to infrastructure within the core government system,
- the degree of coordination between the many entities with an infrastructure role such as the Department of Public Expenditure and Reform (DPER), the National Transport Authority (NTA), the Ireland Strategic Investment Fund (ISIF), the National Development Finance Agency (NDFA), the European Investment Bank (EIB), EirGrid and Irish Water,
- analytical capacity within the policy system, including procedures for programme and project development, appraisal, decision-making and funding, and
- engagement with wider societal stakeholders.

Such discussion would help to flesh out key aspects of how the Irish system works in practice, to identify the types of institutional, policy and procedural changes that would contribute to enhancing the quality, effectiveness and efficiency of the decision-making process, and to ensure that Ireland develops a more effective, robust and realistic way of addressing the complexities inherent in infrastructure policy and planning.

PART II

Descriptions of Key Aspects of the UK Approach

Chapter 5: Changing Institutional, Policy and Analytical Landscape in the UK

5.1 Introduction

This chapter provides an overview of the changing institutional, policy and analytical landscape in the UK. As outlined in Chapter 1, there are important reasons to focus on the UK—in particular, its institutional similarities to Ireland and the extensive efforts in the last decade to enhance the arrangements and procedures associated with infrastructure.

Since 2009, a range of reports and a number of policy developments, taken together, have altered UK infrastructure policy. This section is structured as follows:

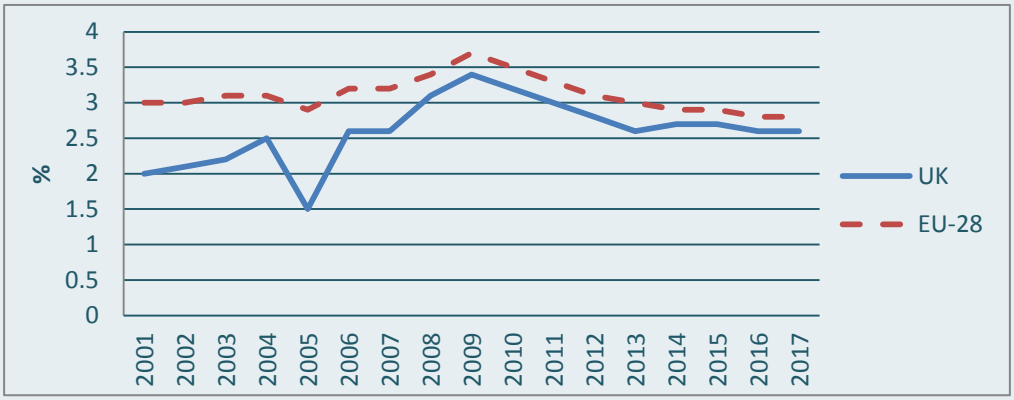
- Section 5.2 describes the trends in investment in infrastructure in the UK.
- Section 5.3 provides an overview of a number of influential reports on UK infrastructure policy.
- Section 5.4 outlines the main institutional developments between 2009 and 2016.
- Section 5.5 provides an overview of the emerging UK infrastructural landscape.

5.2 Infrastructure Investment in the UK

Infrastructure in the UK has suffered from protracted under-investment since the 1980s, especially in comparison to key competitor countries (Pisu *et al.*, 2015).

The UK's general government fixed capital expenditure has consistently lagged the EU average in the period 2000-2016 (Figure 5.1). Gross fixed capital formation (GFCF)—which includes public and private investment in all assets—investment trends in the UK are also lower than the EU average. In 2014 the G7 average for GFCF was 20.1 per cent compared to 17.6 per cent in the UK (Rhodes, 2016). Since 2008-10, public capital expenditure has been on a downward trajectory and it is projected that it will fall to as low as 1.5% of GDP before rising to 1.9% in 2020/21.

Figure 5.1: General Government Gross Fixed Capital Formation (% GDP)



Source: ECFIN, Statistical Annex of European Economy, spring 2016

In 2016 the UK was ranked ninth in terms of the overall quality of its infrastructure (World Economic Forum, 2016). Capacity constraints and investment gaps exist in key sectors such as water supply, waste management, energy, transport (road, rail and air) and digital communications generation (European Commission, 2016).

Infrastructure in the UK relies heavily on private-sector investment: 59 per cent of planned investment, in £50m+ projects, is from the private sector (Rhodes, 2016). The dominant headline position of private financing disguises the active role of the

state in the funding, financing, ownership, regulation and governance of national and local infrastructure (Helm, 2013). In the case of major or mega projects (for example, Crossrail in London), where the risk to the private sector of financing investment exclusively is too great, the state is the critical actor in convening financial institutions and orchestrating the funding, financing and governance of such infrastructure (IPA, 2016; O'Brien & Pike, 2015).

5.3 Overview of Key Reports on Infrastructure

Since 2009 a range of reports have indicated a growing momentum regarding the need to introduce institutional and policy change. They drew attention to the need to enhance the UK's capacity for longer-term strategic policy-making on infrastructure. Table 5.1 lists the reports and their main recommendations.

Table 5.1: Key Reports on UK Infrastructure Policy, 2009 to 2015

Date	Report	Main Recommendation
2009	Council for Science & Technology: 'National Infrastructure for the 21st Century'	Set up lead body for national infrastructure
2013	LSE Growth Commission: 'Investing for Prosperity'	Set up a National Infrastructure Strategy Board
2013	Armitt Review: 'An independent review of long term infrastructure planning'	Establish a statutory independent National Infrastructure Commission
2014	Institute of Civil Engineers: 'State of the Nation'	Improve long-term infrastructure policy and planning
2015	OECD Economic Survey UK, 2015, Pisu *et al.,* 2015 OECD Working Paper	Improve long-term infrastructure strategy

5.3.1 Council for Science and Technology (2009)

In 2009, the Council for Science and Technology concluded that the trajectory of national infrastructure development was no longer viable for three main reasons:

- increased fragmentation in the delivery and governance of national infrastructure,
- a critical need to improve resilience against systemic failures, and
- the need to meet significant challenges associated with climate and social change.

The council called for the government to appoint a lead body on infrastructure. It was argued that this would deliver a clear and consistent vision for national infrastructure to create certainty, address short and longer-term pressures, and attract investment into the UK. The report stated that the choice of the lead body should be a matter for government, but that in its view three organisations were well placed to take on this role: the Department of Business, Innovation and Skills, the Treasury or the Cabinet Office. The lead body would collaborate closely with an independent stakeholder group of business and other major players.

The subsequent decisions to establish Infrastructure UK and adopt the National Infrastructure Plan process are considered to have been heavily influenced by the findings of this particular study.

5.3.2 LSE Growth Commission (2013)

The LSE Growth Commission of 2013 (and Armitt Review discussed below) were particularly influential in the UK policy debate. In its final report, the LSE Growth Commission (2013) highlighted investment to improve the quality of national infrastructure as one of the three key areas in which policy and institutional reform was needed in order to sustain the UK's level of economic growth in a dynamic world economy.

> After years of inadequate investment in skills, infrastructure and innovation, there is a longstanding structural weaknesses in the economy, all rooted in a failure to achieve stable planning, strategic vision and a political consensus on the right policy to support growth (LSE Growth Commission, 2013: 1).

It called for the development of a new national-level institutional architecture, including a new independent National Infrastructure Strategy Board, to govern infrastructure strategy, delivery and financing. The three pillars of the proposed new architecture were:

- a National Infrastructure Strategy Board to provide independent expert advice to parliament to guide strategic priorities,

- an Infrastructure Planning Commission to support the implementation of these priorities, and

- an Infrastructure Bank to facilitate the provision of finance, and also bring necessary expertise and work with the private sector in sharing, managing and reducing investment risk in infrastructure assets.

It was argued that these interrelated institutional steps would serve to address short-termism, policy instability and implementation problems, and collectively create the strategic guiding vision required to stimulate the level and type of investment necessary to upgrade the quality of the UK's infrastructure.

5.3.3 The Armitt Review (2013)

The Armitt Review (2013), chaired by Sir John Armitt and commissioned by the Labour Party, highlighted the lack of a long-term strategy and weak political consensus that had resulted in policy uncertainty and poor decision-making. The lack of a coherent long-term strategy was viewed as intensifying the coordination challenges associated with the increasing number of actors involved in infrastructure provision and service delivery (see also (WRR, 2008). Rising private-sector participation since the 1980s in the absence of a coherent long-term infrastructure strategy, while improving efficiency and making service quality more responsive to client needs, may have led to sector fragmentation, impaired a cross-sector view of infrastructure and in some areas weakened accountability for investment to build sufficient long-term capacity (Armitt, 2013).

In reaffirming the need to adopt a longer-term national infrastructure strategy premised on more robust evidence-based assessment of need, the Armitt Review stressed that the delivery of such a strategy was dependent on strong and enduring political will. It focused on the institutional and procedural changes needed to not only facilitate longer-term strategic decision-making but also contribute to the forging of cross-party consensus to deliver on these decisions. In addressing this policy challenge, Armitt recommended the establishment of an independent

National Infrastructure Commission on a statutory basis. Its mandate would be to undertake an evidence-based assessment of the UK's infrastructure needs over a 25-30-year time horizon.

5.3.4 Institute of Civil Engineers (2014)

In its 2014 'State of the Nation Infrastructure Report', the Institution of Engineers noted that, since an earlier report in 2010, the case for infrastructure had been more effectively made by both government and industry. It also noted that various institutional and policy initiatives were underpinning the improved capacity to make the case for infrastructure. It suggested that the establishment of Infrastructure UK and the various iterations of the National Infrastructure Plan (NIP) were improving the way in which government and industry engaged. However, it stated that these institutional and policy improvements needed to be built upon.

5.3.5 OECD (2015)

The OECD (2015a) saw Infrastructure UK and its publication of annual National Infrastructure Plans as the first steps in the right direction towards providing a comprehensive view of the country's infrastructure needs and how government planned to meet them.

However, the OECD indicated that the UK needed to strengthen and improve its long-term infrastructure strategy. Pisu *et al.* (2015), in an OECD Staff Working Paper, recommended expanding the long-term infrastructure component of the NIP to assist in raising the level of debate on infrastructure needs and policies, thus contributing to less policy uncertainty.

5.4 Overview of Institutional Developments

5.4.1 Introduction

This section provides an overview of the key institutional developments in the UK since 2009. Table 5.2 summarises the key functions envisaged for each institutional development. The various institutional and policy initiatives outlined in Table 5.2 reflect the active and increasing role of the UK state in infrastructure policy and planning (Helm, 2013; O'Brien & Pike, 2015).

Table 5.2: Overview of Institutional Developments—2010 to date

Date	Report	Main Recommendation
2010	Infrastructure UK	Unit within the Treasury, responsible for NIP and Infrastructure Pipeline
2010-2014	National Infrastructure Plan (NIP)	Forward-looking assessment of long-term infrastructure needs and how planned projects would be funded
2016	National Infrastructure Delivery Plan	Successor to the National Infrastructure Plan (NIP)
2011	Major Projects Authority (MPA)	Part of the Cabinet Office to provide independent assurance and advice on major government infrastructure projects
2012-2016	UK Guarantee Scheme	Government financial guarantees to fund infrastructure projects
2012	Pensions Infrastructure Platform (PIP)	MOU between the government and major pension funds
2012	Green Investment Bank (GIB)	Government funding, with support from private sector, for green infrastructure
2015	British Wealth Funds	89 Local Authority Pension Funds to invest more in infrastructure
2016	Infrastructure Projects Authority (IPA) Merger of Infrastructure UK and the Major Projects Authority	To bring together public expertise in the financing, delivery and assurance of major projects into a single organisation reporting to the Chancellor of the Exchequer and Minister for the Cabinet Office
2015	National Infrastructure Commission (NIC)	To develop a long-term strategy for UK infrastructure, covering a 30-year timeframe
2014—2016	City Deals and Devolution Agreements	Rolling series of city and regional agreements

5.4.2 Infrastructure UK and National Infrastructure Plans

In 2010 the British Government established Infrastructure UK (IUK) as a unit within the Treasury to enable greater private-sector investment in infrastructure and improve long-term planning and delivery (Rhodes, 2016).

IUK was closely involved in the compilation of the National Infrastructure Plans, which were produced annually between 2010 and 2014. Since 2016 these are referred to as the National Infrastructure Delivery Plan (NIDP). The National Infrastructure Plans (NIPs) included a forward-looking assessment of the long-term infrastructure needs and outlined how planned infrastructure projects were to be funded.

The IUK was also responsible for publishing the annual Infrastructure Pipeline, a collation of all major projects worth more than £50m. The Infrastructure Pipeline was not an official statement of need, nor a commitment to necessarily support the undertaking of the projects listed. Rather, its purpose was to provide a credible overview of the potential level of public and private investment that was being planned and, in so doing, to give an indication of the future requirements from the construction sector and other industries. Ultimately, in key sectors such as energy, ports and waste, the decision to go ahead with individual projects would be primarily the responsibility of the relevant private-sector companies.

5.4.3 The Major Projects Authority

The Major Projects Authority (MPA) was established in 2011 as part of the Cabinet Office to provide independent assurance and advice on major government infrastructure projects. Projects supported by the MPA included IT projects, defence equipment procurement exercises and service delivery transformation initiatives. The MPA also had a role in capacity-building through providing project management training, advice and assistance.

5.4.4 Investment Initiatives and Incentives

Since 2010 the UK Government has also introduced a series of measures to attract increased institutional and capital market investment in infrastructure:

- UK Guarantee Scheme (UKGS 2012—2016).
- Pensions Infrastructure Platform (PIP).
- British Wealth Funds.
- Green Investment Bank (GIB).

These initiatives have not substantially changed the levels of private-sector investment in UK infrastructure, particularly from large institutional investors (OECD, 2015b).

5.4.5 The Infrastructure and Projects Authority

The Infrastructure Projects Authority (IPA) is designed to operate as the single government body to lead the management and delivery of major infrastructure projects across the UK. It is expected that it will bring together public expertise in the financing, delivery and assurance of major projects into a single organisation. These projects range from large-scale infrastructure projects, such as Crossrail, HS1 & HS2 and the Thames Tideway Tunnel, to major transformation programmes such as Universal Credit. The IPA will report to the Chancellor of the Exchequer and the Minister for the Cabinet Office.

A review of the experience of major infrastructure projects, published in January 2016 by the Infrastructure Projects Authority (but carried out by the MPA during 2015), highlighted the diverse and evolving nature of the state's role in planning, financing and delivering major infrastructure projects. Given the importance of these changes in the planning and delivery of infrastructure, Chapter 7 provides a summary of the IPA report.

5.4.6 City Deals and Devolution Agreements

In parallel to developments in infrastructure, the process of devolution was taking place. A key part of this was the programme of City Deals and Devolution Agreements.

City Deals were introduced to incentivise coalitions of local actors to develop strategies—in the areas of infrastructure, skills and business support—to unlock economic development. Each deal was a bespoke package of funding and devolved powers negotiated between central government and local authorities and/or local enterprise partnerships. Between July 2012 and March 2016, 34 city deals were concluded.

The government sought to build on the City Deals programme by enabling combined authorities to gain additional devolved powers through the negotiation of devolution agreements. Since 2014, 19 devolution deals have been agreed with 11 combined authorities and one unitary authority. The core powers that have been made available to most combined authorities include:

- responsibility for consolidated transport budgets and regional spatial planning,
- the capacity to facilitate development through the establishment of public land commissions and mayoral development corporations, and
- new revenue-raising powers.

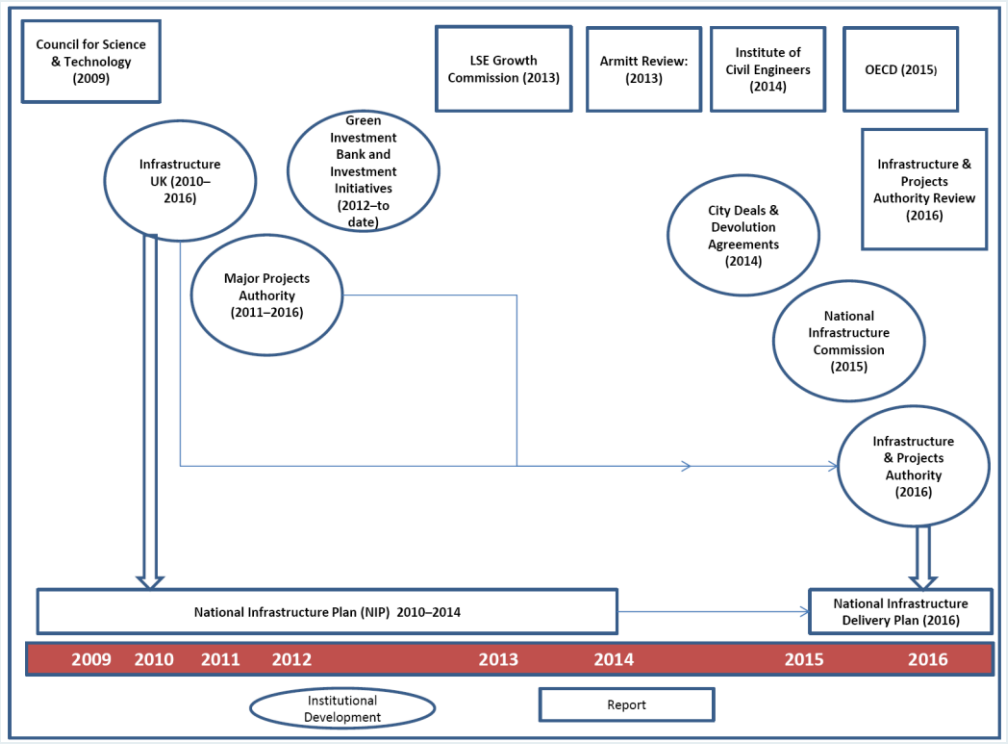
Devolution in England is most developed within the Greater Manchester Combined Authority (GMCA). Through the negotiation of City Deals and Devolution Agreements, the GMCA has acquired greater responsibility for aspects of transport, housing and planning, business support, business rates, training and public-sector reform. The powers given to the GMCA under devolution agreements have substantially enhanced its potential capacity to plan, finance, fund and deliver infrastructure developments.

Chapter 6 discusses the City Deals, Devolution Agreements and the example of the GMCA in further detail.

5.5 Conclusion

This section provides an overview of the emerging UK infrastructural landscape. It highlights the complexity and diversity of initiatives. Figure 5.2 illustrates the main institutional developments and notes some of the reports that have influenced the changes. It traces a time-line from 2009 to 2016. Across the top, it lists the key reports (in rectangular boxes); lower down in Figure 5.2, the key institutional and formal policy developments are listed.

Figure 5.2: UK Infrastructural Developments and Key Policy Reports, 2009-2016



The Figure 5.2 illustrates the ongoing nature of the transition in the UK towards a new approach to infrastructure.

To identify how specific institutional developments work, and crucially how to deal with tensions and trade-offs which tend to characterise decision-making on infrastructure, further detailed interviews were undertaken on two developments:

- City deals and devolution agreements.
- The National Infrastructure Commission.

Both are key developments in the UK story. The first is part of a major national drive to devolve power to regions. The NIC is the latest iteration in the ongoing drive to enhance the UK's approach to infrastructure policy and delivery.

In addition, we elaborate further, in Chapter 7, on the Infrastructure and Project Authority review, mentioned in Section 2.3.4. This provides detailed insights on the changing relationship between public and private-sector interests, in particular the growing realisation in the UK of the limits of what has been termed 'hands off, eyes on' approaches to the management of large contracts.

Chapter 6: Devolution and Local Action on Infrastructure

6.1 Introduction

A key driver of the changes that are taking place in decision-making on infrastructure in the UK is devolution. A central feature of devolution—for example in Scotland, in the City Deals and devolution deals—is the ways in which local stakeholders are using it as an opportunity to enhance how infrastructure is used to enable economic and social development.

This chapter briefly outlines how the devolved Scottish administration has approached the issue of spatial planning and infrastructure policy. It also looks at two central pillars of the UK government's approach to devolution, particularly in England: City Deals and Devolution Agreements. It provides a detailed case study of the Greater Manchester Combined Authority. The latter is the region of England that has been given the most extensive range of powers and responsibilities under this devolution agenda.

This chapter is structured as follows:

- Section 6.2: Revival of National Spatial Planning in Scotland
- Section 6.3: City Deals Programme
- Section 6.4: Devolution Agreements
- Section 6.5: Greater Manchester Combined Authority
- Section 6.6: Conclusion

6.2 Revival of National Spatial Planning in Scotland

The evolution of the Scottish devolved administration has been characterised by an increased focus on national spatial planning and infrastructure policy. Since the Scotland Act of 1998, the Scottish parliament has had full responsibility for spatial planning and related fields such as transport and local government (Colomb & Tomaney, 2016).

This period has witnessed a strong revival in government commitment to national spatial planning, with the publication of three National Planning Frameworks since 2003. This renewed emphasis on national spatial planning and the articulation of a strong vision for Scotland is intrinsically linked to the concept of civic nation-building that has increasingly dominated political and public discourse in Scotland (Colomb & Tomaney, 2016; Marshall, 2013).

The strategic and visionary element of planning is viewed as supporting the SNP's vision of an independent, prosperous and low-carbon Scotland (Tomaney & Colomb, 2013).

The National Planning Framework (NPF) is considered to represent the spatial expression of the government's economic policy and infrastructure investment strategy. Marshall notes that, over time, the NPF has become increasingly infrastructure-intensive. The most recent version, NPF 3, contains a list of 14 large-scale national capital projects that the government has identified as key to achieving its stated economic, social and environmental goals. The identification of these in the NPF does not necessarily mean that they will gain subsequent planning permission or funding. Rather, the aim of the NPF and associated planning policy is to guide and influence the investment decisions of the Scottish Government, public agencies, local planning authorities and private investors as well as the financing capacity of the devolved administration (Colomb & Tomaney, 2016).

The Scottish Executive have sought to guide planning decisions across a range of key sectors, including economic development, environment, climate change, transport and digital infrastructure. However, Colomb and Tomaney (2016) highlight that their capacity is constrained by a combination of their inability to borrow directly on capital markets to fund infrastructure and the UK parliament's retention of competence in key policy areas for influencing spatial development, notably taxation, energy and airports.

6.3 The City Deals Programme

The City Deals programme was designed to encourage coalitions of local state actors to develop strategies and prioritise actions in the areas of infrastructure, skills development and business support (O'Brien & Pike, 2015). Deals were negotiated by cities and central government, supported by the Cities Policy Unit in the Cabinet Office.

The deals were negotiated within a broader context of a sharp reduction in central government grants to local authorities, a tight squeeze on their revenue streams as part of national fiscal consolidation, and the imposition of a highly centralised system of controlling their ability to tax and spend. Additionally, the cities' capacity for self-financing prudential borrowing from the Public Works Loans Board (PWLB) was undermined by the decision to increase the cost of PWLB loans.

Box 6.1 provides an overview of the three waves of City Deals negotiated to date.

The City Deals process has served to incentivise coalitions of local state actors to develop strategies and identify and prioritise infrastructure propositions that went beyond parochial territorial interest (O'Brien & Pike, 2015). It has also been an effective device for stimulating local governance reform. Thirdly, the City Deals have empowered local actors to develop more bespoke and tailored approaches to economic development in which there is strong emphasis on the role of infrastructure investment in unlocking city-regional growth and development.

The funding and financing of infrastructure within these deals has been facilitated by public-sector grant funding or municipal borrowing and a mix of public and private investment. The process has also necessitated the adoption of a more robust *ex ante* evaluation and appraisal framework in which local actors must demonstrate how infrastructure investments contribute to generating broader strategic outcomes, including increases in GVA and employment and financial returns over long-term time-scales. A number of cities also developed single appraisal frameworks to enable them to more effectively prioritise investments (NAO, 2015).

Box 6.1: City Deals—An Overview

Wave 1: 2011—2012

This focused on the largest English cities (Core Cities) outside of London:

- Greater Birmingham
- Bristol City Region
- Leeds City Region
- Liverpool City Region
- Greater Manchester
- Newcastle City Region
- Nottingham City Region
- Sheffield City Region

Wave 2: 2012-2014

The next 14 largest cities and the next six cities with the highest population growth between 2001 and 2010.

Wave 3: 2014—to date

The process extended to the 'devolved administrations' with the negotiation of the Glasgow and Clyde City deal between the UK Government, the Scottish Government and the eight local authorities in the Glasgow Clyde Valley. Deals for Aberdeen City Region, Cardiff Region and the Inverness and Highland City Region. Ongoing negotiations in three cities: Swansea, Edinburgh and Tayside.

The City Deals process has encouraged the development of innovative approaches to financing urban infrastructure, including the GMCA's earn-back model, the Greater Cambridge Combined Authority's gain-share proposal, and the adoption of Tax Increment Financing to support urban regeneration in Newcastle, Sheffield and Nottingham (*ibid.)*.

At the same time, potential negative aspects of this process have been identified. The City Deals programme, it is argued, has facilitated the emergence of a deal-making approach to urban economic growth, in which there is a more transactional business-exchange-type relationship between central and local government. The deal-making process has also been described as opaque, informal and *ad hoc*, leading to a sense that the parameters of what was being negotiated were often unclear to participants. The fact that the deals were the product of 'closed'

negotiations between a relatively small number of elite local actors and senior civil servants has raised concerns about accountability and transparency.

City regions now also have the challenge of developing their capacity to manage, monitor and improve initiatives negotiated under the City Deals in the context of no additional resources for additional managerial responsibility and considerable reductions in funding for staff. At a time of reduced institutional resources and capacity within both central and local government, the efficiency and effectiveness of this rather *ad hoc*, complex and often protracted approach to policy-making has been questioned.

Although city regions were publicly encouraged to be creative and innovative in their proposals, the government was often unwilling to replicate innovative financing arrangements in a wider number of locations. In practice, the broader context of a tight fiscal space, allied to limitations on sub-national authorities taking on and servicing debt borrowings, effectively constrained the capacity of these actors to implement alternative infrastructure financing models. Finally, there has been an uneven geography to the infrastructure funding, financing and flexibilities that cities and city-regions have agreed with the UK and Scottish governments. While the bespoke nature of the individual City Deals means that any comparison is not strictly like-for-like, City Deals with a strong transport infrastructure component have secured the largest additional public investments.

The NAO (2015) suggests that City Deals demonstrate a new way of working between central and local government. In a more critical assessment of their impact, O'Brien and Pike contend that they have effectively reworked the role of the state internally through changes in both centre-local relations and relations within city-regions:

> Regional and urban policy is being recast as a process of deal-making founded upon territorial competition and negotiation between central and local actors unequally endowed with information and resources, leading to highly imbalanced and inequitable outcomes across the UK (O'Brien & Pike, 2015: 1).

6.4 Devolution Deals 2014—2016

Since 2014 the UK Government has sought to build on the progress delivered by the City Deals programme by enabling combined authorities to gain additional devolved powers through the negotiation of Devolution Agreements. As is the case with the City Deals programme, aside from a general emphasis on devolving power to the regions, the government has stipulated that it has no preconceived ideas about which powers should be devolved, to which areas and at what pace.

Rather the onus is on the requisite combined authorities to formulate a devolution proposal or 'bid', and this then becomes the basis of closed-door negotiations between a small number of combined authority representatives and senior government officials. If the negotiations reach a successful conclusion, the devolved deal is published and has to be ratified by each of the councils that comprise the relevant combined authority. Since 2014, 19 devolution deals have been agreed with 11 Combined Authorities and one unitary authority (Cornwall).

There has been a distinctly uneven pattern to the progress of devolution in English regions. In places such as Manchester and Sheffield, government policy has incentivised enhanced collaboration and innovation while in other regions competition between cities hampered progress. The asymmetrical nature of devolution across England reflects differences in the institutional capacity and ambition of regions.

The Greater Manchester Combined Authority has concluded five agreements, with the result that the scale and scope of devolution afforded to this authority exceeds the other English regions (Section 6.5 discusses this in more detail). Progress has also been evident in the Sheffield, Teeside and Liverpool regions.

In contrast, the North-East plan has virtually collapsed as four out of the seven local authorities voted against the new plan. Additionally, two other major areas in the North—North Yorkshire and West Yorkshire—have to date failed to reach agreement on a further deal due to internal differences between competing local authorities.

The devolution deals are 'a standard menu with specials' (Sandford, 2016). A number of core powers or items have been made available to most areas but each deal contains a few unique elements or specials, usually related to commitments to explore future policy options. The core powers that have been devolved (or made available) to most combined authorities are outlined Box 6.2.

The combination of responsibility for consolidated transport budgets and spatial planning, land commissions to facilitate development on public land, mayoral development corporations and new revenue-raising fiscal powers substantially enhances the role of combined authorities in infrastructure planning and investment. It means that infrastructure is at the heart of the devolution process and debate in the English regions.

Box 6.2: Core Powers Devolved or Made Available to Combined Authorities

Integrated Transport systems: Each deal included a unified multi-year transport investment budget in which there is a commitment to improving joint working between the combined authority and Network Rail, Highways England and, where appropriate, HS2 Ltd. The majority of the deals also involve devolving powers in relation to bus franchising and the introduction of 'smart ticketing'.

Planning and Land Use: Many of the deals incorporate the power to create a spatial land-use plan for the combined authority area, and also gives the mayor, once elected, the ability to establish Mayoral Development Corporations. In most cases, non-statutory land commissions/joint asset boards will be established to manage surplus public land and buildings. There are also proposals to allow the combined authorities to use compulsory purchase orders.

Fiscal Powers: All of the deals have included an investment fund of around £30m that can be allocated to capital and/or current expenditure. The power to retain 100 per cent of the growth in business rates is a feature of a number of the deals, and elected mayors will be able to add a supplement of up to two per cent, subject to the agreement of the local enterprise partnership

EU Structural Funds: A number of the areas have agreed to become intermediate bodies for the purpose of making decisions on the allocation of EU Structural Funds.

Business Support: Most of the agreements involved developing an agreed 'devolved' approach to providing business supports in their locality.

The Work Programme: Under the agreements, combined authorities will jointly develop initiatives, within the government's main welfare-to-work programme, targeted at harder-to-help clients.

6.5 Greater Manchester Combined Authority

6.5.1 Introduction

The Greater Manchester Combined Authority (GMCA), established in 2011, consists of the 10 Greater Manchester local authorities working together on a statutory basis to enable region-wide planning and coordination on key issues such as transport, housing, urban regeneration, public-sector reform and economic development.

Influenced in particular by the work of 'The Manchester Independent Economic Review' (MIER), the GMCA has pursued an explicit city-region-wide policy designed to harness the benefits of agglomeration economies by stimulating economic, employment and population growth (MIER, 2009). This emphasis on creating a dynamic and vibrant urban centre, which would function as the engine of economic growth for the wider Metropolitan City Economy, represents a formalisation and intensification of the pragmatic approach to facilitating private-sector-led development in the central boroughs that had been in place since the early 1980s (Folkman *et al.*, 2016). This reflected the view of many councillors—following the abolition of the Greater Manchester council in 1986 by the Conservative Government—that the only way to stimulate development in central Manchester was through activity promoting and facilitating private-sector-led development and regeneration.

The MIER analysis helped align all the partners behind a number of key priorities and facilitated the development of an agreed strategic framework for policy and decision-making. The GMCA subsequently updated and repositioned its strategy in 2013 with the publication of 'Stronger Together: The Greater Manchester Strategy'. This included a greater focus on public-service reform (particularly in relation to labour-market policies) and a stronger emphasis on delivery and implementation. This strategy has formed the basis for the GMCA's ongoing engagement and negotiations with central government on devolution of additional functional and fiscal responsibilities, which they see as necessary to undertake their role in shaping the development of both the region and places within in it.

In taking the lead on devolution in England, the GMCA has benefited from the strong history of collaboration between local authorities, dating back to the late 1980s (Tomaney & McCarthy, 2015). To date, the effectiveness of the GMCA on infrastructure development has been underpinned by a clear willingness to adopt a regional strategy that cuts across local interests and jurisdictional boundaries. Indeed, there is a strong view that what sets the GMCA apart from other English

region is its ability to develop effective and innovative forms of governance that have enabled it to capture benefits of contemporary economic change (OECD, 2015b).

The initial City Deal, by endorsing the Greater Manchester Investment Framework, augmented the GMCA's focus on articulating and integrating city-region infrastructure and economic development needs in a more planned and strategic manner. This region-wide investment framework enables existing funding streams to be combined within the one regional investment platform. This creates additional scale and enhances the capacity and flexibility of regional decision-making.

There has also been a strong tradition of working in partnership with business representative bodies in the region. The business-led local enterprise partnership has actually been a strong advocate of the GMCA's strategy of focusing on building a modern public transport system, whereas in other regions the relationship between the LEPS and local authorities has been more fractious. Indeed, officials from the GMCA contend that the support of the business community and in particular the LEP for their comprehensive public transport strategy was a factor in central government's endorsement of it.[1]

6.5.2 Policy focus in Manchester

Since 2012, and the first City Deal, GMCA has focused strongly on developing 'transformative' transport infrastructure, with an initial emphasis on providing good access into the centre of Manchester by upgrading and expanding the Metrolink, which is Greater Manchester's light-rail (tram) system. This focus on improving and enhancing public transport connectivity within the Metropolitan city-region, particularly to and within the central hub of Manchester, has resulted in the largest transport network development programme outside of London in recent years. The development of a modern light-rail system and other complementary public transport initiatives was financed through the Greater Manchester Transport Fund Programme.

The perceived success of an integrated approach to transport infrastructure development created a political willingness to strengthen further regional institutional capacity. The GMCA was the first Combined Authority to negotiate and

[1] Source: authors interviews, Manchester, November 2015.

endorse a devolution deal with the government in November 2014. They have concluded four subsequent deals, resulting in the Greater Manchester region being given greater responsibility for more aspects of transport, housing, spatial planning, business support and business rates, skills and training, and elements of public-sector reform, in particular services for 'workless' people and their families and services for children. Indeed, the scale and scope of devolution to the GMCA exceeds that given to any other English authority in this period.

Table 6.1 shows the policy areas devolved to the GMCA between 2014 and 2016. This includes new powers that will take effect in 2017, in the areas of strategic planning, land and housing.

Table 6.1: Selected Policy Areas Devolved to the GMCA 2014-17

Strategic Planning	Transport	Land and Housing	Finance
Statutory spatial framework	Devolved consolidated budget Enhanced Earn Back agreement Bus franchising Joint working with Highways England and Network Rail Smart ticketing	£300m recyclable Housing Investment Fund Exploring a Greater Manchester Land Commission Public Land Commission / joint assets board Housing Loan Fund Spatial Strategy Mayoral Development Corporations Compulsory purchase orders	Investment Fund Single consolidated funding pot Retention of 100% business growth rates Pilot retention of 100% business rate revenues Intermediate Body for EU Structural Funds Mayor Business Rate Supplement Community Infrastructure Levy

Source: Adapted from Sandford (2016)

Through the series of devolution agreements, the GMCA has acquired a number of additional powers—the Community Infrastructure Levy; a Mayoral Business rate supplement; greater retention of business rates, and an enhanced earn-back agreement (see Box 6.3). Together, these have the potential to enhance the GMCA's capacity to finance and fund future infrastructure investment.

Box 6.3: Earn-Back Model

As part of its initial City Deal, agreed with the UK government in 2012, the GMCA has implemented an innovative Earn-Back Model that will build on the original GM Transport Fund.

Central Government has agreed in principle that up to £1.2bn invested up front in regional transport infrastructure improvement will be 'paid back' to the combined authority as real economic growth occurs. The Transport for Greater Manchester planning team convinced the Department of Transport to accept an alternative cost-benefit/project appraisal approach premised on output, gross value added, productivity and financial payback.

The earn-back mechanism enables the GMCA to invest local funds in transport infrastructure, retain a share of the proceeds of the subsequent tax yield and then reinvest in further gross value-added-enhancing infrastructure linked to regional economic growth (O'Brien & Pike, 2015). This approach represents the establishment of the first ever UK city-region revolving infrastructure investment fund. It will operate over a thirty-year time span. It also meant that the relevant public actors had to be willing to take on greater risk as their financing model is premised on expected growth in economic activity, increased passenger numbers and property uplift.

Under the latest devolution deal, the GMCA has taken on more risk as it is now directly responsible for the Metrolink's 'fare box' revenues. Although there has been a strong focus on infrastructure within the GMCA's strategy, it recognises that the impact of its major transport investment schemes is ultimately dependent on implementing a complementary set of economic and social policies.

Under the model, the GMCA has responsibility for maximising gross value-added, though it does not have the powers and policies at a regional level to influence gross value added (Folkman *et al.*, 2016). However, others have argued that increased economic development and productivity will generate the additional revenue required to unlock further rounds of infrastructure investment (Voterra Partners, 2014).

At the same time, as with other regional bodies, the GMCA has to grapple with the implications of the central government's fiscal consolidation agenda, which has curbed traditional forms of current and capital expenditure.

In the GMCA, as in other regions, the government's willingness to cede additional powers is dependent on a commitment to governance reform, in particular the election of a mayor. Following the GMCA's first mayoral election in May 2017, the mayor has acquired responsibility for various policy areas, including the Housing Investment Fund, the Earn-Back Agreement, the transport budget and the spatial strategy. Interestingly, it is argued that the acquisition of powers in relation to statutory strategic planning and the subsequent publication of the draft Greater Manchester Strategic Framework (GMSF) have caused political tensions and a degree of uncertainty within the 'Manchester Model', in part because it involves moving powers upwards from the local to the city-region rather than downwards from the centre to the regional (Tomaney & McCarthy, 2015).

The influence of an emerging place-based development coalition is also evident in the investment activities of the Greater Manchester Local Authority Pension Fund (GMPF). In contrast to most UK-based pension funds, the GMPF has been increasingly willing to invest in commercial property and infrastructure within its own region, provided this accords with their prevailing risk strategy and overall investment portfolio.[2]

Furthermore, GMPF has recently announced a joint venture with the London Local Authority Pension Fund that will create a £500m investment fund that will target housing and other infrastructure, particularly along the routes of the new HS2 rail link. This willingness to adopt a more proactive approach to infrastructure appears to have been driven by its senior management, taking the clear position that investing in regional infrastructure is 'the right thing to do'.[3] Although the level of infrastructure investment is still relatively small compared to more active funds in other countries, the GMPF has signalled its intentions to increase the allocation to this asset class in coming years.

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2 Source: authors' interviews, November 2015.

3 *Ibid.*

6.5.3 The Northern Powerhouse

The devolution process in the North has also been reinforced by the government's commitment to the concept of a Northern Powerhouse, centred on Manchester, Liverpool, Sheffield, Leeds and Newcastle.

The emergence of the Northern Powerhouse reflects long-standing concerns about the need for spatial rebalancing and addressing the north-south divide (Colomb & Tomaney, 2016; OECD, 2015a). It also indicates the influence within regional policy of agglomeration economics and the emphasis on cities as the drivers of economic growth within meso-regions.

Through a combination of targeted investments and enhanced collaboration between metropolitan regions, the Northern Powerhouse aims to create a more dynamic, innovative and productive northern economy. In practice, it is part political brand, part strategy (Lee, 2016). This has enabled the government to effectively incorporate into the concept of a Northern Powerhouse a series of existing and new initiatives: the devolution deals, new investment in science and R&D, the establishment of Transport for the North, the High-Speed 2 Project (HS2) and investments in the North's road and rail network (Bradley-Depani *et al.*, 2016; Lee, 2016).

Transport for the North's (TfN) articulation of a pan-northern transport strategy has also served to reinforce the strong emphasis on the relationship between enhanced inter and intra-regional connectivity and regional economic development.[4] TfN is a collective endeavour that brings together all the northern transport authorities, combined authorities and local enterprise partnerships (business representatives). The government signalled that it would make it a formal statutory body in 2017. It has a partnership board made up of elected representatives, business representatives (LEPs) and representatives from central government and national transport agencies including Network Rail, the Highways Agency and HS2.

A recent report from the IPPR also identified infrastructure and connectivity as one of the four key drivers of the Northern economy—in conjunction with human capital, innovation and business support and leadership/policy development (Cox & Davies, 2014). It argues for a step-change in government policy, with large-scale government capital spending of up to £50bn required to leverage even greater private investment.

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[4] See http://www.transportforthenorth.com/

Although endorsing the potential economic benefits at the heart of the Northern Powerhouse, Lee (2016) contends that it has morphed into an increasingly fuzzy agenda (see also Tomaney and McCarthy, 2015). In fact, he argues, it has become essentially a generic, though politically powerful, brand for all government policy in the North. More specifically, he concludes that its potential impact will be limited by two contextual factors:

- a limited focus on education and skills, and
- the provision of quite small additional resources when compared to the scale of cuts imposed on local government spending.

Even strong advocates of the Northern Powerhouse are concerned that the overarching commitment to fiscal discipline could constrain the potential of the increased collaboration and policy innovation that has been evident in the North. At the same time, the Northern Powerhouse brand has been adopted by regional stakeholders to foster increased collaboration and make the case for additional investment and further devolution of powers to the region. Furthermore, an equivalent initiative, the 'Midlands Engine', has been established to support economic growth in the East and West Midlands. Although not yet on the same scale as the Northern Powerhouse, it may presage similar pan-regional developments in other areas of England (Bradley-Depani *et al.*, 2016).

6.5.4 Key Features of the GMCA

The proactive and innovative approach that the GMCA has taken to regional development in general, and transport infrastructure in particular, is based on a combination of institutional capacity-building, strong political leadership, a place-centred developmental ethos, effective regional coalitions, financial incentives and some devolution of financial and political authority. This combination of factors has created an institutional capacity and political willingness to take on additional powers and responsibilities in the context of the various city and devolution deals.

The GMCA has been at the vanguard of the devolution process in England. The adoption of the innovative Earn-Back Model potentially gives it the capacity to generate locally based revenue that can then be reinvested through a revolving infrastructure fund in other key infrastructure projects. Under the most recent devolution agreement, the directly elected mayor will have the power to create a statutory spatial development plan for the city-region, which will include provisions for employment, land, housing and infrastructure to 2033. The scope to establish a Land Commission and Development Corporations, moreover, give the GMCA the

potential to adopt a more strategic approach to active land management and urban regeneration.

The GMCA's economic development strategy has attracted considerable favourable comment since 2011 and it is often presented as the role model for other regional authorities in the UK. It is certainly apparent that Manchester city centre has been transformed in terms of new buildings, population increases and new employment opportunities. The creative deal-making by the GMCA and Manchester City Council has played a central role in this process. Additionally, the GMCA has overseen the largest investment in public transport outside of London in recent years.

Enabling the GMCA to acquire a broader range of powers and develop more innovative initiatives serves to demonstrate the potential of greater regional autonomy. It has also to some degree stimulated local authorities in other regions to adopt a more collaborative approach in an effort to attract the type of powers and resources given to the GMCA.

An alternative narrative of the development that has occurred is that, since the 1980s, city officials have effectively sponsored the transformation of the city by private developers who have invested heavily in office blocks and apartments (Folkman *et al.,* 2016). Folkham *et al.* argue that the GMCA's regional development strategy reinforces this trend and has served to format the city for exclusive growth, with gross internal inequalities that cannot be changed by upskilling workers or providing improved public transport links to deprived districts and boroughs. These authors also contend that the GMCA's strategy has been less than impressive in terms of stimulating private-sector job creation. Additionally, while central Manchester has experienced economic and employment growth, they argue that Greater Manchester has not pulled away from other British cities in terms of gross value added.

6.6 Conclusion

The combination of the City Deals programme, Devolution Agreements and the Northern Powerhouse agenda, by devolving increased power and resources to combined authorities, is reworking centre-local relations and relations within regions across England (Colomb & Tomaney, 2016; O'Brien & Pike, 2015). It has also driven reform in local governance arrangements by encouraging the establishment of combined authorities and securing commitments to have new directly elected mayors for these authorities.

The UK's devolution process has been criticised for lack of transparency and public consultation and has been characterised as a form of 'controlled' decentralisation in that the government very much determines what powers are ceded to the regions.

Given the focus of this paper it is evident that infrastructure policy has been at the heart of the devolution process in English regions. The combination of assuming responsibility for consolidated transport budgets and spatial planning, the setting-up of land commissions to facilitate development on public land, the power to establish mayoral development corporations to drive regeneration and potentially new revenue-raising fiscal powers substantially enhances the role of combined authorities in infrastructure planning and investment. Although the economic benefits of transport infrastructure tend to be overstated (Cox & Davies, 2014), major investment in infrastructure has come to be seen as having a potentially transformative impact on the Northern economy. At the same time, government reductions in centralised funding for local government could limit the potential benefits of the devolution initiatives.

It is also significant that Northern Connectivity was one of the first policy priority studies undertaken by the NIC. The positive endorsement of Transport for the North/Department of Transport proposals has added momentum to this strategy and also highlighted the interrelationship between the pursuit of regional issues and broader national strategic goals.

Additionally, bodies such as the Institute of Civil Engineers (ICE) (2016b), in calling for increased devolution, have emphasised the need for the government to give more power and flexibility for regional infrastructure planning and financing to regional bodies. The ICE has also proposed the establishment of Regional Infrastructure Forums with a remit to develop more customised regional infrastructure strategies.

The GMCA has acquired a more extensive range of powers compared to other English regions under the devolution process. As a result of a series of negotiated agreements the GMCA now has the potential to play a more active and strategic role in statutory spatial planning, housing supply, infrastructure provision and land management.

Critically, there has been a distinctly uneven pattern to the progress of devolution in English regions to date. In places such as Manchester and Sheffield, government policy has incentivised enhanced collaboration and innovation, while in other regions competition between cities has hampered progress. The asymmetrical nature of devolution across England also reflects differences in the institutional capacity and ambition of regions. In the case of the GMCA, local leaders have displayed a willingness to gradually take on a wider range of policy areas and

commitment to policy innovation. This proactive approach has not been as evident in all regions. Equally, it has been argued that government rhetoric has not been matched by willingness to mainstream some of the more innovative and potentially costly policy options.

Commenting on the variable pattern of devolution, Colomb and Tomaney conclude that:

> This pragmatic, deal-making and discretionary approach to devolution has the potential to create a complex, multi-speed system in England, which combined with processes of central government funding allocation, could reshape and accentuate patterns of uneven economic development (*ibid.*, 11).

Alternatively, the negotiation of bespoke deals and selective devolution to ready and able regions is seen as the most effective and appropriate approach as it enables those regions with the requisite institutional and governance capacity to proceed, rather than waiting until all regions are in the same position (RSA, 2014). There is certainly merit in the view that affording the GMCA the scope to develop more innovative initiatives serves to demonstrate the potential of greater regional autonomy. It has also to some degree stimulated local authorities in other regions to adopt a more collaborative approach in an effort to attract the type of powers and resources given to the GMCA. The experience of the devolved administrations—Scotland, Wales and Northern Ireland—also suggests that devolution is more of a process than a one-off event (Alexander, 2007). It is still unclear whether other English regions will be able to negotiate their own progressive agreements or will continue to remain small-scale and 'sub-Manchester' in content. This, however, still leaves open the question of the economic and social outcomes generated by such regional strategies. While there is agreement that the GMCA, for example, has been to the forefront in terms of pursuing and acquiring devolved powers, the impact of its policies in terms of urban regeneration, democratic governance and regional economic development remain contested.

Chapter 7: Insights from Major Capital Projects in the UK

7.1 Introduction

The UK has delivered, or is in the process of delivering, a number of high-profile major capital programmes. Lessons learned from their delivery have been applied to the design of subsequent programmes. For example, the lessons from the Olympics and Crossrail are being used in the design of the delivery arrangements for HS2 (High Speed 2—the proposed railway line from London to Birmingham).

An execution strategy with common elements has emerged that attempts to address the challenges inherent in these programmes. The Infrastructure and Projects Authority, supported by Deloitte, published a paper to draw together some aspects of this experience. It was based on a review of case-study experience, and discussions with leaders from the programmes. The objective was to inform the design and delivery of future major capital programmes.

Whilst the context of each major infrastructure project—including the market, regulatory and statutory environment—has differed in each case, a number of broad trends have emerged in the delivery strategies adopted for recent major capital programmes in the UK.

The paper notes that the largest public-sector capital programmes face particular challenges: they are 'too big to fail', are very expensive, even in the context of public finances, and involve high levels of inherent uncertainty and risk. The examples cited demonstrate the evolution of a programme delivery strategy that has responded to these challenges.

The paper provides important insights which highlight that, contrary to what proponents of new public management might predict, more rather than less public-sector involvement is necessary to ensure that infrastructure is delivered effectively and efficiently. This involvement is facilitated by collaborative or cooperative contractual arrangements that allocate risk more effectively than the highly contractual arms-length approach adopted earlier. This type of collaboration and

the complexity associated with major projects has resulted in improved capabilities within the public sector. Drawing heavily on the IPA paper, this chapter examines these insights and innovations in further detail. It is structured as follows:

- Section 7.2: Need for significant public-sector involvement to enable private sector delivery.
- Section 7.3: The emergence of new ways of working across government.
- Section 7.4: Collaborative contracting methods to help mitigate risk and improve efficiency.
- Section 7.5: Why enhanced public-sector capability is needed.

7.2 Substantial Public-Sector Involvement is Needed to Enable Private-Sector Delivery

In recent years, effective delivery strategies for major capital programmes have been built around a more nuanced boundary between the private and public sectors. There is renewed recognition that a greater role for the public sector is needed to help create the conditions in which the private sector can deliver successfully. In recent major capital programmes, the role of the public sector has been substantial, as sponsor, client and sometimes partner in the delivery organisation, and the public sector has been required to take on some of the roles that, in previous arrangements, it had attempted to transfer to the supply chain.

Previously, in major capital programmes, there was an attempt to package up a significant portion of the client role and contract with a single 'prime' supplier. This, the IPA report notes, 'was driven by a view that the public sector could be reduced in size, thereby cutting direct costs, and that the expertise to act as a client was more readily available in the private sector' (IPA, 2016: 5). However, experience demonstrated that this did not always work.

The paper argues that the strengthening of the public-sector role in recent major capital programmes has reflected the challenge of transferring in a meaningful way bulk risk in major capital programmes to private-sector suppliers, which is a prerequisite to incentivise and hold private-sector providers to account. There are, the paper argues, two main challenges that need to be considered.

First, the scale and complexity of these programmes means that the private sector is often not the natural 'owner' of the risk of unsuccessful outcomes and is, therefore, unwilling or unable to take responsibility for the required levels of risk. By definition, major capital programmes have a broad set of risks that no single private-sector company is likely to be able to manage or offset. In other cases, it may be that no organisation has a balance sheet sufficiently strong to take on overall programme risk. This was one of the considerations that led to the management of Crossrail by a public-sector-controlled entity. As a corollary to this, companies are likely to charge a high premium where they are asked to take on risk for major capital programmes with high levels of uncertainty which they cannot control. In response, contracts were designed to allow risk and opportunities to be shared.Box 7.1 Box 7.1 provides an example.

Box 7.1: Heathrow Terminal 5

In this project, 'the client holds all the risk, all of the time'. Contracts were let to Tier 1 suppliers on a cost-plus basis, with profit margins held in project-by-project incentive pots, calculated by Heathrow Airport Holdings Ltd (formerly BAA), through pricing of risks and opportunities with the supply chain. The incentive pot remaining at the end of the programme was split on a 50:50 basis. The only Tier 1 contractor 'liability' was a reduction in the proportion of the incentive pot that they might receive. This aligned BAA and Tier 1 contractor objectives around effective risk management, contributed to a culture of collaboration for mutual benefit, and prevented costly and disruptive litigation (IPA, 2016).

Second, these programmes are often of national importance. Government cannot tolerate delivery failure, and, if delivery failure is imminent, it is typically required to step in regardless of the contractual position. An example was the use of the armed forces to provide security at the Olympic Games.

In the context of major capital programmes, the public sector also needs to counteract supplier-side power. This may be either because of monopolistic characteristics in the industry, or because incumbent private-sector suppliers are the only organisations capable of continuing to deliver the programme regardless of their performance. Understanding market conditions will enable the client to take an informed view of the most appropriate commercial approach. In some cases, the paper argues, 'this may include market building in order to introduce an element of competition' (*ibid.*: 7).

The scale and complexity of the challenges faced by major capital programmes create an environment where it is difficult to develop a meaningful single contract for the entirety of the programme. The experience of the London Underground Public Private Partnership contracts illustrates this point (Box 7.2). Importantly, the IPA paper notes that it 'is a challenging task to specify time, cost and quality outcomes in major capital programmes without creating perverse incentives' (*ibid.:* 8).

Citing various defence and other projects, the paper observes: 'This move to a "hands off, eyes on" approach was symptomatic of the general trend at that time towards cost reduction in the public sector and a reliance on private sector innovation' (*ibid.*: 8).

Box 7.2: London Underground

Recognising the need to exercise control over very large private-sector consortia, the response was to create lengthy and detailed contracts, which attempted to anticipate and provide for the whole range of programme management and operational circumstances that might occur. This was supported by a fully staffed arbitrator. Not only was the contracting process itself very long and costly—the contracts took up to four years to reach financial close, with two years of negotiations from best and final offers—but the management of the contracts required significant investment from the 'thin' client to oversee the performance of the contractors. In effect, this meant paying twice for programme management, to the supplier to manage, and to London Underground.

7.3 Major Capital Programmes Require New Ways of Working in the Centre of Government

The major capital programmes discussed in the IPA document were delivered through more innovative, collaborative and flexible ways of working at the centre of government (the sponsor level) and between government and public-sector client bodies.

The traditional government structures and ways of working—with the Treasury setting annual spending limits, departments defining policy and delivering, and the

Treasury holding departments to account—were judged in some cases to be inappropriate for managing government interests in major capital programmes.

In some cases—notably London 2012, Crossrail and HS2— a much more collaborative approach to managing government's role as sponsor has been developed. This is particularly apparent in the more involved approach taken by the Treasury, Cabinet Office and the relevant department to the design and operation of the major programme operating environment. It has often meant the creation of joint sponsor boards (e.g. London 2012, HS2), enabling the interests of all the relevant Whitehall departments to be represented. In the case of Crossrail, a Crossrail Sponsor Board was established, with both the Department for Transport (DfT) and Transport for London (TfL) represented.

A number of flexibilities, compared to the 'normal' public-sector operating environment, are now evident. Each is a result of a more considered approach to managing greater uncertainty and financial risks.

First, in many cases, the Treasury has taken a much more active interest in creating the conditions that enable the public sector to manage financial risk, aligning the capability to manage risk with programme accountability in a more transparent way. In high-risk major programmes that are 'too big to fail', the Treasury has chosen to hold ultimate financial liability in a role, implicitly or explicitly, akin to that of an insurer. This has the important implication: 'that the Treasury has therefore needed to understand the underlying cost model and risks to a much greater degree than in the 'normal' course of its public spending control activity' (IPA, 2016: 9). To do that effectively, it has to be engaged early in the programme, working closely with the sponsor department as an active partner in the programme's development. London 2012, Crossrail and HS2 are all cited as demonstrating how this has worked.

Second, the approach to funding has changed. The traditional approach to securing funding for large programmes has been to develop a 'Main Gate' final business case, through its various stages for final financial and political (including parliamentary) approval before the programme can commence in earnest. This approach has been supplemented in programmes such as Crossrail and HS2 with a stage gate 'Review Point' process, whereby financial and procurement authorities are delegated only once departments and the Treasury have confidence in budgetary certainty and the plan for delivery. This has been because it is questionable whether, for programmes with such uncertain and risky characteristics, sufficient certainty can be created so as to 'cost out' the entire programme, which may last for decades, for a one-off approval (*ibid.*: 9).

Third, the cases highlight substantial changes in the standard sequence of decision-making. The paper points out that decisions on execution strategy are needed well in advance of decisions on major funding commitments; and both these decisions could potentially be required at a different time from when it makes most sense to obtain political and parliamentary approval. For example, at Sellafield, regular review points drive efficiency, allowing project teams to relay cost information to the Nuclear Decommissioning Authority (NDA) as the programme's scope becomes clearer and risks mature. In cases where the programme is subject to considerable uncertainty (for example, where there are high levels of technological innovation), a formal structured set of contingency arrangements that can be drawn down over time has proved helpful. These are underpinned by the development of a thorough understanding of risks at the outset of the programme, with the potential to allocate elements of the contingency to particular risks. Maintaining this clarity builds confidence in delivery and supports collaboration through openness between stakeholders.

Fourth, there is flexibility across multi-year budgets. Annualised budgets for multi-year programmes are undoubtedly a key financial control mechanism intended to mitigate against potentially wasteful underspends, which is of particular importance in times of public spending constraint. However, the IPA point outs, successful management of very large, long-term capital programmes has benefited from the ability to move resource between years, as risks materialise and the programme matures. The development of structured, multi-year contingency funding cannot be easily accommodated within conventional annualised budgets. Other financial flexibilities that have proved useful for programme budgets have included the ability to move resource between revenue and capital expenditure as required.

7.4 Collaborative Contracting Methods Help Mitigate Risk and Improve Efficiency

The IPA paper emphasises the degree to which enabling and incentivising successful private-sector delivery has required the public sector to create and manage a sophisticated commercial and project control environment, and to oversee the long-term development and maintenance of scarce skills. The development of a more sophisticated operating environment has manifested itself in a range of features. These include the development of more collaborative approaches to commercial arrangements, the design of more sophisticated programme control architectures, and the involvement of the public sector in ensuring that private-sector capability is in place.

The traditional UK approach to contracting and commercial strategies involved clear delineation between the client and the supply chain, perhaps facilitated by delivery partners, with an objective of transferring as much risk as possible out of the client organisation. But this encouraged some inefficient practices within the supply chain and client, with the fear of litigation resulting in closed books and opaque cost-tracking.

The programmes reviewed in the IPA paper highlight two key changes.

First, a move away from a 'prime' relationship with a contractor to whom risk is passed. This means that the public sector has contracted with a more disaggregated supply chain. This has encouraged private-sector involvement at more attractive prices, motivated by targeted incentives around manageable packets of work, focusing on collaborative risk mitigation.

Second, more collaborative commercial arrangements have been developed. Both clients and contractors are seeking many of the same certainties, specifically in terms of cost, delivery timescales and quality standards. The paper notes that:

> Contrary to previous practice, it has been shown that collaborative working facilitates this and is particularly successful when risk is held at the right level, not necessarily transferred to the supply chain. Contracting methods have changed over the past 20 years, with a trend towards collaborative and new standardised commercial arrangements between the public and private sector. Contracting structures have moved away from procurement of a 'product' and towards incentivising joint delivery of a common endeavour (IPA, 2016: 11).

Such approaches have become standardised over time 'with the express intention of moving away from confrontational negotiation around minutiae and towards a stronger focus on more substantive matters that are bespoke to the programme in question, often termed outcome-based contracting or cardinal point specifications. Disaggregating the supply chain to reduce supplier power creates the risk of complexity, but standardised contracts such as the New Engineering Contract (NEC) help mitigate this risk'.

In the case of Terminal 5, BAA created a commercial 'alliance' structure. All 'Tier 1 contractors signed up to the 'T5 Agreement', a document which doubled as a working handbook as well as a legally binding agreement:

> The partnership approach that BAA adopted required all contractors to work collaboratively in fully-integrated transparent teams. This allowed the supply chain to focus on risk management rather than litigation

> avoidance which, combined with a gainshare mechanism, encouraged best-in-class performance… Importantly, this departure from traditional contracting methods required a step change in culture for many of the supply chain organisations (*ibid.*: 12).

The more recent trend towards 'alliancing' continues on the collaborative theme, as an explicit attempt to secure the benefits of disaggregating supply while mitigating the integration risk that comes with moving away from a prime contractor model. It also represents a shift away from bilateral arrangements between a supplier and the client, to multilateral relationships between numerous suppliers and the client, with the aim of strengthening collaboration.

Experience suggests that, within an alliance, all parties need to have 'skin in the game' and be incentivised to work as a partnership. Incentives need to be large enough to motivate collaborative behaviour. Furthermore, given that major programmes are long-term, stretching over many years (and sometimes decades), alliances need to be sufficiently flexible to accommodate varying levels of supplier primacy at different phases of the programme.

Third, a robust framework that enables the client to exercise the required control over programmes has proved to be an important component of recent successful execution strategies. In a highly complex operating environment with much enhanced client responsibility, multilateral contracts and high levels of uncertainty, the public-sector client has needed to satisfy itself that the programme is proceeding as planned, and that it can intervene if required. A well-designed programme control framework, underpinned by data architecture that gives the client real-time, independent overview of programme progress, has become a key aspect of successful major capital programmes in the UK, enabling timely and evidence-based decisions to be made.

7.5 Projects and New Ways of Working Require much Enhanced Public-Sector Capability

The IPA paper highlights the degree to which the more complex context for infrastructure development has required improved public-sector capacity in order to fulfil an enhanced 'client' role. It is also leading to greater investment in specific private-sector skill deficits.

In relation to the public sector, the programmes reviewed in the report used different combinations of in-house skill development, external support and the

tactical or strategic use of delivery partners, to develop the required capability. While additional capability is sometimes bought in, recent experience of major capital programmes suggests that the appointment of strategic delivery partners has not always proved the optimal way of developing capability, in particular for longer-term programmes and enterprises. For example, HS2 decided from the outset to build its capability internally, without reliance on external partners, with particular regard to the fact that it will require this client capability over a long timeframe. Similarly, Crossrail found that the size and cost of its delivery partners started to increase, and thus it moved to a strategy based on building up its internal understanding of project management processes, leading to less reliance on its partner organisations.

The major projects discussed have also been characterised by evolving delivery arrangements and different degrees of delegation. A common feature of these programmes has been progressive delegation of authority as confidence in the competence of the client and the supply chain has increased, and the nature of the decisions has changed from being mostly strategic to mostly tactical. In some cases, rather than being planned at the outset, the evolution of client structures and capability has been in response to a change in delivery strategy during operation; for example, recent changes at Sellafield, and the evolution of approaches to client capability in Crossrail.

In addition, in many recent UK infrastructure projects, such as London 2012 and Crossrail, the response of the public sector has been to set up bespoke entities that are able to create the conditions for success (Box 7.3). This can make it easier to develop fit-for-purpose arrangements and organisational cultures that enable programme delivery, without constraint from existing governance, processes and ways of working. But setting up a new organisation is not a prerequisite for success. In some cases, amendments have been made within existing organisations to create some of the required enabling conditions; for example, the establishment of the Rail Executive within the Department of Transport.

Box 7.3: HS2—A Bespoke Delivery Organisation

A decision was made to set up HS2 Ltd as a non-departmental public body, still answerable to the public but with bespoke freedoms and flexibilities to deliver this major infrastructure programme. The sponsor and programme organisations are supported by structures, such as governance and financial arrangements, which are appropriate for the HS2 programme. The financial freedoms afforded to HS2 Ltd have allowed the programme to offer competitive remuneration packages to attract talent.

Finally, the IPA highlights the fact that a product of the increased collaboration is increased investment in the private-sector skill base. Skills shortages in specific industries and regions in the UK have proved challenging for major programmes. Under certain circumstances, the market has been incapable of providing these skills in the timeframes required; in particular, niche skills without broader market demand where long-term training is required. Examples include engineering skills in nuclear decommissioning and railway signalling. Leaders of such programmes have been required to focus on longer-term skills planning rather than relying on the supply chain. For example, the UK lacks people with the right skillsets to deliver high-speed rail programmes. HS2 has thus committed to establishing a college for the next generation of engineers. In a similar fashion, Crossrail established a Tunnelling and Underground Construction Academy with the objective of ensuring it had the skills it needed for construction. The Nuclear Decommissioning Authority has developed the case for a National Skills Academy for Nuclear (NSAN), part-funded a new £20m centre of excellence for skills and training in West Cumbria, supported the creation of around 400 apprenticeships, and launched the national Nuclear Graduates scheme.

Chapter 8: The National Infrastructure Commission

8.1 Introduction

This chapter focuses on the National Infrastructure Commission (NIC), established in October 2015. It argues that, viewed in the context of the wider changes in UK infrastructure policy, the NIC can be seen as an attempt to create a more effective combination of technical analysis, political decision making, and coordination among expert and societal interests.

The chapter is structured as follows:

- Section 8.2: Establishment and governance structure.
- Section 8.3: Commissions' mandate and analytical functions.
- Section 8.4: The political dimension and NIC independence.
- Section 8.5: Coordinative capacity and societal engagement.
- Section 8.6: Conclusions.

8.2 Establishment and Governance Structure

Over a decade or more, there was within the UK infrastructure policy community a growing consensus on the need for new thinking and new approaches to the planning, governance, financing, managing and delivery of infrastructure.

The National Infrastructure Commission (NIC) was established with the aim of enabling long-term strategic decision-making to build effective and efficient infrastructure in the UK. The establishment of the NIC was accompanied by a formal

recognition that the prevailing strategic approach to infrastructure planning was not fit for purpose (HM Treasury, 2016b).

By providing an overarching and independent process for assessing long-term infrastructure needs, the NIC aims to achieve three interrelated objectives:

- Foster long-term and sustainable economic growth across all regions of the UK.
- Improve the UK's international competitiveness.
- Improve the quality of life for those living in the UK.

In 2016, the Treasury initiated a public consultation on the governance, structure and operation of the NIC, complemented by a process of direct engagement with a range of infrastructure stakeholders (*ibid.*).

In its formal response to the public consultation, the government outlined its initial intention to establish the NIC as a Non-Departmental Public Body (NPDB) via primary legislation.[5] An NDPB is a body which has a role in the processes of national government, but is not a government department or part of one, and which accordingly operates to a greater or lesser extent at arm's length from ministers. In the 2016 Queen's Speech it was announced that the NIC would be placed on a permanent, independent and statutory footing as part of a forthcoming Neighbourhood Planning and Infrastructure Bill (Rhodes, 2016). Surprisingly the government introduced the legislation in September 2015 without any reference to the NIC. This decision generated criticism from a number of commentators and professional bodies who argued that it created unnecessary uncertainty in addition to potentially undermining the NIC's future authority and effectiveness (Plimmer, 2016).

Despite some initial equivocal statements regarding the future statutory status of the NIC,[6] the new UK Chancellor, Philip Hammond, subsequently endorsed the NIC, affirming that this institution would be at the heart of the government's plans to

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5 The NIC's classification as an NPDB will ultimately be a matter for the Office of National Statistics and the Cabinet Office; as such, the aim is to work towards meeting the relevant criteria that would facilitate the commission achieving this status (HM Treasury, 2016a).

6 When Chancellor Philip Hammond appeared before the House of Lords Select Committee on Economic Affairs (08/09/16), he was asked directly if he intended to make the NIC a statutory body. In reply, he merely confirmed a commitment to work with the NIC to drive a new approach to infrastructure policy (House of Lords, 2016).

modernise UK infrastructure.[7] The NIC has since been established as a permanent executive agency of HM Treasury, and it has been stipulated that it will operate independently and at arm's length from government.[8] Increased government investment in productive infrastructure was also a central theme of the chancellor's Autumn Statement.[9] Furthermore, in highlighting the need for sustained investment in infrastructure and innovation to make a lasting difference to the UK's productivity performance, the chancellor affirmed that he had formally asked the NIC to make its recommendations on the future infrastructure needs of the country.

The NIC is managed by a board of commissioners chaired by Lord Adonis, the former Labour Minister for Transport, with Sir John Armitt serving as deputy chair. [10] All the commissioners were appointed by government, and the reputation, status and expertise of this grouping is viewed as a key organisational asset.[11] From the outset, Lord Adonis has appeared to adopt a hands-on, day-to-day approach to the NIC's work and is, to an extent, the public face of the commission.[12] At the same time, the CEO is responsible for the NIC's overall work programme and leading its ongoing engagement with government departments and key stakeholders in the public and private sectors. The NIC has started with a relatively small number of core staff (around 30). It has the capacity, however, to commission research from the public and private sector, and it is also anticipated that it will be given the capacity to draw on expertise from other government departments and arms-length bodies.

The UK Government has committed to issuing a formal response to all recommendations contained in the NIC's various reports, preferably within six months of their issuance and never later than 12 months (HM Government, 2016). NIC recommendations that the government agrees with will become 'endorsed recommendations'. Where the government is responsible for delivering 'endorsed

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7 Philip Hammond MP, Speech to Tory Party Conference, 3/10/2016 (unauthored, 2016).

8 Charter for the National Infrastructure Commission. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/559269/NIC_charter_6_final.pdf

9 Philip Hammond MP, Autumn Statement (Hammond, 2016).

10 The establishment of a National Infrastructure Commission had been a central element of the Labour Party's election manifesto. The CEO of the commission is also on the management board, along with the appointed commissioners.

11 Brief biographies of the commissioners and the CEO are available at https://www.gov.uk/government/organisations/national-infrastructure-commission

12 A senior UK civil servant suggested that Lord Adonis was *de facto* the actual head of the organisation (authors' interview, May 2016).

recommendations', endorsement will be a statement of government policy. In instances where the government rejects a commission recommendation, it may put forward an alternative proposal.

In seeking to deliver endorsed recommendations, the government has stated that it will draw on a range of appropriate policy levers, including spending, regulation, deregulation, market stimulation and the setting of strategic priorities for regulators (*ibid.*). Additionally, the government outlined, in its response to the public consultation on the NIC, its commitment to introduce a series of measures to reform the planning system to ensure that endorsed recommendations can be taken forward more swiftly (HM Treasury, 2016b).

The NIC's chief executive argued that its establishment was a pivotal moment for UK infrastructure planning and investment:

> Muddling through is not the answer. The National Infrastructure Commission marks a clear break from siloed, short term thinking. Rigorous, independent thinking, backed by an open and transparent approach, can make a real difference' (Graham, 2016).

It has, in his view, the potential to enhance strategic infrastructure planning by:

- articulating a shared vision of national infrastructure needs,
- establishing the strategic priorities that government should focus on, and
- providing policy recommendations to government, within the context of the fiscal remit that it sets (*ibid.)*.

Noting the long-term trends in state capital expenditure, the CEO has argued that the real challenge for the UK is how to ensure investment in strategically important infrastructure in a period of lower overall public investment (*ibid.*). He suggested that, if the UK Government was serious about improving quality of life and economic performance, there had to be a shift in emphasis from addressing current infrastructure constraints towards more strategic forward-looking investments that enable growth and open up new economic and social possibilities.

In his 2017 Autumn Statement, the chancellor indicated that the government plans to boost infrastructure investment over the period 2017-2020, and has given the NIC a key role in establishing long-term infrastructure priorities.

The chancellor is to issue an annual letter to the NIC setting out the fiscal remit for the organisation, based on the government's broader fiscal envelope. This 'fiscal remit' will apply to all NIC recommendations that have public spending implications, whether set out in the NIA or in individual policy studies. The government argues that this will ensure that the commission considers the affordability of different options and delivers realistic recommendations. Although it is accepted that the NIC should be mindful of the broader economic and political realities, concern has been raised that its capacity to influence the future trajectory of infrastructural policy could be constrained by an overt adherence to a strict fiscal remit.

8.3 The Commission's Mandate and Analytical Functions

The NIC has been mandated to deliver the following products and services:

- an analysis of the UK's strategic infrastructure needs and priorities over a long-term time horizon (up to 30 years) and the publication of a National Infrastructure Assessment (NIA), including recommendations, once in every parliament,
- studies on pressing infrastructure challenges at the request of government, and
- the publication of an annual monitoring report taking stock of the government's progress in areas where it has committed to taking forward NIC recommendations.

8.3.1 The National Infrastructure Assessment

Producing a National Infrastructure Assessment (NIA) once each parliament will be a central responsibility of the NIC. The undertaking of the NIA is a challenging and complex task. Table 8.2 summarises the process and methodologies.

A recurring critique of UK infrastructure policy has been a weak capacity for strategic planning and the failure to establish strategic infrastructure needs based on a stronger evidential basis. Producing a comprehensive NIA every five years is viewed by the commission as an opportunity to address some of the inherent problems that have been identified in long-term infrastructure planning in the UK (see Table 8.1).

Table 8.1: The Case for an Independent Infrastructure Assessment

Problems	NIA Solutions
Lack of long-term strategy, leading to a piecemeal approach	A clear strategic vision, encompassing all infrastructure sectors
Siloed decision-making, with no common approach between sectors	A structured methodology to consider interdependencies
Fragile political consensus and short-term considerations cause uncertainty for investment	Proposal of recommendations consistent with a long-term objective
Lack of transparency, and inadequate consultation and engagement hinder consensus	Wide engagement and consultation
Innovative solutions and risky ideas are politically difficult decisions to make	Consideration of all potential solutions, including challenging ones
There needs to be better consideration across sectors of the UK's carbon targets	NIC work that is compatible with all legally binding and long-term obligations, including carbon targets
Government not held to account for delivering infrastructure	Objective scrutiny of government action

Source: National Infrastructure Commission, 2016c: 11

In June 2016, the commission initiated a three-month public consultation on the process and methodology that will underpin the NIA exercise. It set out the rationale for having an NIA and invited individuals and organisations to submit their views on a range of key issues, including:

- the remit and scope of the NIA, including sectoral coverage, interdependencies and guiding principles for this work,

- the methodological approach for determining the vision, needs and investment priorities,

- how to validate the NIC's conclusions, and

- the best ways to capture the expertise and opinions of a wide range of stakeholders.

The key elements and process of the NIA are illustrated in Table 8.2. These are designed to strengthen the evidence base underpinning the development of a long-term strategy for infrastructure. The NIA will cover all areas of economic infrastructure, including (but not limited to) energy, transport, water and sewage, waste, flood defences and digital communications. Although it has not been asked to consider directly the issue of housing supply, it is accepted that infrastructure can affect housing projects, and that housing development needs infrastructural support. The commission can, therefore, comment on the interactions between its infrastructure recommendations and housing supply. Indeed, this was a significant element in its recent report on Crossrail 2 and has also featured in its work on the Cambridge-MK-Oxford-Corridor (National Infrastructure Commission, 2016a, 2016b).

As a first step, the commission will seek to establish the current infrastructure baseline by appraising the quality and condition of the UK's infrastructure assets. It has indicated that the NIA will adopt a systematic approach that will involve identifying and exploring the most important interdependencies and resilience implications, and highlighting the opportunities and risks associated with the interactions between different sectors. This will involve an in-depth assessment of each sector, taking account of strategic cross-cutting issues which affect the planning of major infrastructure, including governance, sustainability, funding and financing, costs and resilience.

Table 8.2: The National Infrastructure Assessment Process

Objectives & Principles	**Objectives** • Support sustainable economic growth across all regions of the UK • Improve competitiveness • Improve quality of life	**Principles** • Open and transparent, engaging with a wide range of stakeholders • Independent, evidence-based, objective and rigorous • Forward-thinking, challenging established thinking • Comprehensive, taking a whole-system approach and studying interdependencies and feedbacks
Stakeholder Engagement	• Consultation • Call for evidence • Roundtables with local representatives • Sector workshops • Expert seminars • Social research	
Methodology	• Methodology: Quantitative and Qualitative Approaches • Development of scenarios • Quantitative modelling of baseline outcomes • Capturing of expertise and opinions • Social research • Requests for local plans and strategies • Commissioning analysis and literature reviews • Cost-benefit analysis of individual projects and proposals • Identifying and learning from best practice	
Sectors and Cross-Cutting Issues	**Cross Cutting Issues** Funding & Financing, Performance Measures, Resilience, Evaluation & Appraisal, Methodology, Governance & Decision-Making, Geography & Local Growth, Sustainability & Environment **Interdependencies** Flood Risk Management, Water & Wastewater, Solid Waste, Digital Communications, Energy, Transport	

Source: National Infrastructure Commission, 2017b: 32

Given the long-term focus of the NIA, the commission will seek to identify scenarios for four key drivers of change—economic growth, population and demography, climate change and technology—and explore their implications for the scale and nature of infrastructure required. The NIA process will involve some detailed modelling across each of the sectors. It is recognised that while such modelling will provide insights, it will also simplify reality. Its role, therefore, is essentially to provide context for the commission's judgements. This process would seem to be influenced by the system-of-systems thinking and analytical approach developed by Hall and the IRTC (discussed in Chapter 9). However, the NIC approach combines this with other processes of analysis, and with networking and stakeholder engagement (see Box 8.1).

In doing its work, the commission will build on the work of expert stakeholders—including government departments, industry, sub-national and regional bodies, academia and regulators and civil society—to develop a more comprehensive sectoral and geographically based assessment of infrastructure needs. Additionally, the range of activities that the NIC will be undertaking under the heading of stakeholder engagement is also designed to capture the expertise and opinions of a diverse range of public and private actors (see Table 8.2).

The commission has recently established two high-level expert advisory groups: a Technical Panel (industry and academic representatives) and an Analytical Panel (mainly academics). These two panels will provide the NIC with a range of perspectives related to all strands of its work, advise on specific issues and problems and provide additional pre-publication scrutiny of NIC documents.

One important input to the commission's work on the NIA will be a separate National Needs Assessment recently published by the Institute of Chartered Engineers (ICE). That ICE project was chaired by Sir John Armitt, now Deputy Chair of the NIC (ICE, 2016a). As part of the ICE exercise, the Infrastructure Transitions Research Consortium, based at Oxford University, was engaged to undertake research on future infrastructure needs, drawing on their scenario-based modelling methodology. The background research and analysis that underpinned the engineers' report has been shared with the commission to support the NIA work.

Box 8.1: NIC Methodologies

- Developing scenarios: Based on empirical evidence on past trends and quantitative and qualitative forecasts of changes in the economy, population and demography, climate and environment and technology.
- Quantitative modelling: Modelling of the baseline outcomes identified by the scenarios and packages of policy proposals in the most reliant scenarios to allow an assessment of the robustness of policy options to future uncertainties.
- Capturing the expertise of a wide range of stakeholders: Range of mechanisms including:
    - a formal call for evidence,
    - face-to-face engagement events, and
    - seminars and workshops.
- Social research: Exploring the views of the general public using a mix of deliberative techniques and survey data.
- Expert roundtables: Participants from a range of disciplines and professional experience.
- Cost-benefit analysis (CBA): Undertaking CBA of individual projects and proposals, while accepting the limits of standard CBA approaches and exploring improvements that can be made to current methodologies.
- Commissioning of research: New analysis and literature reviews on specific projects and issues.
- Id Identifying and learning from international best practice: Engaging with international best practice.

Source: National Infrastructure Commission, 2017b: 22-3.

As noted in Box 8.1, the commission will draw on a combination of quantitative and qualitative sources of evidence. This reflects a growing recognition of the benefits of drawing on a broader range of methodological tools and mechanisms in analysing and assessing strategic infrastructure needs and how these should be addressed.

In accepting that CBA can be a powerful way of bringing together multiple dimensions of differing projects in a broadly comparable way, the NIC also

recognises the limits of standard CBA approaches and will thus be exploring improvements that can be made to current methodologies. Indeed, while the NIA will use CBA to provide evidence, particularly with regard to the viability and deliverability of projects, this national assessment exercise is focused primarily on articulating strategic objectives, establishing long-term needs and exploring how specific projects can support these goals. As noted by the NIC Chief Executive Philip Graham:

> The ranking of projects based on certain criteria only really makes sense if they are linked to solving a specific set of problems and/or meeting identified needs (Graham, 2016).[13]

This suggests that NIC sees the need to more closely integrate the strategic and economic cases for infrastructure investment (Venables *et al.*, 2014).

The NIA is designed to enhance the analytical and technocratic basis of long-term infrastructure planning. At the same time, the commission has stipulated that the NIA's recommendations will ultimately reflect the judgement of the commissioners (Armitt, 2016; Rosewell, 2016a). Rosewell, who has been appointed as a NIC commissioner, contends that, despite the emphasis on collating more robust evidence within the NIA process, exercising judgement will still need to play a big part in assessing the UK's future infrastructure needs (2016b).

The first published output of the NIA process will be a 'Vision and Priorities Report', which will set out the commission's long-term vision up to 2050, the priority areas for action and the policy options to address the needs identified. The next stage of the NIA will involve extensive public consultation on the conclusions in the 'Vision Report'. There will also be a continuation of the 'analytical' work, including modelling activity, although the focus will shift from determining needs to developing specific recommendations that address the issues identified in the 'Vision Report'. Similarly, the commission's ongoing sector and geographical analyses will concentrate on how the range of strategies being pursued in sectors, cities and regions can address the needs and priorities that will have been identified in the commission's work.

This consultation and ongoing analytical work will shape the final NIA report, to be published in 2018. The NIA will contain recommendations on how the identified infrastructure needs and priorities should be addressed by government and other

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[13] National Infrastructure Commission Conference, 5 May 2016.

stakeholders. The commission has indicated that it envisages that its policy proposals to meet strategic needs will incorporate a combination of approaches, including: maintenance and upgrade of existing stock, investment in new infrastructure assets, new and innovative strategies for capacity and efficiency enhancement, and demand management strategies.

The commission recognises that the process, modelling and analytical approaches associated with the NIA will need to continually refined and that it will take several iterations to get the NIA fully developed.[14] Additionally, the outputs from this five-yearly exercise will be subject to regular periodic reviews to reflect the emergence of new information and relevant policy developments.

8.3.2 Studies of Priority Infrastructure Policy Issues

The NIC has also been given the role of undertaking, at the request of the government, studies of high-priority infrastructure policy issues, examining pressing and significant infrastructural issues. To date, the NIC has published three reports on priority infrastructure issues:

- **High Speed North**: provision of advice on future investment priorities to improve transport connectivity between cities in the North of England.

- **Transport for a World City**: a review of the strategic options for future investment in large-scale transport infrastructure in London with a particular focus on Crossrail 2.

- **Smart Power:** commentary on improving energy storage, interconnectivity and demand management in the UK's energy sector.

In Budget 2016, it was announced that the NIC would be carrying out two further policy studies, one focused on what the UK needs to do to become a world leader in 5G deployment and a second concerned with developing proposals and options for the long-term infrastructure priorities to unlock growth, jobs and housing within the Cambridge-Milton Keynes-Oxford corridor. An interim report on the latter policy issue was published in October 2016 (NIC, 2016e).

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[14] Source: Authors' interview with NIC commissioner, 05/05/2016.

In undertaking its work on Northern Connectivity, the NIC worked closely with both the Department of Transport and Transport for the North, drawing on the Northern Transport Strategy (HM Government, 2015). There was also direct engagement with other key stakeholders such as Highways England and Network Rail. A similar collaborative approach has been adopted in the commission's current work on the Cambridge-Milton Keynes-Oxford corridor. Indeed, having focused primarily on gathering and reviewing the evidence, phase two of the Cambridge-Milton Keynes-Oxford project will see the commission playing a more active role in the corridor in terms of encouraging new thinking on joined-up strategic planning, governance, infrastructure financing and place-making (*ibid.*). It will also support the various stakeholders in progressing the policy recommendations from its Interim Report.

In recent discussions of UK infrastructure policy development and of the National Infrastructure Commission, most attention is given to the NIA. However, it is possible that the commission's studies of specific high-priority infrastructure policy issues will be just as, if not more, important than the more comprehensive NIA.[15]

First, when a particular issue is designated by government as a priority area for study by the NIC, it creates an opportunity to put in place a process whereby key sectoral players must demonstrate how their specific sectoral strategies relate to the achievement of the goals of the priority area.

Second, in the various policy studies undertaken to date, the NIC is not engaging with a particular strategy, plan or project but also building relationships with a network of stakeholders. This collaborative activity can serve to augment the type of horizontal and vertical coordination necessary to foster more robust commitment to an agreed strategy across a diverse network of public and private actors.

Third, engaging with current governmental policy priorities affords the NIC an 'immediate' role and a degree of relevance within the policy system. It is certainly noteworthy that all of its recommendations in the first three completed reports, and also the interim report on the Cambridge-Milton Keynes-Oxford corridor, have been endorsed by the government. If the NIC were focused only on a long-term strategy, it could increase the opportunity for the political system, with its shorter-term horizon, to passively ignore the NIC's deliberations.

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[15] One of the current NIC commissioners suggested that, while the NIA was very important, the policy studies could end up being even more relevant in terms of their influence on policy. Source: Authors' interview with NIC commissioner, 05/05/2016.

Fourth, the policy recommendations of the individual reports are effectively the building blocks of the NIC's long-term vision for UK infrastructure and, as such, may provide a tangible and constructive bridge between current and medium-to-long-term policy actions. Overall, requests for NIC reports on specific infrastructure issues, and the commission's preparation and delivery of these, enable the NIC's thinking to be brought to bear on current policy issues and, *vice versa*, brings prevailing policy concerns into the arena of the commission's longer-term analysis.

8.3.3 Monitoring Progress

The *Charter for the National Infrastructure Commission* (2016) stipulates that the NIC monitor and report on an annual basis the government's progress in delivering infrastructure projects and programmes recommended by the commission and endorsed by the government. The first NIC monitoring report, due to be published in the third quarter of 2017, will address the recommendations accepted by the government that were contained in the policy study reports published to date.

8.4 The Political Dimension and the NIC's 'Independence'

A central goal of the NIC is to achieve influence within the UK core executive and among leading political actors. It does not believe that this can be achieved purely by means of its analytical work; it also requires close links to the Treasury and building relationships with senior political actors. This should not surprise us, if we accept that the complexity, uncertainty and ambiguity of infrastructure issues limits the power of purely objective analysis and ensures that infrastructure always has a substantial political dimension. Consequently, achieving an effective combination of analytical work, political direction and societal engagement inevitably involves a delicate balance. Our research suggests that, on this issue, there is some divergence of views and proposed approaches among actors in the UK.

The commission operates on the premise that decision-making on infrastructure must reside with democratically elected politicians (Armitt, 2013). It aims to improve the policy system's capacity for strategic decision-making and enhance the quality of infrastructure policy. As its role evolves, the NIC will have to achieve a delicate balance. On the one hand, it needs a degree of independence to ensure that its views on infrastructure are considered to be credible, legitimate and authoritative within both the broader infrastructure community and society in

general. On the other hand, too much independence could make it distant from the real policy action and would make it easier for ministers to ignore its analysis and recommendations.

Much of the UK discussion of the role of the NIC in policy focuses on its statutory status, its formal communications with the political system, the procedures defining how the government must respond to its recommendations and the appropriateness of the government communicating a fiscal envelope within which it must undertake its analysis and deliberations.[16]

Some of the arguments for the statutory independence of the NIC probably reflect the kind of naïve institutionalism noted in Chapter 2. But the formal procedures are likely to play a role in shaping the commission's policy and political influence. These include government response to the NIC's policy recommendations within a 12-month statutory deadline, the procedure for identifying 'endorsed recommendations', the commission's right to monitor the government's progress in delivering endorsed recommendations, and the preparation of a National Infrastructure Assessment once per parliament. In addition, the government request that the commission undertake studies on specific issues creates a framework for regular and structured engagement with the political system. The NIC is closely linked to the Infrastructure Projects Authority and is, indeed, physically housed in the Treasury. Our analysis suggests that the value of these statutory and formal processes depends on how they are used. They will depend on the NIC's capacity to function as an influential 'boundary organisation' straddling the interface between analysis and policy (Owens, S., 2015; Guston, 2001).

Beyond these formal links with the political and governmental system, the commission intends to play an active role in building consensus among senior decision-makers in the administrative and political domains, and to engage directly with the political system, rather than operating as a technocratic outsider. This reflects the belief that one of the fundamental weaknesses of UK infrastructure policy has been lack of political consensus, which has contributed to policy uncertainty, short-termism, delays in implementation and a recurring stop-start approach to investment in strategic infrastructure (Armitt, 2013; Council for Science and Technology, 2009; LSE Growth Commission, 2013; Pisu *et al.*, 2015; HM Treasury, 2016b, 2016a). Key figures within the leadership of the NIC are seasoned and highly skilled political actors. The organisation has been characterised as

[16] At the Waterfront Conference on the National Infrastructure Commission, this issue of the recommendations and how government would respond to them was one of the main topics debated by participants.

something of a cross-party initiative, and the appointment of two former ministers from the two main parties, Lord Adonis and Lord Heseltine, reaffirms this perspective. On his appointment as Chair, Lord Adonis resigned the Labour Party whip in the House of Lords and moved to the 'independent' crossbenches in order to underpin the independent non-party political nature of the commission's role. The composition of the commission is viewed as an asset in giving it the capacity to build stronger consensus among politicians and senior decision-makers.[17] Thus one of the commissioners has observed:

> There will be an element of iterative negotiation between academics and civil servants and politicians regarding infrastructure policy… we also need to be pragmatic and reach a balance in our recommendations between need and what is possible' (NIC Commissioner, 2016).[18]

This can be seen as reflecting the fact that the complexity, uncertainty and ambiguity of infrastructure policy inevitably forces some meshing of technical, political and social considerations and perspectives. There are of, course, tensions and risks inherent in these overlaps. Indeed, there is evidence of somewhat divergent views on the scope of the commission's independence and how it should engage in policy and political debate. Commenting on the potential evolution of the NIC, one of its commissioners has suggested that the NIC 'should aim to have an authoritative, high profile and loud voice on infrastructure matters', analogous to the role of the Monetary Policy Committee of the Bank of England.[19] Indeed, it was suggested that the NIC's work on infrastructure and its funding might lead it to a view on how to capture 'betterment value' and planning gain, and that it should be willing to advocate that position publicly. Others might feel that, regardless of the analytical merits of the argument, it would risky for the commission to stray into an issue as politically sensitive as local tax.

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17 Source: Authors' interviews, London, May 2016.

18 Comment made by Commissioner at Waterfront UK Conference, 2016.

19 Source: Authors' interviews, 5 May, London.

8.5 Coordinative Capacity and Societal Consensus

In the UK as in other OECD countries, the infrastructure regime now involves multiple actors and several levels of governance. The National Audit Office (2015), for example, has referred to 'the complex system' that now exists to plan, operate and regulate rail services. As noted in Chapter 2, it is recognised that the diverse network of actors involved in different infrastructure sub-sectors will often pursue different strategic goals, operating within different time-horizons, and following different institutional logics (Hammerschmid & Wegrich, 2016). Delivering an agreed long-term strategy to meet national infrastructure needs will necessitate enhanced coordination across this diverse network of actors, particularly in relation to their individual investment and planning strategies.

A key aspect of the coordination challenge that the NIC will have to address is its relationship with the independent and influential regulatory bodies for economic infrastructure.[20] There is a view that, under the current regulatory and policy regime, there is an inherent tension between the regulatory bodies' focus on ensuring short-term affordability and price competition and, on the other hand, the capacity of private companies in these sectors to secure the finance to undertake long-term investment in necessary infrastructure renewal and upgrading (Rhodes, 2016).

As noted above, part of the government's policy repertoire for delivering endorsed recommendations can include the setting of strategic priorities for regulators. The NIC may play a role in proactively supporting the regulatory bodies in progressing relevant recommendations by offering leadership and policy advice.[21] As Hiteva *et al*. (2016) highlight, there is a need to establish governance and regulatory mechanisms that enable cross-sectoral collaboration and decision-making and improve infrastructure provision.

The emphasis within the NIA on building on the knowledge of existing actors, combined with the various mechanisms for engaging with geographically based and sectorally focused institutions, underlines the degree to which the commission's

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[20] This would include bodies such as the Civil Aviation Authority, the Office of Road and Rail, the Office for Nuclear Regulation, Ofgem (gas & electricity markets), Ofcom (communications), Ofwat (water services), the Water Industry Commissioner Scotland and the Utility Regulator (water, gas and electricity in N. Ireland). The UK Government has also announced that the Oil and Gas Authority (OGA) is to be established as the independent regulator for the oil and gas industry.

[21] iBuild Research Centre (2016), Response to the National Infrastructure Commission public consultation (source: personal correspondence).

work will include a coordinative dimension. This is already evident in the studies undertaken on priority policy areas as in most cases the NIC is engaging with place-based actors and their development strategies. As already outlined, part of the second phase of the Cambridge-Milton Keynes-Oxford corridor work will involve the NIC supporting the various stakeholders to progress the recommendations from the Interim Report, in part by bringing new thinking to bear on key policy areas such as strategic planning and infrastructure financing. This suggests a deepening of the collaboration between the NIC and relevant local actors, government departments and national delivery agents, and highlights the potential role of the NIC in animating or reinforcing development coalitions. In addition, as part of the National Infrastructure Assessment, the commission plans to comment on how the existing plans and strategies of key sectoral and regional entities correlate with its own multi-sectoral assessment.

Seeking to orchestrate and mobilise a diverse network of actors in pursuit of an agreed longer-term national infrastructure strategy is a major policy challenge for the NIC that has been characterised as 'aiming to mobilise a collective effort using market forces'.[22]

8.5.1 Building Societal Consensus

Developing and delivering a long-term strategy for infrastructure also necessitates democratic legitimacy and societal support. The experience in the UK and elsewhere demonstrates how societal opposition to infrastructure projects can result in considerable political prevarication on contentious decisions and often long delays within the formal planning phase.

A recent survey of public attitudes to infrastructure in the UK highlights that the vast majority (90 per cent) of interviewees want to see new investment in infrastructure although they also want more of a say in how it is planned and delivered (Copper Consultancy *et al.*, 2015). The Copper/ICARO Survey (*ibid.*) identified meaningful and early community engagement as the most important measure that would build greater societal confidence in future infrastructure plans. Additionally, this work suggests that, in addition to more intensive engagement, building societal confidence also requires the articulation of a more positive narrative, a clearer demonstration of a coordinated strategic approach and strong and balanced leadership (Copper Consultancy, 2015).

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[22] Authors interviews, 5 May 2016.

Some argue that the NIC must also communicate directly with wider society:

> There has never been a clearer case for improving communications in this sector. Communicating a clear, coordinated national case for infrastructure and engaging us, the public, earlier in the planning process would significantly enhance our understanding of each project and its wider benefits (Copper Consultancy *et al.*, 2015).

The NIC Chair, Lord Adonis, has emphasised the importance of framing the debate around future infrastructure policy in terms of tangible ordinary activities—'We must never forget that infrastructure boils down to the stuff of everyday life—the school run, the heating bill, staying in touch with our friends and family' (Adonis, 2015). The NIC has outlined a range of activities designed to increase public engagement on infrastructure (see Chapter 5) and it has stated that this is a key issue for their work (Lord Adonis, Copper Consultancy, 2015).

Indeed, beyond high-level links with political decision-makers and the core UK executive, the NIC's pivotal role in garnering evidence and making the case for infrastructure strategy highlights that there is an opportunity for it to take the lead in animating a new and constructive relationship between technocracy and political and societal consent, drawing on its evolving analytical and communicative capabilities.

> Public interest in infrastructure is as much driven by fear of disrupted lives as it is by the promise of greater convenience, speed or improved quality of life. The challenge for us all—the Institute of Engineers, Government and the NIC alike—is to open up the debate and address these fears. Our ability to explain—in plain language—what we are trying to achieve and why, to be prepared to consider alternative solutions and to put ourselves in the public shoes is absolutely vital if we are to gain sufficient political and public support without which important projects cannot proceed (Sir John Armitt, Copper Consultancy, 2015).

There is, however, a view that the NIC's approach to engagement is somewhat expert-centric and that opening up infrastructure planning actually necessitates a commitment to better, deeper and more structured public engagement (Green Alliance, 2015).[23] In particular, the Green Alliance have called for the establishment

[23] This perspective was reaffirmed in the authors' interview with the CEO of the Green Alliance, May 2016.

of new national and regional democratic institutions and processes that would focus on both securing a public mandate for new infrastructure and fostering greater societal consensus around long-term infrastructure strategy. This perspective reaffirms Coelho *et al.'s* (2014) contention that the UK needs to develop strong deliberative institutions designed to stimulate constructive public engagement and problem-solving deliberation.

Owens (2016b) considers that the establishment of the NIC represents an opportunity to substantially improve societal engagement:[24]

> Seeking the input of communities and the public more generally should play an important part in the NIC's work, if its recommendations are to gain public recognition and acceptance and therefore be much more persuasive of government. This could be a real game changer for engagement and ultimately will help to unite us all in overhauling UK infrastructure (*ibid.*).

He argues that only when public opinion begins to genuinely influence infrastructure policy-making will there be a discernible shift in public attitudes to more controversial projects. Achieving this type of progress, however, will require a fundamental shift in the mindset of senior decision-makers in terms of their willingness to seek engagement and see participation as a positive process rather than as a barrier to progress (Owens, R., 2016a).

8.6 Conclusion

The UK has suffered from a long and protracted period of underinvestment by the state in infrastructure while policy initiatives designed to attract more institutional and capital markets investment in infrastructure have been less than successful. The Government has highlighted the need to increase public and private investment in infrastructure.

The NIC is the latest in a series of institutional reforms designed to improve infrastructure policy and planning in the UK. It will be interesting to see the extent to which the commission makes any specific comments or recommendations in

[24] R. Owens references the NPD in France as a primary example of such institutions, which is also one of the examples that Coelho's work looked at.

relation to the levels of financing for infrastructure or the types of funding models that could be used to deliver key infrastructure.

Indeed, one argument in favour of developing a more robust longer-term strategy that has political and social buy-in is that it can create the type of policy certainty that institutional investors require for the long-term financing of infrastructure. At the same time, it has already been noted that commenting on funding or financing is politically contentious, and could pose serious dilemmas for the NIC, especially in terms of its relationship with key political actions. Furthermore, despite the emphasis on the need for a sustained increase in infrastructure investment and the promise of additional funding, the UK Government's capital expenditure plans as a percentage of GDP will still be comparatively low in an EU context.

Chapter 9: New Approaches to the Analysis of Infrastructure Needs and Projects

9.1 Introduction

A strong feature of the UK infrastructure story is the emergence of interesting ideas and methodologies on approaches to evaluating and analysing proposed programmes and projects, and assessing infrastructure needs.

This chapter begins by summarising the reflections of a highly experienced British economist on the traditional decision-making process in the UK and the unproductive combination of technical cost-benefit analysis, planning inquiries and political choice. This is followed by a brief report on the evolving thinking on the need to include consideration of the wider benefits of infrastructure in technical analysis, appraisal and decision-making. This kind of thinking is particularly in evidence in analytical work on the appraisal of transport infrastructure. The final section provides an overview of emerging work which seeks to deal with the systemic nature of infrastructural investment.

The chapter is structured as follows:

- Section 9.2: Planning curses—reflections on problems in the UK system of appraisal and decision-making.
- Section 9.3: Evaluation infrastructure—a complex challenge.
- Section 9.4: Incorporating wider economic benefits in transport appraisal.
- Section 9.5: A systems-of-systems modelling framework

9.2 'Planning Curses'—Reflections on Problems in the UK System of Appraisal and Decision-Making

Drawing on over twenty years of professional experience in planning and infrastructure, Rosewell (2010) argues that the UK has a poor record of 'getting things done'. Her paper, 'Planning Curses: How to Deliver Long-term Investment in Infrastructure', argues that without clearer structures to decide the detail, execution and financing of long-term infrastructure projects, the UK will experience the same round of delays and hesitation which have characterised decision-making for decades. In exploring the reasons for the failure to invest, and possible improvements, she draws on examples of recent infrastructure projects, large developments and regional economic and spatial plans to illustrate the problem and its roots. Her overall argument is that:

> Fundamentally these [problems] lie in the way in which an edifice of technocratic analysis based on complicated economic models bearing little relation to the real life impact of infrastructure investment has undermined the ability to debate decisions and build consensus around contentious projects. The vested interests of experts have obscured debate around practical issues and trade-offs by couching decisions in inaccessible, bureaucratic language which has singularly failed to engage local communities or interest groups, in particular around the potential benefits of such investment (Rosewell, 2010: 6-7).

It is worth considering how her view on technical analysis has interacted with both the formal processes of public engagement and the political decision-making of government. She suggests that there are four main elements to the problems currently faced.

First, she argues that economists have persuaded us to give too much credence to their forecasts and forecasting models. In spite of their poor track record, complicated models are still used to underpin crucial planning decisions. Current assumptions tend to undermine the role of investment, growth and change. 'When all opportunities are always taken as a given, nothing can ever be additional. It becomes impossible to prove the value that a new railway, road, bridge or development, can provide' (Rosewell, 2010: 7). The assumptions underpinning the 'do nothing' case make it 'exceptionally hard to prove that any investment is actually "needed". The role of agglomeration and other processes that happen over time are easily ignored, while the equilibrium assumptions imply that that the status quo is somehow desirable' (Rosewell, 2010: 46).

Second, the dominant welfare analysis and cost-benefit calculations—based largely on time savings which are given a monetary value—make little sense to relevant actors (businesses, investors, consumers and or communities), but are also conceptually faulty in terms of economic theory and analysis (RTPI & TPS, 2010; Network Rail, 2010). For example, the debate on Crossrail turned on the treatment of the benefits of people working near each other and the extent to which the value to time savings captured the real benefits of the new line. She points out that the simple case that Crossrail was being proposed to make it easier for people to get into central London, which is busy, productive and essential to the economy of the UK, yet has a gridlocked transport system which is harming its competitiveness and the quality of life for its residents and commuters, was never addressed in the technical models (Rosewell, 2010: 8-9).

Third, Rosewell makes the insightful observation that the way in which models, forecasts and their assumptions are presented has had the paradoxical consequence of focusing attention on the short term. 'Under the assumption of these models it seems that so much is going to happen anyway that it becomes easy to take the long-term for granted' (*ibid.*: 9). Consequently, short-term expediency rules as political considerations come to the fore. Indeed, she highlights the tension between technocratic processes and political pressure, and the paradoxical and unintended effect: 'The existence of technical models which purport to give priorities to projects which need a priesthood to understand means that in reality decisions become political' (*ibid.*: 50).

Fourth, prevailing technocratic approaches combined with political short-termism delivers an inadequate overall decision-making process. The technocratic process provides an apparently objective analysis, but one which is outside the understanding of the relevant stakeholders. Thus there are no mechanisms to debate and resolve differences of opinions and interests. Rather, differences are fought out in the political arena, planning inquiries and/or the courts, which serves to entrench positions and encourage adversarial attitudes and confrontation. In this context, regulation and central political diktat have emerged as the practical substitute for debate and better decision-making.

In her analysis of a number of infrastructure projects and debates—Crossrail, the Thames Gateway Bridge, regional spatial plans and forecasts, a shopping centre in North Kent and Canary Wharf—she illustrates these weaknesses in the system. The lessons of the campaign to get the Crossrail project approved are not just about the analytical framework used. 'It is also about how many forces had to be mobilised to generate the ability to make this decision, how long it took and how many attempts' (*ibid.*: 24). In the case of the Thames Gateway, 'What had started as a scientific hurdle – how to provide a sensible assessment of the likelihood and likely scale of

economic improvements in Greenwich, Newham and other nearby boroughs – had become an administrative nightmare of legalistic guidance and debate over the appropriateness of tests' (*ibid.*: 29). Inspectors and others sought certainty equivalent to that in engineering. Rosewell states frankly: 'The honest answer is that no such certainties exist in social science. It is a judgement of probabilities informed by statistical analysis and buttressed by some imperfect theories'. However, policy guidance 'is couched in a way which makes it look as if such certainties are there if only the tests are properly executed' (*ibid.*: 29-30).

Rosewell suggests a number of steps that would improve the overall combination of technical analysis, public discussion and political decision-making:

- Projects should be evaluated on the basis of their contribution to understandable dimensions of the real economy, not their contribution to the economic concept of 'welfare'.

- The business case for individual projects should be articulated in a way that has relevance and meaning for businesses and other stakeholders.

- There is a need to move from detailed plans towards planning frameworks that set the strategic context for decisions. A framework would set out not only how a particular policy aims to shape the future, but also how it will react to economic and social developments that change the context in which decisions have to be made.

- Enabling local areas to retain local taxes to finance infrastructure would engender more innovation and experimentation and the adoption of projects tailored to local needs.

Rosewell highlights the need for project evaluation to consider the wider economic benefits of major transport infrastructure investment (Rosewell & Venables, 2014) (see below). This, however, is not simply an argument for replacing a narrow technical analysis with a more sophisticated one. As the range of possible economic, social and environmental effects taken into account widens, the relevant data and cause-effect relationships become more uncertain and subject to divergent understandings. This requires not only a change in the actual analysis undertaken, but in the place of technical analysis in the overall decision-making process:

> Between political negotiation and technocratic decision making there is a big gap. If models were only seen as exploratory and partial, it would be easier to use them as tools to play with rather than tools for answers and this would give much more potential for the processes to

> create consensus rather than creating divisions which can only be resolved by direct intervention (Rosewell, 2010).

Analysis, she emphasises, is crucial. But it needs to be concentrated on those aspects which are amenable to such treatment. 'This means those where we are clear about the assumptions and can present the risks most clearly. It means downgrading analysis by mechanisms where we cannot sensibly judge the correct assumptions – for example when we assess the value of time.' (Rosewell, 2010: 62).

9.3 Evaluating Infrastructure: A Complex Challenge

Particular characteristics of infrastructure investment make evaluation both complex and problematic. For example, Brown and Robertson (2014) highlight the challenges of:

- adopting a systemic approach to assessment,
- identifying and estimating costs and benefits that are non-monetary, dynamic and non-marginal, and
- dealing with uncertainty.

These reflect the fundamental characteristics of infrastructure discussed in Chapter 2: complexity, uncertainty and ambiguity.

The systemic nature of infrastructure ensures that conventional cost-benefit analysis, which underpins project appraisal in the UK for example, is fundamentally weak as a tool for deciding how much (and arguably what kind of) infrastructure should be provided by the state. Helm (2013) states: 'Infrastructure typically comes in systems, not discrete bits. Choosing what sort and level of infrastructure to supply is not a marginal decision. It is often about one system or another. Marginal analysis—as the core of cost-benefit analysis—has little to offer' (Helm, 2013: 290). Consequently, Helm proposes that individual projects should be evaluated in terms of how their relative costs and benefits fit into and support broader strategic goals, rather than being evaluated as stand-alone projects.

Other commentators suggest that appraisals should be more context- and project-specific and be informed by a clear narrative about likely economic impacts of that investment (Venables *et al.*, 2014). These perspectives are not necessarily mutually

exclusive as, to an extent, they affirm the need for closer integration of the strategic and economic cases underpinning a particular investment.

In this context, it argued that conventional appraisal techniques are not particularly appropriate for considering the non-marginal impacts of transformative or game-changing infrastructure investments (Brown & Robertson, 2014; Rosewell & Venables, 2014; Volterra Partners, 2014). For example, the High Speed 2 (HS2) project is likely to bring about changes that go well beyond the proximate impact of the project and will be extra-marginal in nature. The transformative potential of this type of investment—in terms of its influence on the spatial distribution of economic activity and population growth, investor behaviour, increased productivity and the generation of new economic opportunities—is not adequately captured by prevailing cost-benefit methodologies (Rosewell & Venables, 2014; Venables *et al.*, 2014).[25] In particular, it will not capture the feedback effects that change the nature of places, even when so-called wider benefits are taken into account (Volterra Partners, 2014). Of course, identifying and quantifying the benefits and costs of (re)investment in an infrastructure system (e.g. the rail network), in a manner that changes that system in significant and structural ways, is challenging and problematic (Rosewell & Venables, 2014).

The focus on 'game-changing' investment has led British analysts to suggest the need for an appraisal framework that is more growth-orientated and opportunities-focused. The changes experienced at Canary Wharf, for example, demonstrate that past trends are not a useful guide to the future in all circumstances.[26] Volterra argue that the adoption of a growth-orientated cost-benefit methodology—focused on output, gross value added, productivity and financial payback—would change the dynamics underpinning financing and funding decisions on major urban infrastructure investments (Volterra Partners, 2014). For example, major transport expansion programmes in Greater Manchester were facilitated by a locally led, risk-based funding programme. A significant proportion of finance was secured through borrowings against the increased future fare box returns and local council tax receipts that would be generated by new infrastructure investment. These key regeneration-led investment projects were judged less favourably under national welfare-based appraisal approaches than the productivity-led analysis and prioritisation used by the Greater Manchester authorities.

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25 It should be noted that Vickerman's suggested solution is to use spatial, computable, general-equilibrium models to evaluate large-scale mega transport infrastructure projects (2008).

26 Rosewell (2010) and Volterra (2014) highlight that the original transport proposals for Canary Wharf failed the conventional cost-benefit analysis.

Additionally, Roelich argues that traditional cost-benefit analysis is limited by its failure to capture the value of investment in infrastructure resilience, and highlights the need to adopt methodologies that can quantify and/or monetise environmental and social outcomes (Roelich, 2015). It is increasingly argued that these social and environmental benefits need to be viewed as being on an equal footing with economic outcomes.

In part, addressing the challenges of evaluating and appraising infrastructure projects requires the use of a wider set of quantitative and qualitative research tools and methodologies (OECD, forthcoming 2017; Rosewell & Venables, 2014). The European Bank for Reconstruction and Development, for example, has used a combination of conventional cost-benefit analysis and qualitative investigation to assess the impact of transition projects in Central and Eastern Europe. Similarly, empirical analysis of the regional impact of major transport investment can be deepened by the use of case studies and greater engagement with key actors—businesses, politicians, academic institutes—whose strategies and future actions will be pivotal in harnessing the full potential of a particular investment.

Brown and Robertson (2014) stress the need to carefully develop standard approaches and techniques, while also introducing more non-standard approaches for estimating costs and benefits. Research suggests that different evaluation and appraisal models are better at capturing different impacts; in the area of transport, different economic outcomes are associated with different and accepted modelling methodologies (Venables *et al.*, 2014).

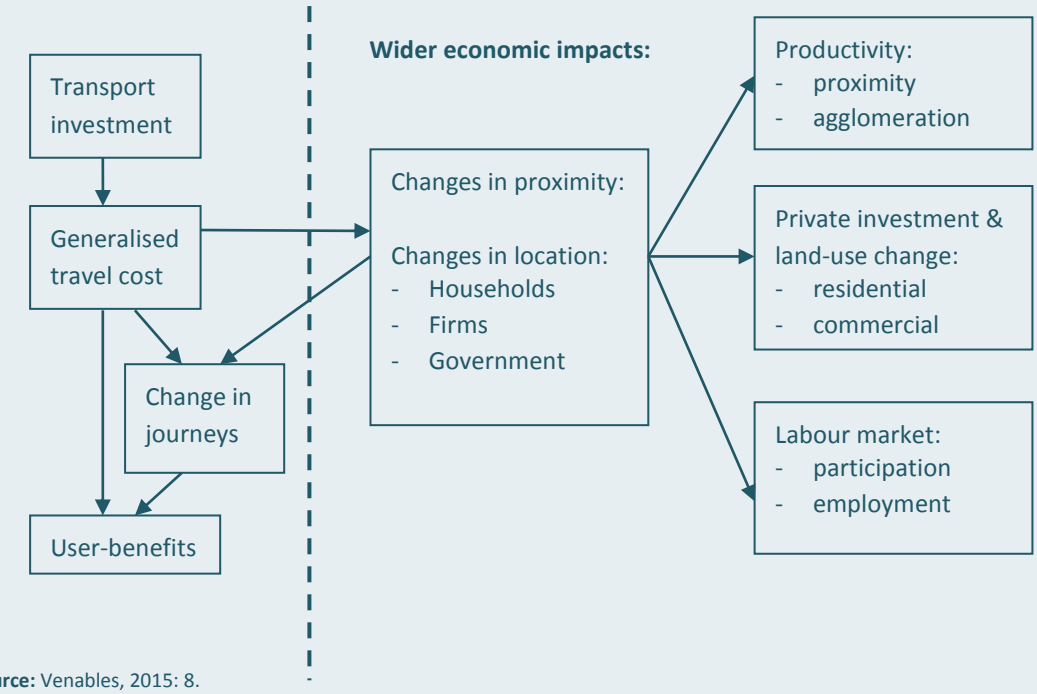
9.4 Incorporating Wider Economic Benefits in Transport Appraisal

The evolution of British thinking on how to analyse infrastructure is perhaps most evident in work on the challenge of incorporating wider economic benefits in the appraisal of proposed transport investments. The policy case for investment in transport improvements is frequently made in terms of its potential positive impact on investment, employment, urban regeneration and local or regional economic development (Cox & Davies, 2014; Moss Kanter, 2015; Rosewell & Venables, 2014; Vickerman, 2008). These wider economic impacts, however, typically go beyond conventional transport cost-benefit analysis, which focuses on the time-based user-benefits or welfare benefits. This creates a mismatch between the type of information that is most relevant to political decision-makers—impact on jobs and

regional growth—and what is actually provided by standard transport cost-benefit analysis (International Transport Forum, 2017; Venables, 2015).

Economists and others have increasingly made the case for an appraisal framework that goes beyond a narrow focus on time-savings for existing users, to incorporate a wider set of potential beneficial economic impacts. These include enhanced productivity, private investment and land-use change, and increases in employment and labour-market participation (see Figure 9.1).[27] This thinking distinguishes between the effect of improved transport within cities and enhanced connectivity between cities/regions—the effects of which are likely to be somewhat different.

Figure 9.1: The Effects of a Transport Improvement



Source: Venables, 2015: 8.

[27] For example, see Cox & Davies, 2014; Rosewell & Venables, 2014; Venables, 2015; Venables *et al.*, 2014; Vickerman, 2008; Volterra Partners, 2014; MIER, 2009.

Transport improvements *within* cities enable economic activity to concentrate at a higher density within an urban location by removing commuting constraints and/or providing additional connectivity. The concentration of economic activity and creation of thicker labour markets can enable metropolitan city regions to achieve the self-reinforcing benefits associated with agglomeration economies. Although there is a strong evidential basis supporting the relationship between the concentration of economic activities in urban locations and higher productivity, the precise role of transport effects will vary across transport projects, areas and sectors (Venables *et al.*, 2014).

Enhancing connectivity *between* cities also allows reorganisation of economic activity between places, with firms, plants and offices moving to new—and now more efficient—locations (Rosewell & Venables, 2014). Enhanced connectivity is viewed as facilitating increased task and functional specialisation, which drives improvements in innovation, competitiveness and productivity. Transport improvements can attract private investment and create employment opportunities.

Of course, enhanced connectivity is a necessary, but not sufficient, condition for these types of economic benefits to be delivered. Indeed, it is increasingly recognised that whether they materialise or not will depend on the willingness and capacity of market participants to take up the opportunities, and the extent to which poor connectivity has constrained them. One leading UK expert suggested that their views of the benefits of the HS2 link between Manchester and London were strongly influenced by a positive assessment of the level of stakeholder collaboration in Manchester and the plans and strategies that key actors were willing to put in place to harness the potential of the high-speed linkage (author's interviews, 2016).

The evolution of analytical thinking in the UK confirms that, as the range of benefits under consideration widens, the nature and solidity of both theory and evidence change (Venables *et al.*, 2014). In making the case for a new approach to evaluating the economic impact of transport investment, Venables *et al*. (*ibid.*) note that the research literature has not been able to provide good estimates of the *ex post* benefit-cost ratios (or rates of return) on particular transport investments that have been undertaken. This is partly because the benefits of a transport improvement can be quite diffuse, affecting many different individuals and firms, and partly because of the difficulty of establishing a good counterfactual—what would have happened if the project had not been built?

These authors also contend that the UK Department for Transport's appraisal guidelines provide a rigorous framework for appraising projects and, therefore, the

focus should be on how to extend and improve appraisal techniques in order to more fully capture (and critically evaluate) the economic impact of transport investments. This poses the challenge of how to be more ambitious in broadening the scope of appraisal, while remaining grounded in rigorous analysis (Venables, 2015). Other commentators, such as Volterra, are more critical of the limitations of the DoT's appraisal methodologies.

Venables *et al*. (2014) indicate that understanding the impact of large infrastructure projects necessitates an appraisal framework that assesses the impact of the different mechanisms that influence economic growth. Secondly, this approach requires better estimates of how transport changes quantities, i.e. journeys, patterns of investment and employment. Thirdly, this more robust evidential base needs to be combined with local and project-specific knowledge, including a clearly articulated narrative of what a project is expected to achieve. Indeed, it is interesting that the major transport project Crossrail 2 is now characterised as a transport and land-use project, as a major objective of this investment is to unlock land for substantial residential development. In highlighting this particular benefit, Venables (2015) notes that both the appraisal tools and evidential base for exploring transport investments' impact on land-use change are not as developed as those which can be applied to the other wider economic impacts.

The attempt to include consideration of wider economic benefits of transport investment reflects particular beliefs and theories on the benefits of agglomeration in dense urban centres and the effect of infrastructure on the regional pattern of economic activity. Indeed, the intellectual influence of endogenous growth theory and the 'new economic geography' has been such that agglomeration effects are often taken for granted by social scientists, urban and regional authorities and national governments. Despite the enormous influence of these ideas, a number of authors have begun to question the force and benefits of the 'increasing returns' effects associated with the spatial agglomeration and concentration of economic activity (Martin *et al.*, 2014). Martin (*ibid.*) is critical of the dominance of spatial economics and agglomeration theory, in particular in UK public policy, arguing that it does not provide an appropriate framework for addressing long-standing spatial imbalances in the economy. Recent work by Folkman *et al*. (2016) has also questioned the presumed positive economic benefits of the Greater Manchester Combined Authority's (GMCA) strategy of seeking to stimulate the growth of the Metropolitan City Region by concentrating investment and economic activity in central Manchester. Some argue that realising the potential regional economic and social benefits of major transport investment requires a wider set of complementary economic and social policies (Cox & Davies, 2014; Morgenroth, 2011, 2014).

Another strand of thinking and debate in Britain should also be mentioned. We noted that Rosewell and others suggest that the failure to incorporate wider benefits, such as enhanced productivity, into the technical analysis of mega projects, such as Crossrail in London, means that there is an underestimation of the benefits of new transportation in cities, leading to under-investment in necessary projects (Rosewell, 2010). Flyveberg, of Oxford University, in a series of papers on policy processes in infrastructure, has argued that megaprojects are characterised by a systematic overestimation of benefits and an underestimation of costs and delivery time-scales (Flyvbjerg, 2016). While this leads him to advocate some alternative methods of appraisal, it also forms the starting point of his much wider inquiry on the interactions between knowledge, interests, mass media and power in decision-making (Flyvbjerg, 2009, 2014, 2016; Bruzelius *et al.*, 2002). Indeed, this includes proposal for forms of 'social science that matters', drawing on Aristotle's concept of *phronesis* (Flyvberg *et al*., 2012). Some Irish research also suggests an optimisation bias in estimating the costs and benefits of infrastructure investment, particularly transport infrastructure projects (Morgenroth, 2011). Certainly, it cannot be assumed *a priori* that every mega infrastructure transport project will produce significant wider economic benefits (Vickerman, 2008). Additionally, the economic impacts of individual projects will also vary considerably in both magnitude and direction (*ibid*.).

9.5 A System of Systems Modelling Framework

The 'system of systems' framework has had a strong influence on the analytical approaches adopted by some British researchers and policy actors.

As outlined in Chapter 3, a key theme in the international literature on infrastructure is the fact that infrastructure regimes are comprised of a complex network of interconnected and interdependent systems and sub-systems (iBUILD, 2015; Hall *et al.*, 2016; Brown & Robertson, 2014; Council for Science and Technology, 2009). Interdependencies between infrastructure sectors create both risks and opportunities. Increases in the demand for water, for example, have the effect of increasing the demand for energy due to the energy intensity of water treatment and distribution (Hall *et al.*, 2013). Demand interdependencies create increased risks of interdependent failure, as problems in one sector (system) can result in cascading failures across interdependent sectors. Social, demographic, economic and technological changes, allied to the uncertain impacts of climate change, are increasing and deepening the interlinkages and interdependencies

between individual infrastructure systems (Brown & Robertson, 2014; Bouch, 2014; Hall *et al.*, 2016).

The Oxford-based Infrastructure Transitions Research Consortium (ITRC) is developing and demonstrating a new generation of simulation models and tools to inform and shape strategic infrastructure analysis, planning, investment and design.[28] A central feature of this work is development of a quantified system-of-systems modelling framework for analysing the performance—defined as the quality and reliability of service provision to clients (businesses and households)—of interdependent infrastructure systems under a range of possible and uncertain future conditions.

The ITRC argues that the prevailing 'predict and provide' approach to infrastructure planning and investment is no longer fit for purpose and that the UK needs to formulate a longer-term cross-sectoral infrastructure strategy. In their view, a credible long-term vision for infrastructure provision requires the adoption of an approach that incorporates the deepening interdependencies between sectors along with the complexity and uncertainty associated with these interconnected systems.

In this vein, Hall *et al*. (2016) have developed an assessment and modelling framework to provide evidence that can inform particular questions about the future performance of the national infrastructure system under a range of scenarios. This framework consists of four interrelated steps (Figure 9.2 and Figure 9.3):

- Scenario Generation
- Strategy Generation
- Infrastructure System of Systems Modelling
- Evaluating Infrastructure Systems

[28] See http://www.itrc.org.uk/

Figure 9.2: Overview of Analysis Framework

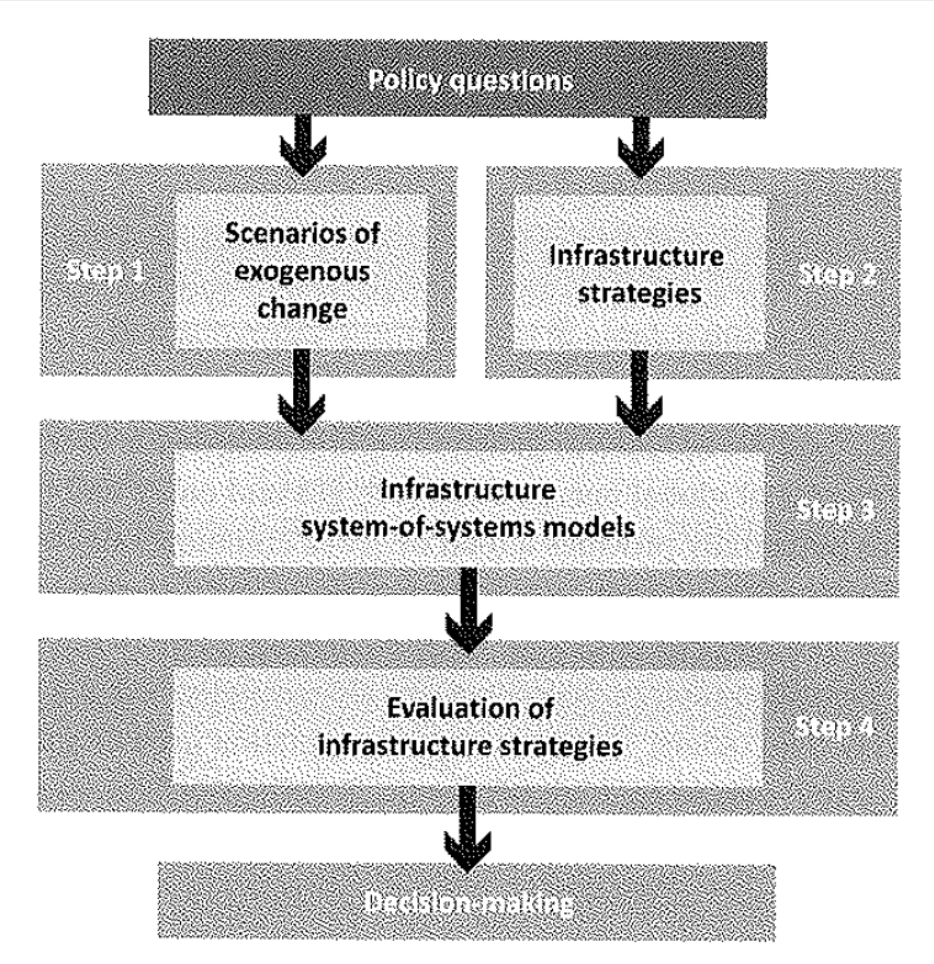
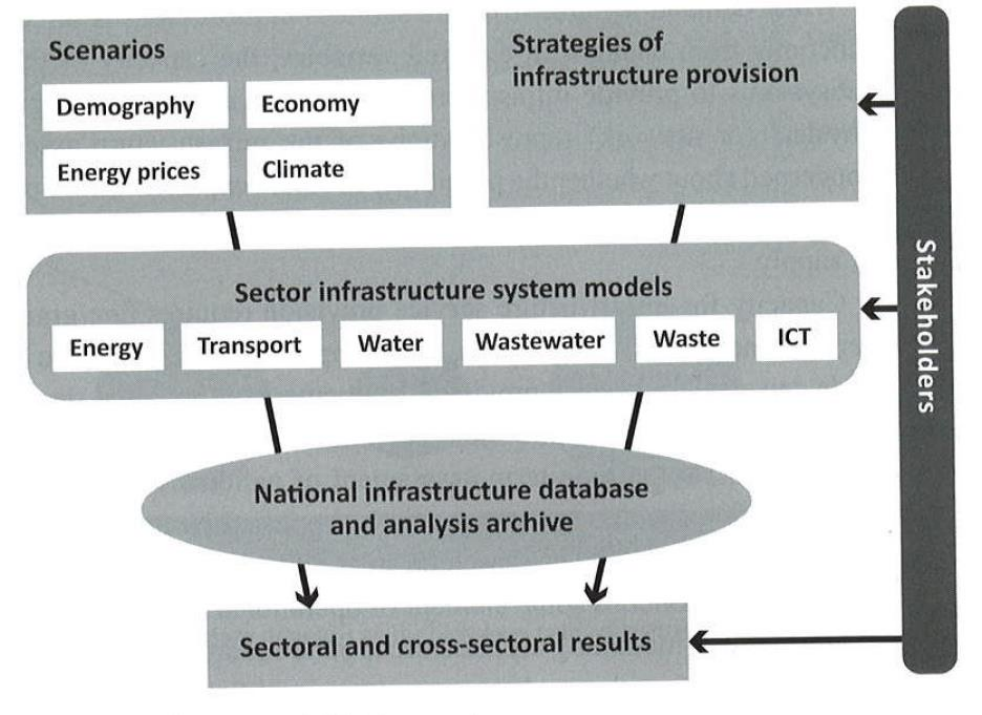


Figure 9.3: Overview of the System-of-Systems Modelling Framework



Hall *et al*. suggest that their quantified systems-of-systems modelling framework provides a robust and flexible methodology for engaging with this task. It is important to stress that this model has been designed to provide evidence that can answer specific questions about the future performance of interdependent infrastructure systems. These questions include:

- When and where are we anticipating breaking points of the current system under changing external conditions?
- What infrastructure strategies provide robust service performance under a wide range of possible conditions?
- Can we identify potential multi-sector transitions/changes?

They believe that this approach will help build an integrated capability for long-term policy evaluation in national infrastructure provision. This is seen as key to developing a vision of the future of national infrastructure and improving long-term strategic decision-making.

In proposing this methodology, Hall *et al.* are not calling for a grand 'master plan'. That would neglect the profound uncertainties that face the provision of infrastructure in the future and the need for strategies to adapt to different conditions. Indeed, taking full account of complex interdependence underlines the deep uncertainty in any attempt to estimate the future demand and supply of infrastructure services. There is also recognition that the infrastructure regime involves multiple actors pursuing different objectives. However, Hall *et al.* argue that their framework can provide a normative perspective and common platform for:

- developing a shared understanding about future challenges and trade-offs, and
- the testing of alternative strategies for national infrastructure provision under a range of uncertain futures.

This modelling framework seeks to capture the systematicity of infrastructure and the need for this to be incorporated into policy planning and investment. This work underlines the need to focus not on physical infrastructure assets *per se*, but rather on the quality and reliability of the *services* provided to households and businesses. In addition, despite the strong 'engineering' underpinnings to their work, Hall *et al.* stress the need to adopt a multidisciplinary approach to addressing infrastructure challenges.

However, there seem to be limitations to this modelling approach, some of which the authors recognise.

First, the modelling framework treats the economy and demography as exogenous inputs and, thus, there is no feedback loop between the socio-economic system and the performance of infrastructure. This is problematic given that infrastructure investment contributes to changes in the socio-economic system within which it operates.

Second, forecasting future infrastructure need requires making broad assumptions about economic growth, population change, technology and climate change (Brown & Robertson, 2014; Hall *et al.*, 2016). It has been pointed out that there is no consensus in most countries about the overall need for new infrastructure investment. Although the IRTC—and, indeed, the EIB—seek to pin down

infrastructure need using sophisticated analytical techniques, Marshall observes that ‘much social-scientific wisdom would doubt the prospects for such approaches –especially if funders are expecting one “correct” answer’ (Marshall, 2013).

Finally, Hall *et al.* are clear that their modelling and analytical framework cannot provide the answers to key questions, such as how much are we prepared to invest in infrastructure and where should it be located. These imply value judgements that need to be made as part of the broader democratic decision-making process. The development of this highly technical quantified system-of-systems model does not remove the need for political and societal choice within the decision-making process.

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