

What's wrong with infrastructure decision making?

Conclusions from six UK case studies

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About this report

Evidence suggests that the UK performs poorly on infrastructure compared to some other wealthy countries. This Institute for Government work programme explores why UK economic infrastructure policymaking is weak and how it can be improved.

The aim of this initial report is to contribute to a discussion about how best to plan, deliver and evaluate infrastructure, by identifying some of the main flaws in recent and controversial 'megaprojects'. The Institute is undertaking further work on the key issues raised in this initial report.

Subsequent publications will look in detail at:

- government's approach to modelling, in particular how cost-benefit analysis can be reformed so that we back the right projects more often
- how infrastructure projects are financed, and government's ability to strike good deals
- politics and institutions, including public consultation, devolution, and the role of politicians and experts in decision making.

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Summary

High-quality economic infrastructure – energy, transport, utilities and digital communication – supports successful modern economies. Well-chosen projects contribute to job creation and increased productivity. Given this, government has prioritised infrastructure investment as a means of strengthening the economy. In the Autumn Statement, the Chancellor Phillip Hammond pledged to spend £23 billion (bn) in the National Productivity Investment Fund over the next five years. From 2020, government plans to spend between 1 and 1.2% of gross domestic product (GDP) on economic infrastructure.

But not all infrastructure projects are equal. Some are significantly less likely than others to deliver economic benefits effectively and efficiently. And looking back at historic decisions, from the Millennium Dome to the Garden Bridge proposal, it is apparent that government is not always adept at identifying the best investments. This is a serious problem. Picking the wrong infrastructure projects can lead to white elephants – projects that deliver scant economic dividends compared to better alternatives, wasting public money in the process. To compound this, bad infrastructure decisions are often extremely difficult to undo. Infrastructure requires high levels of up-front capital which cannot be easily recouped, meaning that once the initial investment has been made, it is economically and politically difficult to turn back.

Successive governments have tried to reform the infrastructure policymaking process through:

- depoliticisation
- the creation of new planning and delivery agencies
- increased use of private finance
- extensive additional research to map the effects of infrastructure more comprehensively.

Most recently, Philip Hammond promised that 'long-term economics, not short-term politics, [would] drive Britain's vital infrastructure investment'. But so far, these reforms appear to have come up short.

In this paper we look at six large and controversial infrastructure projects (the Heathrow third runway, High Speed 1, High Speed 2, the Thames Tideway Tunnel, Hinkley Point C and the Jubilee Line Extension) to understand the decision-making process and identify opportunities for improvement. We identify six shortcomings which make it more difficult than it would otherwise be for government to make sound, timely infrastructure decisions:

- 1. There is no national strategy for infrastructure investment.** As yet, there is no overarching government strategy articulating a long-term vision for UK infrastructure and how it should fit into broader national goals. This makes it extremely difficult to decide which infrastructure projects to back, because different goals imply different projects. In the case of High Speed 2 (HS2), its

purpose has shifted. It has at various points been mooted as a means of saving travellers' time, of dealing with excess demand and of regenerating the West Midlands. Without a clear understanding of what goals government wants to achieve, it is almost impossible to test it against meaningful alternative options. In the absence of a strategy, the choices and sequencing of UK infrastructure have not been clearly explained, contributing to investor uncertainty and higher costs of capital.

2. Government does not devote enough attention to assessing early options.

Government devotes less than one-third of project development time to the critical early stages of options appraisal, with ministers and civil servants too quickly settling on preferred projects. Failure to devote sufficient attention to examining early options can result in better solutions being overlooked. This may have been the case with the Thames Tideway project, where credible alternatives were too quickly disregarded and were not revisited even as projected costs grew significantly.

3. The more ambitious the forecast, the more questionable the model. Uncertain long-term forecasting may be used to green-light schemes which are costly and difficult to deliver – as some have alleged was the case for the third runway at Heathrow and Hinkley Point C. Detailed future economic analysis, particularly for complex outcomes such as employment, investment and regeneration, is where governments traditionally struggle. Criticisms of individual projects are often driven by concerns about the robustness of their business cases. Despite these concerns, successive governments have failed to communicate the inherent difficulties of modelling large projects with long-term payoffs, and continue to put more weight on these estimates than may be justified.

4. Ministers and senior civil servants can fail to understand project risk. Decision makers can misunderstand the uncertainties and risks inherent in infrastructure investment. Risk-averse ministers may not understand the uncertainty of projected benefits; civil servants may plan budgets based on dubious estimates; and failure to communicate risks misinforms the public and parliamentary scrutiny bodies. In some cases, there has been little planning for what happens if things go wrong, even when there are large unknowns. Consequently, government finds itself stranded with few good options when plausible scenarios, interpreted as accurate predictions, turn out to be incorrect – as the Labour Government found with High Speed 1 in the late 1990s.

5. Government finds it difficult to make decisions which create 'concentrated losers'. Economic infrastructure has diffuse benefits and concentrated costs, creating small groups of highly vocal 'losers' who are likely to oppose projects. The drawn-out tales of Heathrow and HS2 indicate that a small number of influential voices can seriously delay, or even derail, decisions. The history of our six case study projects – particularly in the period between final analysis and the start of construction – illustrates the problems governments have when deciding whether to go ahead.

6. Inadequate evaluation misses the opportunity to improve future projects. After a project is complete and delivered, evaluation is normally insufficient. Decision makers have little idea whether projects are value for money or achieve their objectives in a cost-effective way. This contributes to a lack of improvement in pre-project modelling and forecasting, and repetition of the issues outlined above: decision makers are not routinely learning from past mistakes. Yet the evidence suggests that when evaluation is carried out, such as at Highways England, forecasting becomes more accurate and schemes achieve better value for money.

Government has and is pursuing worthwhile reforms to the infrastructure decision-making process. The creation of Infrastructure UK (2010), the Major Projects Authority (2011) and the National Infrastructure Commission (2015) is a positive step forward. Similarly, the Major Projects Leadership Academy and the awaited update to the Treasury's appraisal and evaluation guidance should improve practice. However, urgent action is required to address remaining and persistent issues.

Infrastructure decision making is one of the most consistently difficult tasks for government. The aim of this report is to contribute to a discussion about how best to plan, deliver and evaluate infrastructure projects, by identifying some of the main flaws in recent and controversial 'megaprojects'. Over the coming months, the Institute for Government will undertake further work on some of the issues raised in this initial report. Subsequent publications will look in detail at:

- government's approach to modelling, in particular whether cost-benefit analysis is fit for purpose
- how infrastructure projects are financed and government's ability to strike good deals
- politics and institutions, including public consultation and the role of politicians and experts in decision making.

Introduction

Improving infrastructure policymaking

The UK needs to make major strategic infrastructure decisions over the next few years.¹ There is a long-standing need to address many challenges, such as:

- airport capacity in the south-east of England
- climate change and energy security requirements, for example, the UK is committed to reducing greenhouse gas emissions by at least 80% in the Climate Change Act 2008
- maintenance and replacement of existing infrastructure (£8.3bn is due to be spent on roads between 2020 and 2025)²
- and the pressure of a rising population.³

Well-judged infrastructure investment contributes to a successful modern economy. It can support better economic performance by helping raise productivity and creating jobs.⁴ But poor investment decisions could lock the economy into inappropriate infrastructure systems for many years, with significant harmful effects

 Well-judged infrastructure investment contributes to a successful modern economy

on future prosperity.⁵ Bad investments can result in white elephants – projects that waste public money and fail to deliver the economic benefits a better decision could have brought about. The infrastructure built today shapes the infrastructure it is economical to build tomorrow, because assets fit into a wider system – whether the transport network or the national grid.



Despite the importance of this investment, there is well-established evidence that demonstrates problems in the way that government goes about infrastructure policymaking. These include:

- short-sightedness and lack of overall strategy
- serious weaknesses in the evidence base and modelling processes, on occasion leading to poor choice of projects
- shortcomings in government's ability to understand and handle risk
- failures to comply with the guidance in the 2003 Treasury *Green Book* which aimed to avoid exactly these pitfalls.

There are also frequent political flaws such as failure to secure cross-party agreement, which translates into high political risk for investors, and local community opposition, which often leads to delay.⁶

Weaknesses in the process are leading to the selection of the wrong projects, and to a contested and lengthy decision-making process in many cases, wasting both time and money.

Paper overview

The Institute for Government has looked before at problems in the way that governments make decisions about infrastructure, particularly in handling the politics. In previous work we have argued that some poor decisions reflect the lack of institutions that could allow politicians, experts, interest groups and local communities to take part constructively in policymaking.⁷ We have also looked at how best to enhance citizens' voices in major policy changes.⁸

In this paper, we focus on the flaws in the process of infrastructure policymaking itself. We look at what needs to change for government to make better choices about which proposals get the green light, and to ensure that the decision-making process is as efficient and effective as possible. We do this by looking at six recent, controversial infrastructure decisions that illustrate several flaws, where the enduring controversy reveals much about the shortcomings of the process.

Heathrow runway expansion

The question of UK airport capacity has been considered many times since the 1968 Roskill Commission, yet progress has been slow and successive governments have postponed the decision on where to give the go-ahead.⁹ When Theresa May's Conservative Government approved a third runway at Heathrow in October 2016, it provoked a cabinet split and public criticism, on grounds of noise, environmental impact, and the expense of the particular model chosen, which would pass considerable costs onto airlines and passengers.

An air of uncertainty still hangs over the project; a public consultation is underway, to be followed by a national policy statement (NPS) on aviation and a parliamentary vote. Meanwhile, the only new runways built in recent decades have been at London City and Manchester airports. London airports still rely on runways that have been in place since the middle of the 20th century.¹⁰

Problems with the expansion of airport capacity in the south-east of England illustrate the failure to create appropriate institutions and methods of serious engagement with local communities, as well as to compensate them for the costs that large infrastructure projects impose on them.¹¹ The continued controversy (even after the final report of the Airports Commission) also demonstrates the challenges of using long-term forecasting to justify schemes that are costly and difficult to deliver in the short term.

Hinkley Point C

When deciding how to provide electricity for the UK (the famous challenge of 'keeping the lights on'), governments must balance the demands of energy security, emissions obligations and cost; known as the 'energy trilemma'.

The new nuclear power station at Hinkley Point C looks like a sound decision only if energy security and climate change obligations are given greater weight over cost.

And even so, critics argue that other models of nuclear plant or offshore wind would be cheaper.¹² The deal guarantees French energy supplier EDF a notably high price, at £92.50 per megawatt hour in 2012 prices. At the moment, wholesale electricity prices are significantly less than that.¹³

However, it is difficult to ascertain the main factors in the Government's decision, because it has not been transparent about the evidence that led it to favour Hinkley over other projects, which is a flaw in the process itself. The value-for-money assessment appears perfunctory at just three pages long¹⁴ and has little reference to the energy trilemma.¹⁵

High Speed 2

Ongoing controversy over the case for building a high-speed railway line connecting London to the north of England is a good example of the perils of undertaking infrastructure investment without a clear overarching strategy, and the difficulties of managing local engagement and competing interests effectively.

HS2 has been lambasted as a 'solution in search of a problem' since it was announced in 2009.¹⁶ First proposed as a way of stimulating jobs, it became a way of saving travellers' time, then of dealing with excess demand on the West Coast Mainline, then of regenerating the West Midlands. This confusion of purpose has led to suggestions that the choice to build it is as much political vanity as cost-effective investment in regional regeneration.¹⁷ Critics have questioned the robustness of the data and forecasting used in the Government's business case for HS2, as well as the impact on journey times, carbon emissions, homes, communities and habitats. Successive governments have struggled to manage competing interests and, in particular, to foster informed, evidence-based discussion with those who will lose out from its construction.

Thames Tideway Tunnel

The Thames Tideway Tunnel is the underground tunnel that is being built to deal with sewer overflow in the Thames. Its case highlights the importance of devoting sufficient time at an early stage to appraising different options. The project, which has now begun construction, has a total cost of £4.2bn and will add an estimated £15–£25 a year to London water bills until 2029/30.¹⁸ Critics, including the former Ofwat Director-General, Sir Ian Byatt, say that the cost is unnecessarily high, and that cheaper alternatives were never explored properly.

Decision makers on the Tideway project may have fallen prey to 'project lock-in'.¹⁹ That is, perceived political risks, staff fears of openly expressing disagreement and a decision-making process sceptical of innovation, may have conspired to make decision makers reluctant to turn back after making an early commitment.

In 2014, the former chairman of the Thames Tideway Strategic Study, Professor Chris Binnie, suggested that further research was needed to determine the most cost-effective option for managing sewer overflow.²⁰

High Speed 1

High Speed 1 (HS1), also known as the Channel Tunnel Rail Link, is the high-speed rail connection between London and the UK end of the Channel Tunnel. Once again, it demonstrates process challenges on forecasting and understanding risk.

A version of the project was first proposed in the 1970s, with construction on Section 1 beginning in 1998 and Section 2 finally opening in 2007.

The consortium of companies bidding for the project, London and Continental Railways Consortium (LCR), made over-optimistic predictions about passenger growth on the Channel Tunnel in the 2000s. The Conservative Government of the time did not challenge them and subsequent re-estimates by external consultants, Booz Allen Hamilton, were also inaccurate.²¹ By 2004, the revised central case estimate was below both the 1998 and 2001 'low cases'. Once it became clear that the projected revenues were inaccurate, the project did not seem like a good bet to investors whom LCR had assumed would provide debt or equity finance for the project. LCR struggled to secure finance, and the Government was forced to step in and guarantee £3.7 billion that LCR would borrow to fund construction.

The project went ahead on the basis of wider objectives, including regeneration and 'national prestige'.²² But the most recent evaluation estimates that it currently stands as a net loss to the taxpayer.

Jubilee Line Extension

The Jubilee Line Extension (JLE), which connected Green Park to Stratford and unlocked the expansion of the Canary Wharf business district, is widely considered a success.²³ Although it was initially approved with a benefit-to-cost ratio of 0.95²⁴ (implying that its lifetime benefits would fall short of its costs), according to more recent analyses, the project in fact delivered a return of 1.75.²⁵ However, even in the case of a project widely assumed to be a success, the need for more effective analysis, before and after construction, is clear. As it stands, it is unclear how far the economic benefits (such as the revival of Docklands, which is often attributed to the JLE) are the direct consequence of the project. Wider outcomes such as increased employment in the 'JLE corridor' could be attributable to other policies, in particular investment in the East End and the Canary Wharf development.²⁶

In summary, each of these examples demonstrates how process flaws can lead to poor project selection and a contested, lengthy, decision-making process. These problems can lead to further delay and instability in vital investment, increasing the cost of capital for projects. In the following sections, we look at these challenges in more detail and show how overcoming them could lead to more confident and timely project selection, with more strategic coherence at lower cost for the UK's people and businesses.

Methodology

This report was produced through an in-depth review of the academic and broader literature as well as interviews with current and former senior civil servants, academics and consultants. Throughout the report we highlight issues with reference to six major economic infrastructure projects.

Projects were selected that:

- covered a variety of economic infrastructure sectors, e.g. energy, transport, utilities
- have a sufficiently detailed academic research base
- were large and capital-intensive
- have had substantial concerns raised about them by academics, politicians, citizens and commentators.

We recognise that the third and fourth criteria in particular will mean that this sample is not representative of all infrastructure projects commissioned by governments over this period. This report focuses on large 'megaprojects' because these are the hardest to get right and, despite their complexity, account for 29 of the projects in the Government's current major projects portfolio, with a combined total cost of almost £207bn. There is, however, significant literature, not least the Eddington Transport Study,²⁷ which suggests that smaller schemes are often likely to be more cost effective. The key points in the big vs small debate are summarised in a recent Institute for Government explainer.²⁸

We chose controversial projects to explore flaws in the policymaking process, and they do so clearly. Other projects have not been the subject of such extensive criticism and our report is therefore careful not to draw universal conclusions. The case studies selected do, however, provide clear indicators for ways to improve government infrastructure decision making.

Upcoming Institute for Government work will look in greater depth at:

- government's approach to modelling, in particular whether cost-benefit analysis is fit for purpose
- how infrastructure projects are financed and government's ability to strike good deals
- politics and institutions, including public consultation and the role of politicians and experts in decision making.

The weaknesses in government decision making

Governments of different parties, across a wide span of time, have not made wise infrastructure investments which best support their various objectives. Those objectives have, in any case, often been unclear. Poor decision-making procedures are a major contributing factor to this sustained failure and have led to loss of credibility with key stakeholders, high costs and delays. Key problems in the process are set out in detail in this chapter, moving chronologically from early strategy to post-project evaluation, illustrated with examples from the six selected projects.

Framing and project selection

There is no national strategy for infrastructure investment

There is no overarching government strategy articulating the future vision for UK infrastructure and how it should fit into broader national goals. There is neither a single co-ordinating body, nor an overall governing vision to clarify how infrastructure investment should be approached and prioritised.

 Poor decision-making procedures are a major contributing factor to sustained failure and have led to loss of credibility, high costs and delays

This is not to say that governments have never articulated wider objectives for infrastructure. There have been a variety of national policy statements²⁹ (for example detailed planning guidelines for projects such as new runway capacity in the south-east of England³⁰), but these only cover project-specific developments.

 There have also been national infrastructure plans and pipelines³¹ published annually since 2010 by the Infrastructure and Projects Authority,

previously Infrastructure UK. But crucially, neither the plans nor pipelines have articulated a cross-sectoral vision for infrastructure and how it should fit into national goals. The bulk of the national infrastructure 'plans' have been wish-lists of projects, rather than clear objectives and frameworks against which projects could be assessed. There are only objectives for each infrastructure sector (roads, rail, ports etc.) within each plan.

While the plans and pipelines have helped provide some additional certainty to potential investors, they do not constitute an overall vision of how infrastructure investment should be approached and prioritised. There has never been a UK process similar to Denmark's strategic analyses, which have had cross-party buy-in outlining infrastructure investment priorities.³²

The lack of overarching infrastructure strategy has been repeatedly criticised from a variety of perspectives by academics,³³ industry³⁴ and politicians.³⁵ In the absence of a strategy, ministers have not clearly explained the choices and sequencing of UK infrastructure,³⁶ contributing to uncertainty on the part of construction firms and investors,³⁷ and higher costs of capital.³⁸

A national strategy enables ministers to make decisions on a consistent basis and prioritise competing infrastructure projects and options. Without a clear strategy and goals, there is a risk that investment in infrastructure will fail to achieve government objectives or at least won't achieve them quickly and cost-effectively.³⁹ In the absence of an alternative, a 'predict and provide' approach has dominated.⁴⁰ This focuses on responding to expected market demand to the detriment of other potential objectives, such as reshaping demand.

By building cross-party and public consensus, a national strategy might also help to reduce inconsistency and change between governments. Managing political opposition and instability is an issue that we will return to at a later stage in our research.

Despite the strong support for a more strategic, integrated approach, attempts to address this problem over the last 20 years have not been very successful. Earlier cross-governmental bodies did not have either the remit or institutional 'teeth' to articulate a holistic strategy. For example, the Commission for Integrated Transport – an arm's-length body of the Department for the Environment, Transport and the Regions (DETR) – only had a remit covering best practice research and advice on specific issues, such as national road traffic targets and transport safety. Its legal status did not specify any mechanisms for how, if at all, ministers should respond to its recommendations,⁴¹ so it couldn't bring its recommendations to the forefront of the debate. Similarly, the Infrastructure Planning Commission, established in 2009, was in operation for less than three years before its powers were transferred to relevant secretaries of state and the Planning Inspectorate.

The creation of the National Infrastructure Commission (NIC) in 2015,⁴² which the Institute for Government welcomed at the time,⁴³ has been an extremely positive step. Its National Infrastructure Assessment,⁴⁴ due to be published in 2018, could help resolve some of the issues associated with the lack of national strategy. However, its role could be strengthened. So far there has been little detail on the format of the final report that the NIC will produce, or how it will hold the government to account for its recommendations in a timely fashion. The government is bound to respond to the NIC's recommendations within a year, but where it disagrees with a recommendation, there is no requirement to precisely justify why it disagrees.⁴⁵

The NIC could also be more independent of government. Despite ministers indicating that it would be a non-departmental public body,⁴⁶ it was established only as an executive agency of the Treasury and Michael Heseltine's recent dismissal as a commissioner⁴⁷ illustrated its ultimate subordination to party politics. However, a number of interviewees have argued that the NIC's closeness to the Treasury allows it to influence government policy more effectively than a fully independent body could.

Case study: High Speed 2

The initial proposal to expand the London to West Midlands/North West England route, which eventually became HS2, was first proposed in a 2008 Department for Transport white paper.⁴⁸ This was then expanded, with the creation of HS2 Ltd to investigate high-speed possibilities in January 2009;⁴⁹ and officially became government policy in October 2010.⁵⁰

HS2 provides an excellent illustration of the challenges of making infrastructure decisions in the absence of a strategy. Since it was first mooted in 2008, HS2 has repeatedly been criticised as a 'solution looking for a problem'.⁵¹ Its objectives have repeatedly seemed to shift. Initially suggested as an employment stimulus, it has subsequently been sold as a way to cut travel time, reduce overcrowding on the West Coast Mainline and regenerate the West Midlands. The lack of clarity over the purpose of HS2 has led to lengthy delays in decision making, as the Government has reworked its analysis and communications strategy, at significant cost, to deal with parliamentary and public opposition. On top of this, critical public and parliamentary stakeholders remain uncertain about whether HS2 represents the most cost-effective solution (not least because there is such disagreement about which problem it is aiming to solve), or good value for money. In a 2011 review of HS2, the House of Commons succinctly summarised the problem:

'The absence of a transport strategy makes it hard to assess how HS2 relates to other major transport infrastructure schemes, regional planning and wider objectives, such as bridging the north-south divide. This seems to have deterred some groups, which might otherwise have supported HS2, from doing so. The biggest single transport investment proposed in this parliament should be grounded in a well thought-through strategic framework and we are disappointed that the Government has not developed a strategy.'⁵²

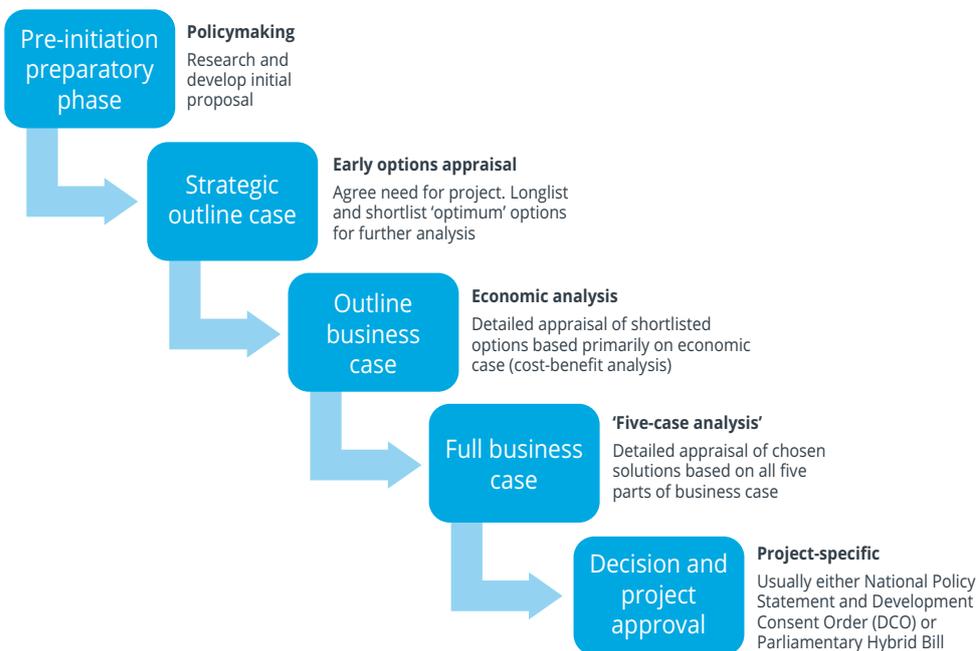
HS2 has repeatedly come under fire in relation to whether it will meet one of the objectives that has been mentioned most often: 'to build a stronger, more balanced economy capable of delivering lasting growth and widely shared prosperity'.⁵³ Many have argued that there are far more cost-effective options to meet this objective, such as increasing investment in existing regional connections between northern towns and cities.⁵⁴

Government does not devote enough attention to assessing early options

As discussed, clear objectives can enable ministers to prioritise projects and make decisions on a consistent basis. These objectives can be as broad as rebalancing regional productivity rates,⁵⁵ or as specific as meeting demand in a particular market. Often objectives cover both.

At this point in the decision-making process, several options for meeting objectives are proposed and are subject to early analysis, before a limited set of solutions are taken further.* The Treasury's *Green Book*, which provides guidance for public sector bodies on how to appraise proposals before committing funds, calls this the 'strategic outline case'. Figure 1 illustrates this in more detail.

Figure 1: Government approval process for programmes and projects



Source: Institute for Government analysis of HM Treasury Guidance: 'Treasury approvals process for programmes and projects', and 'Assessing Business Cases: A short plain English guide'.

This 'front-end' decision making typically involves less than one-third of the total time spent on project development. However, it has a disproportionate impact on outcomes, as most early 'shaping actions'^{**} occur during this phase.⁵⁶ As one interviewee put it, in most cases of government infrastructure investment 'the big fault line in projects [occurs] as you go from a nebulous policy idea into a specific project [...] often a nebulous policy idea has come up with a solution without fully understanding it'.⁵⁷ In other words, governments move to a preferred solution far too quickly.

* These solutions are then the subject of further, more rigorous appraisal including cost-benefit analysis.

** 'Shaping actions' refer to decisions which delimit ('shape') future options, based on whether to continue committing to a project, or to abandon it, at a certain stage in early options appraisal.

This is an important shortcoming. Failure to devote sufficient attention to examining early options can result in better solutions being overlooked.⁵⁸ This problem is



Failure to devote sufficient attention to examining early options can result in better solutions being overlooked

amplified because once solutions are agreed and projects announced, it is rare for previous or newly-emerged options to be reconsidered, even if these options are subsequently shown to better achieve the government's objectives or provide greater value for money.



Government has recognised that lack of attention to early options appraisal is a problem. The 2010 Coalition Government

undertook reforms to improve early options appraisal that focused on increasing the external review of decisions. The reforms gave the Infrastructure and Projects Authority⁵⁹ an active role in reviewing the early options appraisal and initial business case phases of infrastructure projects,⁶⁰ and separately brought in external challenge panels of academic and industry experts on select major projects.⁶¹ However, external challenge is not present in all projects. An independent Airports Commission recommended Heathrow and there is a challenge panel for HS2, but neither approach was used for Hinkley Point C.

Case study: Thames Tideway

The Thames Tideway project shows the problems which can be caused by failure to devote enough attention to early options appraisal. The boundaries of the analysis were set quickly and narrowly in the early options phase, and decision makers later did not return to alternative solutions despite cost reductions over the decision-making lifecycle. Consequently, technical and political stakeholders criticised the analysis on which the full business case was built as superficial (see below). Even now, it is not clear that the tunnel is the best solution.

The main problem with the early options analysis was that a mixed solution (using a combination of smaller measures to address storm sewage) was not considered in detail. This is an example of the seeming preference within government for large projects. Options appraisal began positively in 2000 with the analysis framed around the problem – that is, 'assessing the environmental impact of intermittent discharges of storm sewage'⁶² – rather than a single solution. This aligned with best practice for decision making,⁶³ which highlights the importance of clearly defining the problem rather than beginning with a preferred solution.

However, the scope of the options considered in the initial study narrowed too quickly. The first publication of the Thames Tideway steering group (2005) concluded that the only viable option was to intercept sewage before it got to the Thames, rejecting a combination of 'sustainable drainage solutions'* and other options as a solution, without proper analysis. A later, 2014 National Audit Office (NAO) report identified that

* 'Sustainable drainage solutions' refer to a variety of approaches which all try to mimic natural drainage systems, such as retaining water where it falls or reducing the run-off volume, as opposed to drainage approaches which aim to convey water off-site as soon as possible.

2005 was the effective decision-making point, as that was when the study had ruled out all other options aside from interception – although the minister with overall responsibility at Defra did not make an announcement to this effect until March 2007.⁶⁴ In practice, this meant some kind of tunnel was the only solution under consideration.⁶⁵ This is problematic as later evidence from Professor Chris Binnie, the chairperson of the original study, suggests that a mixture of sustainable drainage solutions and other measures may have been a more cost-effective solution to the original problem. He changed his mind after his re-analysis suggested the Government had overestimated the number of spills that would occur with sustainable drainage solutions.⁶⁶

Superficial early-options analysis meant that the decision lost credibility, and led to criticism from key stakeholders. The Environment, Food and Rural Affairs Committee first argued that the Government's consideration of sustainable drainage solutions had been insufficient in March 2011, when analysing the Government's national policy statement (NPS) on waste water.* According to the Committee:

'The absence of a detailed evidence base makes it hard to assess whether the draft NPS's conclusions on the potential for [sustainable drainage solutions] to contribute to reducing waste water are either over or under-stated. We recommend that Defra [...] sets out in detail the basis of its assessment for the potential of alternative approaches to mitigate the need for new infrastructure.'⁶⁷

This initial criticism snowballed. With reference to the Committee's conclusion, several London borough councils affected by the tunnel claimed that alternatives to a tunnel had not properly been tested. They commissioned Lord Selborne (who was, at the time, a member of the House of Lords Science and Technology Committee and unaffiliated to the project promoters) to undertake a study of alternative solutions.⁶⁸ Initiated by Hammersmith and Fulham Council, a coalition of councils sponsored and funded the report on the basis that the proposed tunnel would have 'a significant detrimental impact on the environment in the borough'.⁶⁹

More concerning from Defra's perspective, the original chairperson of the 2005 study, Chris Binnie, also criticised the evidence base for the decision. Binnie's subsequent 2013 study argued that:

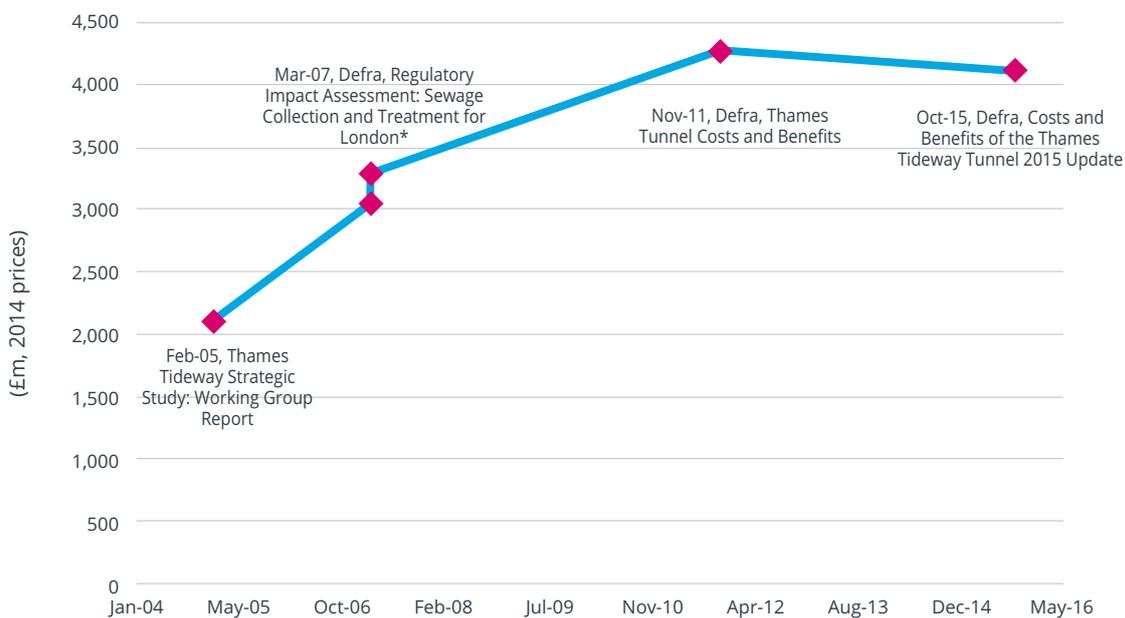
- the Government used faulty assumptions which overstated the number of spills that would occur using sustainable drainage solutions
- further research was required to confirm the most cost-effective solution
- on the basis of the available evidence, a mix of sustainable drainage solutions and sewer upgrades appeared to be the most cost-effective solution.⁷⁰

* That is, one of the final stages prior to project confirmation.

Later that year the former Director-General of the Water Services Regulation Authority (Ofwat), Sir Ian Byatt, similarly accused ministers of dismissing cheaper and more flexible solutions, noting that these had become more widespread in other countries.⁷¹

No reconsideration of alternative options occurred, although improvements in modelling demonstrated cost-escalations in the preferred tunnel option, which doubled in price from £2.1bn to £4.2bn (see Figure 2). According to the NAO's most recent review, Thames Water did not revisit previously appraised solutions (despite improvements in their ability to estimate the number of sewage overflows that would occur under different solutions) because the Secretary of State had already written asking it to proceed with a full-length tunnel in 2007.⁷²

Figure 2: Thames Tideway Tunnel projected costs



* The two estimates in the 2007 Defra regulatory impact assessment represent the range of estimates provided by Thames Water. At this point Thames Water had not decided on the final diameter of the tunnel, and their cost-benefit working group produced a range of results accordingly. The two results cited here are the highest and lowest estimates produced for the largest and smallest diameter tunnels respectively.

Source: Institute for Government analysis of Thames Water and Defra documents.

This does not appear to be in line with the Government's formal best practice guidance. In a 2014 review of risks to value for money in the Thames Tideway project, the NAO noted that normal best practice is to:

- revisit early options appraisal in light of new information
- incorporate the most up-to-date data on feasibility, costs and benefits
- reflect technological developments.⁷³

The *Green Book* also expresses concerns about over-enthusiastic early shortlisting 'eliminating the optimal solution before it is given full consideration'.⁷⁴ And it states that both the outline and full business cases offer opportunities to revisit assumptions and analysis, though it is not clear how often this actually happens.

There is a risk that continually re-opening decisions will lead to inaction. Clearer government guidance, setting out the circumstances that justify revisiting options appraisal, could help avoid this. In the Thames Tideway case though, best practice

// There is a risk that continually re-opening decisions will lead to inaction

clearly was not followed. If best practice was not followed on a project of this size and expense, that raises concerns about whether this is a more general trend across government. Subsequent Institute for Government research will explore in more detail whether guidance is followed consistently and the reasons for deviation from best practice.

Modelling and analysis

The more ambitious the forecast, the more questionable the model

Cost-benefit analysis (CBA) is the process of totting up positive and negative impacts of various options to determine which has the best overall consequences. It is the technical workhorse of infrastructure decision making. The Treasury provides guidance on how to appraise and evaluate proposals in the *Green Book*. For appraisal, the *Green Book* recommends that CBA should quantify as many costs and benefits in monetary terms as possible. This guidance is designed to provide consistent assessments of projects' value for money, taking account of wider social costs and benefits by attributing monetary values to them wherever possible.

The primary criterion used for determining whether government action is justified is 'net present value', that is, whether the benefits over the lifecycle of a project exceed the final costs. However, government sometimes has objectives beyond increasing net economic welfare. Here, the prescribed cost-benefit approach is less helpful. Redistributive objectives, or local economic impacts, for example, cannot be assessed within the Treasury's cost-benefit framework because it only provides an aggregate national assessment. We will return to this problem, and other flaws in CBA, in more detail in a subsequent research report.

Until the late 20th century, CBAs were relatively unambitious, particularly in evaluating benefits. They focused on easily quantifiable direct monetary effects, taking less account of wider economic impacts and non-market impacts.⁷⁵ These limitations were noticed and addressed. A number of reviews suggested that externalities (effects that are not reflected in market prices) and wider economic impacts deserved more attention.^{76,77} In the 2000s, the Department for Transport began developing tools to estimate those impacts.⁷⁸

Current Treasury guidance endorses 'analysis which quantifies in monetary terms as many of the costs and benefits of a proposal as feasible, including items for which the market does not provide a satisfactory measure of economic value'.⁷⁹ Regarding the time horizon of CBA, it recommends that 'costs and benefits considered should normally be extended to cover the period of the useful lifetime of the assets encompassed by the options under consideration'.⁸⁰

This requires extensive economic modelling, including price and demand forecasting. That is difficult, because market disruptions can be highly unpredictable. Technological developments, population changes and disruptions to markets for substitute goods can all quickly render initial predictions inaccurate. Similarly, the choice of discount rate, the figure used to calculate the present value of future benefits, can affect a CBA dramatically.

The more ambitious the analysis in scope and time horizon, the more likely disruption will take place. The Treasury advises departments to make sensitivity analysis* (a way of expressing the uncertainty around particular assumptions) a 'prominent part' of any appraisal. But from the conversations that took place with civil

servants as part of this research, it is not clear how far such analysis is fed up the decision-making chain.

// Critics have worried that uncertain long-term analysis was used to justify schemes which would be costly and difficult to deliver

// In the examples we discuss below, critics have chiefly worried that very uncertain long-term analysis was used to justify schemes which would be costly and difficult to deliver in the short term, at the expense of projects which might pose a lesser implementation challenge and provide more immediate benefit.⁸¹

Case study: Heathrow third runway

The analysis that the Airports Commission undertook for Heathrow attempted to forecast flight demand for the next 60 years. It did so using diverse datasets and a highly complex set of models,⁸² using the Department for Transport's own modelling tools as a starting point.⁸³

The conclusions of this modelling heavily influenced the Commission's recommendations. They predicted 'a faster and more substantial increase in passengers and destinations served at an expanded Heathrow than at Gatwick, particularly in the long-haul market'.⁸⁴ Overall, they assumed linear national and international growth broadly in line with past trends.

However, the aviation market is notoriously difficult to predict. The economist John Kay highlights that moving 'from Orville Wright's first flight in 1903 to the introduction of the jumbo jet took barely 60 years'. The next half-century was less eventful but he notes that 'while the Roskill commission of the 1960s, which reviewed London airport policy, got traffic growth projections broadly right, it did not forecast that the growth would come from low-cost airlines offering point-to-point services'. Even the 2003 air policy review 'failed to appreciate how the centre of the world economy was shifting east, and that Dubai would come to be the world's busiest airport for international passengers'.⁸⁵ The Airports Commission's assumption of such little disruption to existing trends is, given recent history and the pace of technological change, risky.

* Sensitivity analysis establishes how much the value of a benefit would have to fall, or a cost would have to rise, to render a given option unattractive. It gives decision makers some measure of the uncertainty of analysts' predictions.

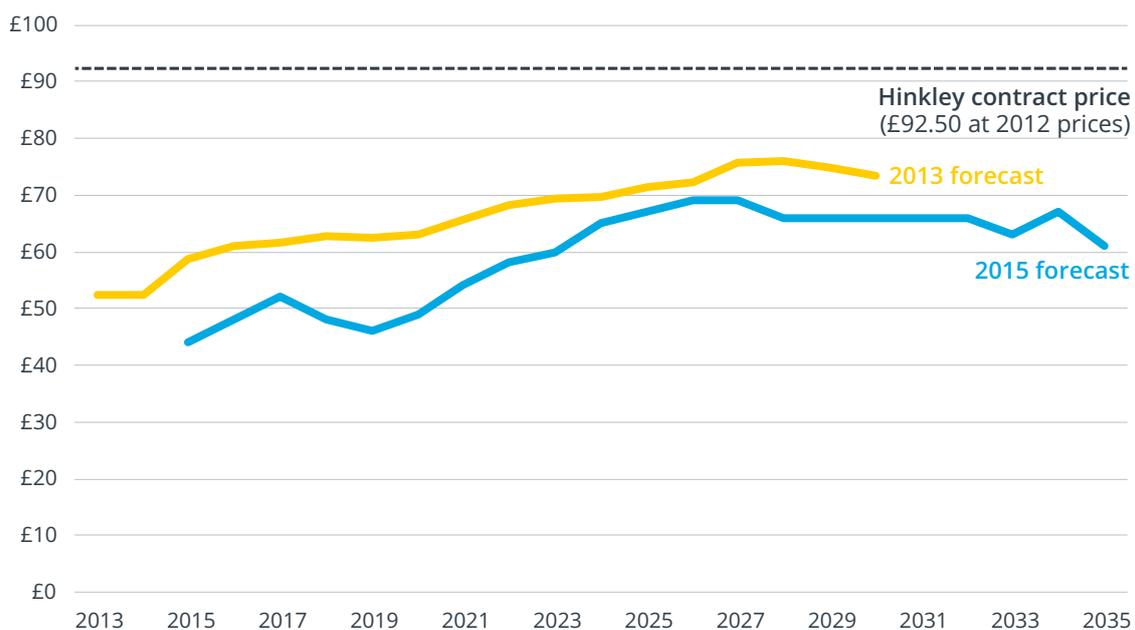
The Commission's base-case forecasts have already been shown up as inaccurate. It predicted Gatwick would reach 40 million passengers by 2024, but the airport got to 41 million in May 2016.⁸⁶ The Commission can hardly be faulted for inaccurate predictions. All forecasts are, by their nature, doomed to inaccuracy. However, given the divergence of demand from the Commission's predictions in less than a year, it looks unlikely that 60-year forecasts will stand up for long.

Case study: Hinkley Point C

Decision making on Hinkley Point C is similarly questionable. The Government offered EDF a 'strike price' of £92.50 per megawatt-hour, in 2012 prices, for the next 35 years. In today's prices, that is just over £96 per megawatt-hour. This means that EDF is guaranteed to be paid that for each unit of energy, regardless of the market wholesale electricity price. So if the market price is £90, consumers will pay over the odds, and if it is £100, they will pay under the odds. That strike price has caused much consternation. (The wholesale price at the moment is around half the price agreed.)

Some worry that developments in the energy market even over the past three years have reduced the value of the deal. Figure 3 shows how the Department for Energy and Climate Change's (DECC, now part of the Department for Business, Energy & Industrial Strategy [BEIS]) own forecasts of wholesale electricity prices for the coming decades have changed since the strike price was agreed in 2013. The unanticipated explosion of the US shale gas market drove prices down, while renewable energy sources have benefitted from subsidies and low operating costs, pushing down the price further. UK energy demand has also not grown with national output and consumption (it has been government policy to decouple them). With the possible exception of the expansion of US shale, these other trends are likely to persist, so even the department's adjusted 2015 forecasts may be too high (see Figure 3).

Figure 3: DECC forecasts of wholesale electricity prices (£/megawatt-hour)



Source: Institute for Government analysis of DECC, Updated energy and emissions projections: 2013, Annex F; BEIS, Updated energy and emission projections: 2016, Annex M.

The Government has not published a detailed analysis for Hinkley Point C. The strike price may have been chosen as a best estimate for average demand over the next 35 years, as providing the return necessary to secure investors, or a combination of the two. Whatever the reasoning, the sharp drop-off in price forecasts since the deal was agreed highlights a key issue when relying on long-term predictions for a major infrastructure investment: how is risk apportioned? In this case, the construction risk lies with EDF and its partner China General Nuclear Power Corporation (CGN), while consumers will bear the risk (and possible reward) of energy price movements. The question of how government can share the risk of infrastructure projects at an appropriate cost will be covered in more detail in a subsequent Institute for Government report.

This analysis is not intended to suggest that government should never undertake large, transformative, 'megaprojects' with uncertain long-term payoffs. But it is worth noting, in respect of the 2006 Eddington report, that government could be more sceptical of investment in major new *grands projets* – particularly where the returns, often based on long-term forecasting, are highly speculative.⁸⁷ There is a large academic literature (including by Atif Ansar and Bent Flyvbjerg⁸⁸) which argues that large megaprojects are inherently more 'fragile', that is, at risk of random events 'breaking' them, either in terms of investment value or literally. Therefore smaller, modular projects should generally be favoured.

Sometimes megaprojects will be appropriate. However, the nature of megaprojects (their high cost and lengthy lifecycle) requires a more transparent debate about their risks. Civil servants must clearly communicate the difficulties and uncertainty to ministers, who in turn must be open about the challenges with the public. (This issue is discussed in an Institute for Government explainer⁸⁹).

Making the final decision

Ministers and senior civil servants can fail to understand project risk

Infrastructure policymaking requires considerable forecasting and prediction, much of which is uncertain. Interviews with civil servants indicate that officials are not always able to communicate the nature and size of the risk as decisions rise up the chain of command. Though analysts in most cases have a tight grip on the different ways markets might develop, it is difficult to quantify or describe risk to others because of:

- the interaction of variables such as demand, market price and technology
- volatile economic conditions
- problems with the models used to evaluate and monetise externalities
- the distribution of probabilities between the 'base case' and other possible scenarios.

Conversations with civil servants during our research support our view that some of this information may be lost by the time advice is presented to ministers in a formal submission, limiting their ability to make considered decisions.

This problem was particularly evident in the work of the Airports Commission. The Commission initially did, to its credit, examine a range of future scenarios for global aviation. In its interim report, it set these out clearly and was even-handed about the range of possibilities. These included 'low-cost is king', in which growth in cheap air travel accelerates and demand pivots from Heathrow to Gatwick.⁹⁰ However, the final report used only the starting point deemed 'most likely' for its analysis and recommendations. Why did this range of scenarios effectively disappear? The final report noted that respondents to the interim report 'raised concerns about the complexity of the approach and the very broad ranges of results produced, arguing that this made it difficult to draw conclusions'.⁹¹ On this basis, the final report took the scenario judged most likely as a 'starting point', and this is the scenario that provided headline figures for subsequent ministerial statements.⁹²

This was a questionable choice. Best practice from the private sector, in particular theories of scenario planning derived from Shell, stress the importance of not narrowing the range of scenarios under consideration, even if it makes decision

 **Outlining a series of plausible futures and asking 'what will we do if this scenario happens?' is far more useful than asking 'what will happen?'**

makers uncomfortable.⁹³ As difficult as it is to accommodate risk, outlining a series of plausible futures and asking 'what will we do if this scenario happens?' is far more useful than simply asking 'what will happen?'.⁹⁴

Assuming that there are no optimal solutions (solutions which would work best in all plausible futures), decision makers can either 'hedge' and pick an option which serves adequately in most scenarios,

or 'bet' on the option which best suits the most probable scenario. For infrastructure projects the former is likely to be more expensive but more adaptable; the latter is likely to be cheaper but less flexible.

If ministers and senior civil servants fail to understand this choice, they will struggle to communicate their decision, and risk damaging public trust. In the Airports Commission case, at the very least, ministers should have been clear that its conclusions were not a strategy to 'preserve flexibility' but rather a 'bet on the most probable scenario'⁹⁵ – which in this case was that 'future demand is primarily determined by central projections published by sources such as the Office for Budget Responsibility, OECD and IMF';⁹⁶ that is, a simple extrapolation from past data that historic trends would continue.*

As suggested above, failure to understand risk is detrimental to decision making. This is for four main reasons:

1. If a risk-averse minister does not understand the sensitivity of a project to changes in market price or demand, they may sign off on a project that they (and their government) do not have the risk appetite for.

* It is worth noting that the final Commission stated that the alternative scenarios were used to test all conclusions drawn, but the Commission does not make clear how this was done.

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2. It can lead to mismanagement. If those planning budgets do not understand the risk that market conditions may change, cutting revenue or pushing up the cost of capital, then future budgetary difficulties are more likely.
 3. Failure to understand risk will inevitably lead to failure to communicate risk. In the political sphere, poor communication restricts the ability of Parliament and the public to scrutinise government's decisions, and can intensify other decision-making problems. If a minister confidently assures Parliament of the cost or benefits of a project and political will coalesces behind it on that basis, then amending the plan in response to changing realities becomes more difficult, even when that would improve a project's cost effectiveness or value for money.
 4. If civil servants and ministers do not fully understand project risk, the cost of capital for large infrastructure projects will be excessively high. This has been a long-running concern for politicians⁹⁷ and scrutiny bodies, particularly in relation to public-private partnership (PPP) and private finance initiative (PFI) contracts.

 If civil servants and ministers do not fully understand project risk, the cost of capital for large infrastructure projects will be excessively high

The NAO highlighted in 2011 that there is insufficient data on the returns which equity investors make for the risks they bear.⁹⁸ Early PFI contracts, for example, generally did not require investors to disclose their returns after contracts had been let. This raises the possibility that the public sector, and ultimately the taxpayer or the consumer, may be paying more than they should for equity investment⁹⁹ and privately financed infrastructure. In a 2012 report, the NAO suggests that one reason

for this may be that the public sector lacks the expertise to challenge investors' proposed returns rigorously. This lack of challenge directly relates to an inability to understand risk and insufficient commercial skills more broadly (though government has taken positive steps to build commercial capability).¹⁰⁰

The Treasury, the department with responsibility for private finance policy, has historically relied on competition to secure appropriately priced contracts, rather than attempting to assess whether the pricing of equity is optimal. According to the NAO, this has generated a return to equity of around 12–15% in contracts, a proportion of which cannot be explained by risks born by investors.¹⁰¹

There are good reasons to question whether competition alone will prevent investors profiting excessively from megaprojects. Due to the size of such projects, the market of potential investors is extremely small (a *de facto* oligopoly or even monopoly). As such, there is reduced pressure on investors to provide their most competitive offer (i.e. the lowest rate of return at which they would be willing to finance a project).

These concerns have been illustrated in the Hinkley Point C contract negotiations. At Hinkley, the controversy over the high strike price has partly been due to the way in which the contract was negotiated with EDF. The Government negotiated the contract bilaterally with EDF, rather than going through a competitive process. Although DECC

and BEIS claimed to mitigate the risk through a gainshare financial mechanism and a cost 'discovery and verification process'¹⁰² to check EDF's sums, it is not clear that the high rate of return promised to EDF and CGN is justified, and whether the Government could have negotiated a better deal. The Government's cursory three-page value-for-money publication does little to assuage these concerns.¹⁰³ It does not explain how the Government determined that the strike price is appropriate for the construction risk EDF and CGN are taking on.

In stark contrast, the Government appears to have struck a better financing deal on the Thames Tideway Tunnel. By judiciously using a targeted support package, the Government was able to secure capital from institutional investors with limited risk appetites: Dalmore Capital, Allianz Capital partners and Amber Infrastructure. The final cost of capital for Tideway was just below 2.5%, which is remarkably low for a big construction project, and closer to the low returns expected in the regulatory asset base models in the energy transmission and water sectors. This significantly reduced the financing cost of the project, reducing the annual impact on household bills from £70–80 to £20–25.¹⁰⁴

For Tideway, high-risk, low-probability events, such as the risk of drilling and flooding the Underground were, sensibly, guaranteed by the Government. Where Bazalgette (the consortium responsible for designing, constructing and financing the tunnel) was not able to secure insurance, the Government provided indemnity for claims up to £2.26bn for damage to construction works.¹⁰⁵ In addition to these guarantees, there was a separate competition to provide capital. By accepting and making explicit that there are some risks the private sector are not able to bear, the Government clarified the scope of its implicit support for the project, and successfully reduced the overall cost. Tideway represents a major step forward in the public sector's understanding and handling of risk in comparison to the wholesale risk transfer of earlier projects. (See High Speed 1 below.)

In general, however, insufficient progress has been made on this issue in the last few years – despite Treasury guidance. The *Green Book* (which has remained largely unchanged since 2003 though it is currently being redrafted) recommends giving prominent position to different possible scenarios and the sensitivity of analytical assumptions to changing external conditions in business cases.¹⁰⁶ This should, if practised, make decision makers aware of the uncertainty they face, but there are questions over how consistently this is applied. In any case it is part of the additional guidance rather than a core requirement.

Case study: High Speed 1

In the case of HS1 the Government's failure to understand and communicate project risk led to badly designed legislation. This proved cumbersome and costly when the private consortium commissioned to design and build the project was not able to raise the private finance they had promised.

The problem began with the 1987 Channel Tunnel Act. The Act made government funding for international rail passenger services, the primary purpose of the link, unlawful,¹⁰⁷ meaning that construction would not start until the project received a financially viable proposal from private sector bidders. The Transport Secretary at the time, Cecil Parkinson, repeatedly clarified to Parliament that the Government would

not provide money for the project.¹⁰⁸ There is a strong case to suggest that the Government of the day did not consider the potential difficulties and uncertainties in obtaining private finance for the project at the outset, despite warnings raised by British Rail during pre-appraisal work.¹⁰⁹

The consortium that won the PFI contract in 1996, 'London and Continental Railways' (LCR), over-forecast passenger demand. The Government took these forecasts at face value, not challenging their accuracy until the planned financing method failed. This was despite both the complexity and the importance of passenger demand forecasts in determining future revenues. As both the NAO¹¹⁰ and Omega Centre note, it is concerning that 'no independent assessment of the forecasts were made before the deal between government and LCR was signed in 1996'.¹¹¹ This proved to be a costly mistake.

The most recent re-evaluation by the NAO in 2012 found that actual passenger numbers between 2007 and 2011 were, on average, one-third of the level that LCR originally forecast in 1995, and two-thirds of the Department for Transport's independent, revised 1998 forecasts. Failure to understand the inherent risks of 'basing a business case and financing for a project on demand forecasts where there is only a limited track record'¹¹² led the Government to design a financing mechanism which implicitly assumed the central case demand forecasts, provided by a project bidder, were correct.

When LCR's optimistic forecasts proved to be a significant demand over-estimation, the PFI contract became unsustainable. LCR could not raise finance from the debt or equity markets, and the Government stepped in to restructure the deal, guaranteeing £3.75bn of LCR's debt, in 1998. This allowed LCR to raise the money required for construction to proceed.^{113,114} To avoid breaching the terms of the 1987 Act, the 1998 restructure technically did not involve an increase in government grants, but the deal was fundamentally different to that agreed in 1996. The Government, and by extension the taxpayer, was now exposed to risk that had originally been transferred to the private sector. While the restructured deal was in many respects more robust than the original, the Government would have had greater room for manoeuvre was it not for the 1987 Act.

On both demand forecasts and financing, it is not clear that the Government planned for a situation in which demand was lower than the central case forecast. The NAO note that this is not unique to HS1, and has been a consistent problem: 'Government[s] have not always taken a realistic view of the likelihood of associated risks materialising', which for HS1 meant exposure to an ongoing liability when the Government guaranteed debt despite lower-than-expected passenger revenues.¹¹⁵

Stated simply, mistaken beliefs about ease of access to private finance and the accuracy of passenger demand forecasts that were based on an inadequate understanding of uncertainty, damaged the decision-making process. If the Government had developed a range of scenarios for the HS1 project including, for example, difficulties accessing private finance or lower demand forecasts, it would have been able to better communicate the risks to MPs and the public, and plan for foreseeable difficulties.

Government finds it difficult to make decisions which create 'concentrated losers'

Almost all infrastructure projects have diffuse benefits shared by a lot of people and localised costs, which fall on a smaller number. These 'concentrated losers' bear the brunt of a project's negative consequences, which can include localised property blight, noise, environmental pollution and landscape impacts. There are, of course, steps government takes to mitigate the worst effects. These include attempts to get local 'project buy-in' through engagement,¹¹⁶ and compensation via mechanisms such as compulsory purchases. Despite these mitigating steps, infrastructure often

// Infrastructure often prompts opposition and delay

prompts opposition and delay, as local people rarely perceive compensation and consultation to be sufficient.¹¹⁷

// Delays are amplified by the UK's constituency-based electoral system and open planning and judicial system, which give significant voice to local concerns.

Governments have often been unwilling to confront the problem of concentrated losers directly. They frequently procrastinate, putting off decisions, commissioning new analysis, and developing political work-arounds.¹¹⁸

Successive governments have made little effort to change how they deal with concentrated losers, in contrast to their efforts on other problems identified in this paper. This is particularly disappointing given the examples of deliberative institutions abroad (the Netherlands Alders Commission, the French Commission Nationale du Débat Public and the Australian Productivity Commission) which appear to have made the decision-making process more constructive and consensual.¹¹⁹

Case studies: Heathrow third runway and HS2

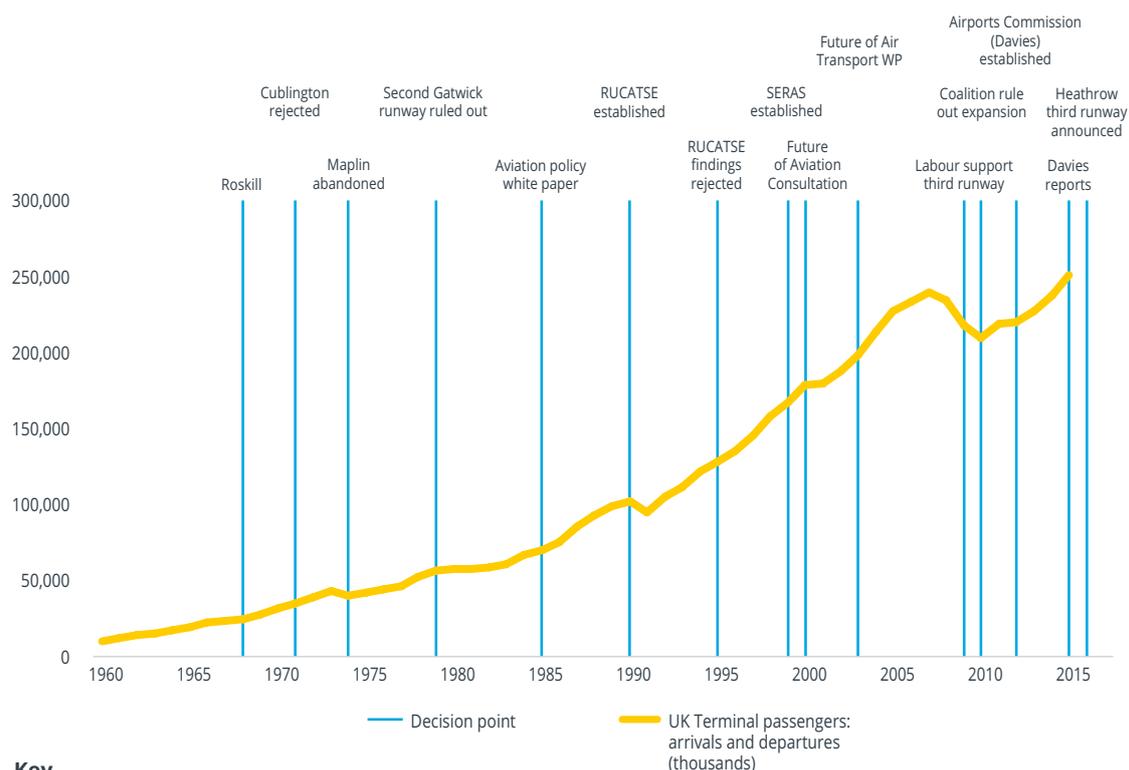
Heathrow third runway and HS2 are particularly pertinent examples of the problems government faces when weighing up local and national concerns.

In the case of Heathrow, the most heated political issue is that runway expansion will increase local environmental and noise pollution, and in some cases oblige people to leave their homes. This has caused significant political dithering. Government responses to the two independent commissions on runway expansion illustrate the problem (see Figure 4).

The Roskill Commission

The Roskill Commission was established in 1968 to determine the best site for a new airport for London.¹²⁰ Its 1971 report recommended an airport at Cublington in Buckinghamshire, but this was rejected by the Government on the basis that it was a political non-starter. Upon receiving the Commission's findings, Edward Heath, the then prime minister, is reported to have commented that the report 'seems likely to give us [the Conservative party] a lot of trouble'. The Roskill Commission's technocratic mandate did not long survive the harsh realities of politics. It should be noted that several people without local interests – including Colin Buchanan, a member of the

Figure 4: Airport expansion decision progress



Sources: Department for Transport, Air Traffic at UK Airports (Table AVI0101); Institute for Government analysis of key airport expansion decisions

Commission, and several MPs – raised questions about the validity of the cost-benefit analysis used to support Cublington.¹²¹ However, local opposition was the primary driver behind rejection of Cublington, in the heart of Conservative safe seats, as a solution.

The Airports Commission

The creation of the Airports Commission in 2012, an independent review established ‘to identify and evaluate how any need for additional capacity should be met in the short, medium and long term whilst maintaining a UK-wide perspective’¹²² bears some resemblance to the Roskill Commission four decades earlier. Despite the Airports Commission providing a clear recommendation in December 2015 to expand Heathrow, ministers delayed their decision to allow for further study of environmental impacts.¹²³ The delay was almost certainly a method of keeping the Heathrow issue out of the 2016 London Mayoral election, pre-empting a rift between Conservative candidate Zac Goldsmith and then prime minister, David Cameron.¹²⁴ As the Transport Committee aptly summarised:

‘The creation of the Airports Commission briefly held out the hope that an evidence-based decision would end years of political dithering, but the Government has largely squandered this opportunity by delaying its decision and calling for further work.’¹²⁵

The Government did eventually proceed with the Airports Commission's recommendation to build a third runway at Heathrow. Only a few weeks after Chancellor Philip Hammond claimed that 'long-term economics, not short-term politics, [will] drive Britain's vital infrastructure investment',¹²⁶ the Prime Minister took the exceptional step of suspending collective cabinet responsibility on Heathrow. This was due to Boris Johnson's longstanding record of opposition as London Mayor, and both his and Justine Greening's constituency-based opposition. While unusual, this approach should allow the Government to secure the necessary parliamentary approval for the project. It does, however, highlight how difficult political leaders in Britain continue to find it to make the case for national infrastructure if it adversely affects their, or their ministerial colleagues', constituencies.

The decision to build a third runway has also been challenged in the courts. Shortly before the Airports Commission reported, Greenpeace and several local authorities brought a legal challenge against the Government¹²⁷ for failing to exclude Heathrow from consideration on the basis of air pollution, and failing adequately to consult local communities. Although rejected in January 2017,¹²⁸ further legal challenges will almost certainly arise at a later stage in the approval process.

High Speed 2

In the case of HS2, local concerns have centred around property issues, environmental concerns and landscape impacts, which led to similar problems to those at Heathrow, although groups opposed to the project have often expressed their opposition as concerns about the project's business case.

Dan Durrant, an academic at the Bartlett School of Planning, University College London, argues that the handling of the consultation has only added further fuel to the fire of community scepticism.¹²⁹ A committee of the House of Lords agrees. The Lords committee on the phase 1 bill concluded that they could not 'stress enough the importance of effective and timely public engagement, something which, we were told time and again, could be improved upon'.¹³⁰ The scope of local opposition is extensive. The NAO note that HS2 Ltd have had to process around 2,600 petitions through the hybrid bill process,¹³¹ which encompasses only a small part of the overall consultation. There has also been judicial delay, as opponents have resorted to using the legal system. In 2013, a series of challenges were brought against the Government by councils and campaigning groups for failures to comply with environmental regulations, compensation, consultation and other decision-making failures.¹³²

One significant difference to the runway expansion debacle, however, is that few MPs are in a position to delay the project. There are no critical cabinet ministers, equivalent to Boris Johnson in political importance who are unequivocally opposed to the project. And the three main political parties in England (the Conservatives, Labour and the Liberal Democrats) all support the project. The hybrid bill comfortably passed its first stage in the House of Commons by 452 votes to 41, in March 2014.¹³³ Accordingly, there has been less political procrastination on the project than with runway expansion, which illustrates the arbitrary way some projects are, and are not, subject to delay based on local concerns. The question of how to deal with concentrated losers created by infrastructure projects will be looked at in detail in an upcoming Institute for Government paper.

Evaluation

Inadequate evaluation misses the opportunity to improve future projects

Government departments, project developers and external scrutiny bodies' evaluations do not adequately consider outcomes or evaluate projects against initial objectives – despite evidence that doing so could improve appraisal. Although these organisations have developed good mechanisms for scrutinising cost, time and scale, they continue to dodge measuring projects against their initial objectives.

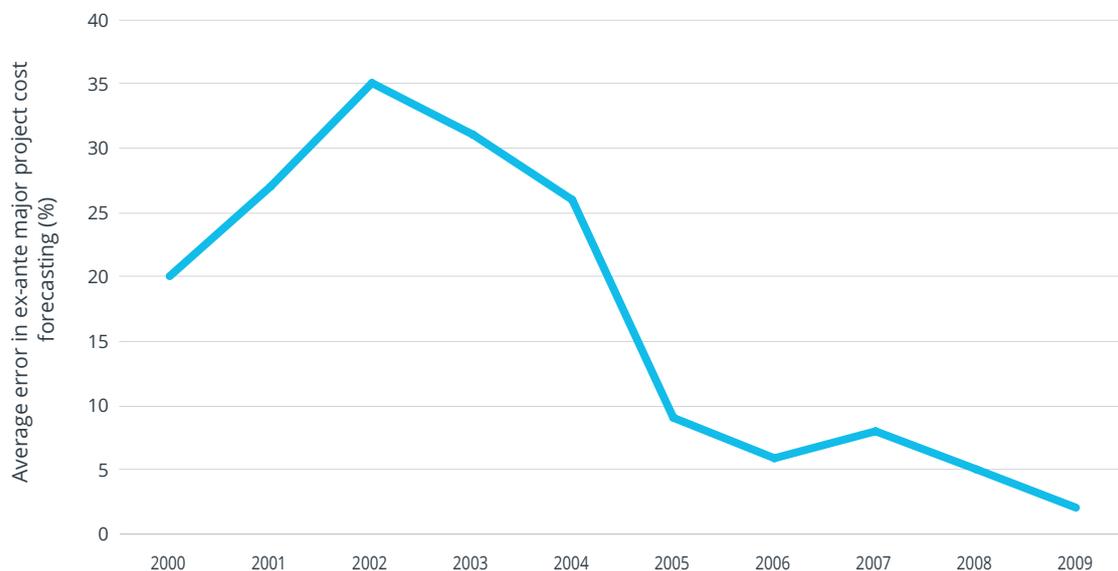
This is partially due to ill-defined initial objectives, but also an institutional set-up which prioritises cost, time and scale.* The government already has well-established procedures for learning delivery lessons, established both formally through schemes such as the Major Projects Leadership Academy,¹³⁴ and informally through

// Better evaluation could increase the accuracy of appraisal



programmes such as the Crossrail Learning Legacy.¹³⁵ But both these programmes focus heavily on traditional 'on-time, on-budget' measures of project success. The evaluation process further encourages the prioritisation of simple metrics rather than more complex, wider objectives.**

Figure 5: Highways England, average error in cost forecasts by appraisal year



Source: Institute for Government visualisation of Highways England, 'POPE Meta-analysis 2015', Figure 6-15 'Margin of error of capital cost estimates by appraisal period'.

* The National Audit Office's mandate is exclusively ex-post, for example.

** By simple metrics we refer to easily definable and measurable metrics, such as the number of transport users and the direct benefits to users. While these are useful, evaluations often overlook complex metrics such as productivity, employment and additional investment, which are often the justifications for infrastructure investment.

Better evaluation could increase the accuracy of ex-ante appraisal (i.e. forecasting done in advance of a project) by increasing our knowledge of how and why policies have impact, the scale of that impact, and the mechanism by which policies result in desired outcomes. This is particularly important for complex wider effects on productivity, investment, employment and redistribution for which the current evidence base is very much inconclusive.¹³⁶ Indeed, since Highways England began a structured evaluation programme, their ex-ante appraisals have become more accurate (see Figure 5).

Case studies: High Speed 1 and Jubilee Line Extension

Two economic impact studies were commissioned in 2009 and 2015 to examine the effects of HS1. The primary focus of the 2009 evaluation was on cost and transport user benefits. While the evaluation did estimate wider economic outcomes, particularly those relating to regeneration, it was unable to come to any definitive conclusions about what impact HS1 had.

Partly this was a result of an inability, or unwillingness, to set measurable targets for wider economic benefits at the outset. The evaluation was only able to go so far as to state that regeneration benefits were 'clearly important and formed a major part of the decision to proceed with HS1'.¹³⁷ In fact, the Department for Transport only commissioned a full evaluation of the economic impact of HS1 following criticism from the Public Accounts Committee in 2012 that the government does not properly evaluate major projects, and therefore does not understand the wider economic impact of transport infrastructure compared with alternative options.

But the inability to measure whether or not a project has met its objectives is also a result of the difficulty in identifying a direct cause-and-effect link between specific infrastructure projects and wider economic outcomes. In the case of the Jubilee Line Extension, multiple post-project evaluations have failed to show that employment and productivity gains (an important part of the early rationale for the project) can be directly attributed to the project itself. This is because the project was interwoven with extensive government investment in East End regeneration, most prominently through the Canary Wharf development. Post-project evaluations struggled to account for the concurrent impact of this regeneration.^{*138}

These methodological difficulties are not confined to these two evaluations. In a recent review of 2,300 transport studies in the Organisation for Economic Co-operation and Development countries, the What Works Centre on Local Economic Growth** found that only 1% meet the Centre's minimum standards.¹³⁹ However, while infrastructure decisions should be made on the basis of the best available evidence, this does not mean leaving it to academics. Relying on academia would almost certainly lead to under-investment, given the stringent standards required to demonstrate causation, and inconclusive evidence on wider effects.

There are few if any uncontroversial truths in public policy and there is not a simple technocratic solution to everything. Tools such as cost-benefit analysis are helpful but they do not fully account for behavioural change, network effects or non-linear effects

which accelerate beyond a point of critical mass.¹⁴⁰ Ministers must therefore use both judgement and evidence. Where projects have been chosen with reference to wider economic impacts, governments should at least attempt evaluation. If, for example, the government argues that increasing local employment is part of its rationale for Heathrow, it could include the numbers of local out of work benefit claimants as one of the evaluation criteria for the project, alongside the standard metrics we would expect on passenger and flight numbers.

In response to variants of the criticisms outlined above, the Department for Transport has outlined its ambitions to integrate evaluation from the start of projects, and now publishes an annual 'monitoring and evaluation strategy' update,¹⁴¹ which details the Department's progress with most evaluation schemes for major projects. The Department for Transport's evaluation strategy is typical of most government departments, although the NAO's most recent review of evaluation in government found that seven departments did not have an evaluation strategy.^{***,142} The Department for Transport also commissioned work on improving the links between appraisal and evaluation in July 2016,¹⁴³ which recommended greater alignment between modelling undertaken before and after projects. There are, however, pockets of good practice within departments and arm's-length bodies, such as Highways England.

Learning from good practice: Highways England

Highways England, a government company, completes a 'post-opening project evaluation' (POPE) survey of all road schemes one and five years after completion. This compares pre-project appraisals and post-project evaluations with the aim of reviewing 'whether it had the benefits and impact predicted'.¹⁴⁴ This is then summarised in a biennial meta-report of all scheme evaluations.

Highways England's evaluation scheme is not perfect. As the What Works Centre for Local Economic Growth notes, its evaluation of wider impacts is flawed because it is based on a before/after comparison and the evaluation relies on basic surveys of local businesses. The Centre therefore recommends using control groups to better demonstrate causation in wider economic impacts, where these are an important part of the strategic or economic case for a project.¹⁴⁵ Highways England itself admits that its assessments of broader objectives such as economic development are often 'anecdotal'.¹⁴⁶

* This is known as the 'selection into treatment' problem and refers to the issue that locations which receive transport investment usually differ (by either under- or over-performing on various economic indicators) from those that don't.

** The What Works Centre for Local Economic Growth was set up in October 2013 as part of the What Works Network to analyse which policies are most effective in supporting and increasing local economic growth. It is a partnership between the London School of Economics, Centre for Cities and Arup.

*** It should be stressed that all departments had an immediate forward plan of evaluation, and a lack of strategy is not tantamount to ignoring evaluation.

However, POPE has had a much greater impact through its standardisation and clear focus than the often post-hoc, badly designed evaluations of other major infrastructure projects. Evaluation of roads now follows a standardised procedure which feeds back into pre-project appraisal in a transparent way. Highways England maintains a list of all the issues raised by POPE, tracks their response to them, and shares best practice with project managers and specialists. The most recent POPE meta-report found evidence of more accurate cost-benefit forecasting since 2004,¹⁴⁷ and an increase in the overall value for money achieved by schemes since 2008.¹⁴⁸ This suggests that their enhanced evaluation process has improved the way they appraise projects before they start.

Conclusion

The economic arguments in favour of well-judged infrastructure investment, particularly in times of stagnating productivity, have been rehearsed many times before.^{149,150} But government does not always make wise investments.

Choosing what infrastructure to build is a fraught, complex calculation for public and private sector alike. But the challenge is particularly acute for government. The private sector can judge success based on return on investment. Governments of all stripes typically find it harder to measure return on investment for their objectives, which are

difficult to monetise, and may conflict. This is especially so for megaprojects, which can have a transformational impact on both local and national systems, and behaviour.

// The absence of a strategic plan for infrastructure can lead to inappropriate and inconsistent project selection

The six case studies selected for this report provide important insights into some of the flaws that can be made in decision-making processes for large infrastructure projects.



- The absence of a strategic plan for infrastructure can lead to inappropriate and inconsistent project selection, alongside investor uncertainty,¹⁵¹ and higher costs of capital.¹⁵² Perhaps most crucially, lack of strategy makes it difficult to know how to judge or compare alternative infrastructure options. You would undertake very different projects depending on whether you wanted to, for instance, rebalance the economy, increase productivity or boost short-term demand.
- Government can fix on a limited number of options too quickly, shutting out alternatives that might prove more effective. This is arguably what happened in the case of the Thames Tideway Tunnel, which has doubled in projected cost and may now be a less cost-effective project than 'sustainable drainage solutions', which was disregarded early on.
- The time horizons of cost-benefit analysis have become increasingly ambitious, but the future remains stubbornly unpredictable. In the case of Hinkley, the consumer is now set to pay EDF double the current wholesale value per megawatt-hour. Ministers are making decisions on what is often highly speculative long-term forecasting.
- This uncertainty is often lost, or downplayed, in the policymaking process. In the case of the Airports Commission, it initially set out a range of possible scenarios to guide decision making and was even-handed about the range of possibilities. These included a scenario entitled 'low-cost is king', in which growth in cheap air

travel accelerates and demand pivots from Heathrow to Gatwick.¹⁵³ However, the final report used only the starting point deemed 'most likely' for its analysis and recommendations. Other scenarios disappeared.

- All infrastructure projects have diffuse benefits and localised costs, and accordingly create a small number of people who endure disproportionate downsides. But government finds it difficult to manage this fallout without introducing enormous delays. The issue of where to expand airport capacity has been kicking around for the best part of 50 years. The delays are currently costing in the region of £6 million a day.¹⁵⁴ Compensation levels, engagement institutions and political management all need to be revisited to better manage the clash of local and national interest.
- Evaluation is failing to capture whether or not infrastructure projects are actually achieving the outcomes they promised, despite evidence that by doing so they could improve future forecasting and project selection.
- Finally, but far from least important, the Treasury's *Green Book* guidance is not always being strictly followed. In particular, early shortlisting can eliminate the optimal solution before it is properly considered, and businesses cases do not always give due prominence to different possible scenarios and the sensitivity of analytical assumptions to changing external conditions.

Government has attempted to improve decision making. It has made progress through a range of reforms including the creation of institutions such as Infrastructure UK (2010), the Major Projects Authority (2011) and the National Infrastructure Commission (2015), alongside training programmes such as the Major Projects Leadership Academy.¹⁵⁵ But with increasing pressure to invest billions of pounds in new infrastructure, it is urgent that the flaws which persist in decision making are tackled to avoid white elephants, hugely expensive commitments and failure to make decisions.

The aim of this report is to provide a prompt to improve this process, and to contribute to a discussion about how best to do this. Over the next year, the Institute for Government will undertake a major programme of work aimed at supporting government to get infrastructure investment right. This will look in detail at modelling, finance, politics and institutions.

References

- 1 Morse, A., *Infrastructure Investment: The impact on consumer bills*, National Audit Office, 2013, retrieved 26 May 2017, <https://www.nao.org.uk/report/infrastructure-investment-impact-consumer-bills-2/>
- 2 Morse, A., *Progress with the Road Investment Strategy*, National Audit Office, 2017, retrieved 26 May 2017, <https://www.nao.org.uk/report/progress-with-the-road-investment-strategy/>
- 3 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, retrieved 26 May 2017 <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
- 4 Bottini, N., Coelho, M. and Kao, J., 'Infrastructure and Growth', *Investing for Prosperity*, 2013, pp. 153-154.
- 5 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, retrieved 26 May 2017, <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
- 6 Morse, A., *HM Treasury: Planning for economic infrastructure*, National Audit Office, 2013, retrieved 26 May 2017, <https://www.nao.org.uk/report/hm-treasury-planning-for-economic-infrastructure/>; Dobes, L. and Leung, J., *Wider Economic Impacts in Transport Infrastructure Cost-Benefit Analysis – A Bridge Too Far?*, vol. 22, no. 1, 2015, retrieved 26 May 2017, <http://press-files.anu.edu.au/downloads/press/p332753/html/argument02.xhtml?referer=1750&page=11>
- 7 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
- 8 Ilott, O. and Norris, E., *Smarter Engagement: Harnessing public voice in policy changes*, Institute for Government, 2015, retrieved 26 May 2017, <https://www.instituteforgovernment.org.uk/publications/smarter-engagement>
- 9 Helsey, M. and Codd, F., *Aviation: Proposals for an airport in the Thames Estuary, 1945-2014*, House of Commons Library, 2014, retrieved 26 May 2017, <http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN04920>
- 10 Airports Commission, *Airports Commission: Final report*, Gov.uk, 2015, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-final-report>
- 11 2M Group, *Letter to Right Honourable Ruth Kelly MP, Secretary of State for Transport*, 27 February 2008, retrieved 28 May 2017, http://www.wandsworth.gov.uk/download/downloads/id/1283/2m_response_to_the_dft_consultation
- 12 Evans, S., *In-depth: The whole system costs of renewables*, Carbon Brief, February 2017, retrieved 28 May 2017, <https://www.carbonbrief.org/in-depth-whole-system-costs-renewables>
- 13 ICIS, *Electricity Prices: Day-ahead baseload contracts – monthly average (GB)*, Ofgem, April 2017, retrieved 28 May 2017, <https://www.ofgem.gov.uk/chart/electricity-prices-day-ahead-baseload-contracts-monthly-average-gb>
- 14 Department for Business, Energy and Industrial Strategy, *Hinkley Point C Value for Money*, Gov.uk website, 2016, retrieved 28 May 2017 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/556917/3_-_Value_for_Money_Assessment.pdf
- 15 Ilott, O., *Hinkley: The dubious value of the value for money assessment*, Institute for Government blog, 3 October 2016, retrieved 28 May 2017, <https://www.instituteforgovernment.org.uk/blog/hinkley-dubious-value-value-money-assessment>
- 16 Kay, J., *HS2 is Yet Another Politically-driven Project in Search of a Rationale*, John Kay's website, 1 July 2015, retrieved 28 May 2017, <https://www.johnkay.com/2015/07/01/hs2-is-yet-another-politically-driven-project-in-search-of-a-rationale/>
- 17 House of Lords Economic Affairs Committee, *First Report: The economics of High Speed 2*, Parliament UK website, 2015, p. 9, retrieved 28 May 2017, <https://www.publications.parliament.uk/pa/ld201415/ldselect/ldeconaf/134/13402.htm>

-
- 18 Morse, A., *Review of the Thames Tideway Tunnel*, National Audit Office, 2017, retrieved 28 May 2017, <https://www.nao.org.uk/report/review-of-the-thames-tideway-tunnel/>
 - 19 Cantarelli C., Flyvbjerg B. van Wee B. and Molin E., 'Lock-in and its influence on the project performance of large-scale transportation infrastructure projects: Investigating the way in which lock-in can emerge and affect cost overruns', *Environment and Planning B: Planning and Design*, vol. 37, no. 5, 2010.
 - 20 Binnie, C., *Thames Tideway Tunnel: Costs and benefits analysis*, 2014, retrieved 28 May 2017, <http://cleanthames.org/wp-content/uploads/Prof-Binnie-TTT-Cost-Benefit-Analysis-2014.pdf>
 - 21 Morse, A., *Department for Transport: The completion and sale of High Speed 1*, National Audit Office, 2012, p. 19, retrieved 28 May 2017, <https://www.nao.org.uk/report/the-completion-and-sale-of-high-speed-1/>
 - 22 *Ibid*, pp. 9-10.
 - 23 McLoughlin, P., *Oral Answers to Questions – Transport – in the House of Commons: High Speed 2*, Parliament UK website, December 2013, retrieved 28 May 2017, https://www.publications.parliament.uk/pa/cm201314/cmhansrd/cm131219/debtext/131219-0001.htm#131219-0001.htm_wqn1
 - 24 Worsley, T., *The Evolution of London's Crossrail Scheme and the Development of the Department for Transport's Economic Appraisal Methods*, OECD Publishing, 2011.
 - 25 Buchanan, C., *Transport for London: Reappraisal of the Jubilee Line Extension: Final Report*, Colin Buchanan & Partners, 2003.
 - 26 Jones, P., 'Assessing the wider impacts of the Jubilee Line Extension in East London', *Handbook on Transport and Development*, 2015, p. 325.
 - 27 Eddington, R., *The Eddington Transport Study: Transport's role in sustaining the UK's productivity and competitiveness*, UK Government Web Archive, December 2006, retrieved 28 May 2017, <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf>
 - 28 Institute for Government, *Big vs Small Infrastructure Projects: Does size matter?* Institute for Government, 2017, retrieved 20 June 2017, www.instituteforgovernment.org.uk/our-work/better-policy-making/infrastructure/big-vs-small-infrastructure-projects-does-size-matter
 - 29 The Planning Inspectorate, National Policy Statements, National Infrastructure Planning, 2012, retrieved 28 May 2017, <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/national-policy-statements/>
 - 30 Department for Transport, *Heathrow Expansion: Draft airports national policy statement*, Gov.uk website, 2 February 2012, retrieved 28 May 2017, <https://www.gov.uk/government/consultations/heathrow-expansion-draft-airports-national-policy-statement>
 - 31 The Treasury and Infrastructure UK, *National Infrastructure Plan*, Gov.uk website, 5 December 2016, retrieved 28 May 2017, <https://www.gov.uk/government/collections/national-infrastructure-plan>
 - 32 Danish Ministry of Transport, Building and Housing, *The Danish Infrastructure After 2020*, 2011, retrieved 28 May 2017, <https://www.trm.dk/en/topics/strategic-analyses/the-danish-infrastructure-after-2020>
 - 33 Helm, D., 'British infrastructure policy and the gradual return of the state', *Oxford Review of Economic Policy*, vol. 29, no. 2, 2013, pp. 296-298.
 - 34 The Confederation of British Industry (CBI) and AECOM, *Infrastructure Survey 2015: Turning momentum into delivery*, CBI website, 2015, pp. 11, 17, retrieved 28 May 2017, <http://www.cbi.org.uk/insight-and-analysis/turning-momentum-into-delivery-cbi-aecom-infrastructure-survey-2015/>
 - 35 House of Commons Transport Committee, *High Speed Rail: Tenth report of session 2010-12*, Parliament UK website, 2011, retrieved 28 May 2017, <https://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/1185/1185.pdf>
 - 36 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, p. 4, <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
 - 37 The Confederation of British Industry (CBI) and AECOM, *Thinking Globally, Delivering Locally: Infrastructure Survey 2016*, CBI website, 2016, pp. 50-53, retrieved 28 May 2017, <http://www.cbi.org.uk/insight-and-analysis/thinking-globally-delivering-locally/>

-
- 38 Bottini, N., Coelho, M. and Kao, J., 'Infrastructure and Growth', *Investing for Prosperity*, 2013, pp. 168-170
- 39 Department for Transport, *The Economics of HS2: Government response to the House of Lords Economic Affairs Committee report*, Gov.uk website, 2 July 2015, pp. 9, 26, retrieved 28 May 2017, <https://www.gov.uk/government/publications/the-economics-of-hs2-governments-response-to-the-house-of-lords-economic-affairs-committee-report>
- 40 Goulden, M., Ryley, T. and Dingwall, R., *Beyond 'Predict and Provide': UK transport, the growth paradigm and climate change*, ScienceDirect website, vol. 32, pp. 139-147, March 2014, retrieved 28 May 2017, <http://www.sciencedirect.com/science/article/pii/S0967070X14000213>
- 41 Department for Transport, Local Government and Regions, *A New Deal for Transport: Better for everyone*, 1998, pp. 81-82.
- 42 HM Treasury and Osborne, G., *Infrastructure at Heart of Spending Review as Chancellor Launches National Infrastructure Commission*, Gov.uk website, 2015, retrieved 28 May 2017, <https://www.gov.uk/government/news/infrastructure-at-heart-of-spending-review-as-chancellor-launches-national-infrastructure-commission>
- 43 Riddell, P., *Statement on the Creation of a National Infrastructure Commission*, Institute for Government, 5 October 2015, retrieved 28 May 2017, <https://www.instituteforgovernment.org.uk/news/latest/statement-creation-national-infrastructure-commission>
- 44 National Infrastructure Commission, *Process and Methodology: Consultation response*, Gov.uk website, 27 October 2016, retrieved 28 May 2017, <https://www.gov.uk/government/publications/national-infrastructure-assessment-consultation-response>
- 45 National Infrastructure Commission, *National Infrastructure Commission Framework Document*, Gov.uk website, p. 4, 24 January 2017, retrieved 28 May 2017, <https://www.gov.uk/government/publications/national-infrastructure-commission-framework-document>
- 46 HM Treasury, *National Infrastructure Commission: Response to consultation*, 2016, p. 5.
- 47 Heseltine, M., 'I've had my marching orders but I can't let us sleepwalk into Brexit', *The Times*, 12 March 2017, retrieved 28 May 2017, http://www.thetimes.co.uk/edition/comment/ive-had-my-marching-orders-but-i-cant-let-us-sleepwalk-into-brexit-qlxn9rww2?CMP=TNLEmail_118918_1457653
- 48 Department for Transport, *Delivering a Sustainable Transport System: Main report*, Southwest Regional Assembly website, 2008, retrieved 28 May 2017, <http://www.southwest-ra.gov.uk/media/SWRA/RFA2%202008/dastsreport.pdf>
- 49 Department for Transport, *Britain's Transport Infrastructure: High Speed Two*, National Web Archive, 2009, retrieved 28 May 2017, <http://webarchive.nationalarchives.gov.uk/20090327165817/http://www.dft.gov.uk/pgr/rail/pi/highspeedtwo/highspeedtwo.pdf>
- 50 Department for Transport and Hammond, P., *Proposed High Speed Rail Network North of Birmingham Confirmed*, Gov.uk website, 2010, retrieved 28 May 2017, <https://www.gov.uk/government/news/proposed-high-speed-rail-network-north-of-birmingham-confirmed>
- 51 Bates, P., 'HS2: It's a solution looking for a problem', *Magazine of the Chartered Institute of Building*, 3 October 2013, retrieved 28 May 2017, <http://www.constructionmanagemagazine.com/comment/hs2-debate-its-solution-looking-problem/>
- 52 House of Commons Transport Select Committee, *High Speed Rail: Tenth report of session 2010-2012*, p. 16, November 2011, retrieved 28 May 2017, <https://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/1185/1185.pdf>
- 53 Department for Transport and High Speed Two (HS2) Limited, *The Strategic Case for HS2*, Gov.uk website, p. 18, 29 October 2013, retrieved 28 May 2017, <https://www.gov.uk/government/collections/the-strategic-case-for-hs2>
- 54 FT Editorial, 'Better ways to link up northern cities: Prioritise connectivity to enhance regional prosperity', *Financial Times*, 23 June 2014.
- 55 Department for Business, Energy and Industrial Strategy, *Building our Industrial Strategy*, Gov.uk website, 23 January 2017, retrieved 28 May 2017, <https://www.gov.uk/government/consultations/building-our-industrial-strategy>

-
- 56 Miller, R. and Lessard, D., 'Evolving Strategy: Risk management and the shaping of megaprojects', in Priemus, H., Flyvbjerg, B. and Van Wee, B. *Decision Making on Mega-Projects: Cost-benefit analysis, planning and innovation*, Elgar online, 2008, retrieved 28 May 2017, <https://www.elgaronline.com/view/9781845427375.00015.xml>
- 57 Institute for Government, Infrastructure Project interview.
- 58 Brown, R., Ashley, R. and Farrelly, M., *Political and Professional Agency Entrapment: An agenda for urban water research*, vol. 25, no. 15, 2011, pp. 4,037-50.
- 59 The Infrastructure and Projects Authority (IPA) is a Cabinet Office and HM Treasury non-departmental public body, which provides expertise in infrastructure financing, delivery and assurance.
- 60 Morse, A., *Delivering Major Projects in Government: A briefing for the Committee of Public Accounts*, National Audit Office, January 2016, retrieved 28 May 2017, <https://www.nao.org.uk/report/delivering-major-projects-in-government-a-briefing-for-the-committee-of-public-accounts/>
- 61 HS2 Ltd Strategic Challenge Panel, *Note of HS2 Ltd Strategic Challenge Panel meeting 27.02.12*, Gov.uk website, 2012, retrieved 28 May 2017, <http://assets.hs2.org.uk/sites/default/files/inserts/Strategic%20Challenge%20Panel%20270212.pdf>
- 62 Thames Tideway Steering Group, *Thames Tideway Strategic Study: Steering group report, national infrastructure planning*, 2005, p. 5, retrieved 28 May 2017, https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/WW010001/WW010001-001256-8.1.2_Thames_Tideway_Strategic_Study_Steering_Group_Report.pdf
- 63 Priemus, H., 'How to Improve the Early Stages of Decision Making on Mega-Projects', in Priemus, H. Flyvbjerg, B. and Van Wee, B., *Decision Making on Mega-Projects: Cost-benefit analysis, planning and innovation*, Elgar online, 2008, retrieved 28 May 2017, <https://www.elgaronline.com/view/9781845427375.00015.xml>
- 64 Morse, A., *Review of the Thames Tideway Tunnel*, National Audit Office, 2017, retrieved 28 May 2017, <https://www.nao.org.uk/report/review-of-the-thames-tideway-tunnel/>
- 65 Morse, A., *Thames Tideway Tunnel: Early review of potential risks to value for money*, National Audit Office, 2014, p. 21, retrieved 28 May 2017, <https://www.nao.org.uk/report/thames-tideway-tunnel-early-review-potential-risks-value-money/>
- 66 Binnie, C., *Thames Tideway: Measures to protect the river environment from the adverse effects of waste water discharges*, Blue Green UK, 2013, p. 4, retrieved 28 May 2017, http://www.bluegreenuk.com/references/government_institutional/A2.%20Binnie%20-%20Measures%20to%20protect%20the%20river%20environment%2022.10.13.pdf
- 67 Environment, Food and Rural Affairs Committee, *The Draft National Policy Statement (NPS) on Waste Water*, Parliament UK website, 2011, p. 16, retrieved 28 May 2017, <http://www.parliament.uk/business/committees/committees-a-z/commons-select/environment-food-and-rural-affairs-committee/inquiries/waste-water-nps/>
- 68 Thames Tunnel Commission, *Report of the Thames Tunnel Commission*, 2011, p. 29, retrieved 28 May 2017, https://drive.google.com/file/d/0B_AyUkU4At3_ODdmYTNmZDAtZDg4ZC00MwY4LThiZGltZDMxOTJlYThhNTA1/view
- 69 London Borough of Hammersmith & Fulham Cabinet, *Establishing a Thames Tunnel Commission*, London Borough of Hammersmith & Fulham, 2011, retrieved 28 May 2017, <http://democracy.lbhf.gov.uk/documents/s11719/>
- 70 Binnie, C., *Thames Tideway: Measures to protect the river environment from the adverse effects of waste water discharges*, Blue Green UK, 2013, retrieved 28 May 2017, http://www.bluegreenuk.com/references/government_institutional/A2.%20Binnie%20-%20Measures%20to%20protect%20the%20river%20environment%2022.10.13.pdf
- 71 Byatt, I., *Thames Tunnel: A critique of a flawed project*, Blue Green UK, 2013, retrieved 28 May 2017, http://bluegreenuk.com/references/government_institutional/Thames%20Tunnel%20-%20Sir%20Ian%20Byatt%20-Critique%20of%20Flawed%20Project%20%20July'13.pdf
- 72 Morse, A., *Review of the Thames Tideway Tunnel*, National Audit Office, 2017, p. 24, retrieved 28 May 2017, <https://www.nao.org.uk/report/review-of-the-thames-tideway-tunnel/>
- 73 Morse, A., *Thames Tideway Tunnel: Early review of potential risks to value for money*, National Audit Office, 2014, p. 24, retrieved 28 May 2017, <https://www.nao.org.uk/report/thames-tideway-tunnel-early-review-potential-risks-value-money/>

-
- 74 HM Treasury, *The Green Book: Appraisal and evaluation in central government*, p. 19.
- 75 Worsley, T., *The Evolution of London's Crossrail Scheme and the Development of the Department for Transport's Economic Appraisal Methods*, OECD Publishing, 2011, pp. 11-12, 14-15.
- 76 Department of Transport, *Report of the Advisory Committee on Trunk Road Assessment*, Her Majesty's Stationery Office, London, 1977.
- 77 Standing Advisory Committee for Trunk Road Assessment (SACTRA), *Transport and the Economy: Full report*, National Archives website, 1999, retrieved 28 May 2017, <http://webarchive.nationalarchives.gov.uk/20090325061432/http://www.dft.gov.uk/pgr/economics/sactra/transportandtheeconomyfullre3148>
- 78 Department for Transport, *Transport, Wider Economic Benefits and Impacts on GDP: Discussion Paper*, 2005, retrieved 28 May 2017, <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/economics/rdg/webia/webmethodology/sportwidereconomicbenefi3137.pdf>
- 79 HM Treasury, *The Green Book: Appraisal and evaluation in central government*, Gov.uk website, 2011, pp. 3-4, retrieved 28 May 2017, <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>
- 80 *Ibid*, p. 19.
- 81 Kay, J., 'Heathrow v Gatwick: The flawed case for expansion', *Financial Times*, 3 November 2015, retrieved 28 May 2017, <https://www.ft.com/content/a7965b96-8216-11e5-a01c-8650859a4767> ; Taylor, S. and Maddox, B., 'The folly of Hinkley', 2016, retrieved 28 May 2017, *Prospect Magazine*, <http://www.prospectmagazine.co.uk/features/the-folly-of-hinkley-point-c>
- 82 Airports Commission, *Airports Commission: Final report*, Gov.uk, 2015, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-final-report>
- 83 *Ibid*, p. 106.
- 84 *Ibid*, p. 116.
- 85 Kay, J., 'Heathrow v Gatwick: the flawed case for expansion', *Financial Times*, 3 November 2015, retrieved 28 May 2017, <https://www.ft.com/content/a7965b96-8216-11e5-a01c-8650859a4767>
- 86 Dunn, N., 'Reading the numbers for UK airport expansion', *Financial Times*, 23 May 2016, retrieved 28 May 2017, <https://www.ft.com/content/bdfd1938-1de3-11e6-b286-cdde55ca122>
- 87 Eddington, R., *The Eddington Transport Study, The case for action: Sir Rod Eddington's advice to Government*, December 2006, pp. 58-59, retrieved 28 May 2017, <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf>
- 88 Ansar, A. and Flyvbjerg, B., 'Big is fragile: Why the UK government should not approve the Hinkley Point C nuclear power station', *Petroleum Review*, vol. 70, no. 834, pp. 37-40, July 2016, retrieved 28 May 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2831603
- 89 Institute for Government, *Big vs Small Infrastructure Projects: Does size matter?* Institute for Government, 2017, retrieved 20 June 2017, <https://www.instituteforgovernment.org.uk/our-work/better-policy-making/infrastructure/big-vs-small-infrastructure-projects-does-size-matter>
- 90 Airports Commission, *Interim Report*, Gov.uk website, 2013, p. 133, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-interim-report>
- 91 Airports Commission, *Airports Commission: Final report*, Gov.uk, 2015, p. 108, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-final-report>
- 92 Department for Transport and Grayling, C., *Government Decides on New Runway at Heathrow*, Gov.uk, October 2016, retrieved 28 May 2017, <https://www.gov.uk/government/news/government-decides-on-new-runway-at-heathrow>
- 93 Wilkinson, A. and Kupers, R., 'Living in the Futures', *Harvard Business Review*, May 2013, retrieved 28 May 2017, <https://hbr.org/product/living-in-the-futures/R1305K-PDF-ENG>
- 94 Harford, Tim., 'Brexit and the power of wishful thinking', *Financial Times*, 13 July 2013, retrieved 28 May 2017, <https://www.ft.com/content/e8793d78-4880-11e6-8d68-72e9211e86ab>

-
- 95 Cornelius, P., Van de Putte, A. and Romani, M., 'Three decades of scenario planning in Shell', *California Management Review*, 2005, p. 95 retrieved 28 May 2017, <http://cmr.ucpress.edu/content/48/1/92>
- 96 Airports Commission, *Airports Commission: Final report*, Gov.uk, 2015, p. 107, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-final-report>
- 97 Public Accounts Committee, *Committee Publishes Report on Private Finance Initiative*, Parliament UK website, September 2011, retrieved 28 May 2017, <http://www.parliament.uk/business/committees/committees-a-z/commons-select/public-accounts-committee/news/pfi-report-publication/>
- 98 Morse, A., *Lessons from PFI and Other Projects*, National Audit Office, April 2011, p. 6, retrieved 28 May 2017, <https://www.nao.org.uk/report/lessons-from-pfi-and-other-projects/>
- 99 Morse, A., *HM Treasury: Equity investment in privately financed projects*, National Audit Office, February 2012, p. 8, retrieved 28 May 2017, <https://www.nao.org.uk/wp-content/uploads/2012/02/10121792.pdf>
- 100 Morse, A., *Commercial Skills for Complex Government Projects*, National Audit Office, November 2009, retrieved 28 May 2017, <https://www.nao.org.uk/report/commercial-skills-for-complex-government-projects/> ; Gash, T., *Building Government's Commercial Capability*, Institute for Government, 8 February 2017, <https://www.instituteforgovernment.org.uk/publications/building-government%E2%80%99s-commercial-capability>
- 101 Morse, A., *HM Treasury: Equity Investment in Privately Financed Projects*, National Audit Office, February 2012, p. 6, retrieved 28 May 2017, <https://www.nao.org.uk/wp-content/uploads/2012/02/10121792.pdf>
- 102 Morse, A., *Nuclear Power in the UK*, National Audit Office, July 2013, p. 44, retrieved 28 May 2017, <https://www.nao.org.uk/wp-content/uploads/2016/07/Nuclear-power-in-the-UK.pdf>
- 103 Department for Business, Energy, and Industrial Strategy, *Hinkley Point C: Value for money assessment*, 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/556917/3_-_Value_for_Money_Assessment.pdf
- 104 Morse, A., *Review of the Thames Tideway Tunnel*, National Audit Office, 2017, p. 31, retrieved 28 May 2017, <https://www.nao.org.uk/report/review-of-the-thames-tideway-tunnel/>
- 105 *Ibid*, p. 37.
- 106 HM Treasury, *The Green Book: Appraisal and evaluation in central government*, Gov.uk website, 2011, p. 32, retrieved 28 May 2017, <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>
- 107 1987 Channel Tunnel Act, Legislation.gov.uk, 1987, Section 42(3), retrieved 28 May 2017, <http://www.legislation.gov.uk/ukpga/1987/53> "no grants shall be made [...] towards expenditure incurred or to be incurred by the Railways Board for the purpose of the provision, improvement or development of international railway"
- 108 House of Commons, *Channel Tunnel, Oral Answers to Questions – Transport – in the House of Commons at 12:00 am on 23rd April 1990*, My Society: They Work For You, No date, retrieved 28 May 2017, <https://www.theyworkforyou.com/debates/?id=1990-04-23a.12.0>
- 109 UCL OMEGA Centre, *Channel Tunnel Rail Link Case Study: Project Profile*, 2008, p. 110, retrieved 28 May 2017, http://www.omegacentre.bartlett.ucl.ac.uk/wp-content/uploads/2014/12/UK_CTRL_PROFILE.pdf
- 110 Bourn, J., *Department of the Environment, Transport and the Regions: The Channel Tunnel Rail Link*, National Audit Office, 2001, retrieved 28 May 2017, <https://www.nao.org.uk/report/department-of-the-environment-transport-and-the-regions-the-channel-tunnel-rail-link/>
- 111 UCL OMEGA Centre, *Channel Tunnel Rail Link Case Study: Project profile*, 2008, p. 110
- 112 Morse, A., *Department for Transport: The completion and sale of High Speed 1*, National Audit Office, 2012, p. 19, retrieved 28 May 2017, <https://www.nao.org.uk/report/the-completion-and-sale-of-high-speed-1/>
- 113 Without government guarantees, 'LCR's attempts to raise private finance would thus have faced difficulties because of the markets' view of the potential risks and the projections of passenger revenue': UCL OMEGA Centre, *Channel Tunnel Rail Link Case Study: Project Profile*, 2008, p. 126, retrieved 28 May 2017, http://www.omegacentre.bartlett.ucl.ac.uk/wp-content/uploads/2014/12/UK_CTRL_PROFILE.pdf
-

-
- 114 House of Commons, *Railways: Channel Tunnel Rail Link (HS1)*, House of Commons Standard Note, 2011, pp. 5-6.
- 115 Morse, A., *HM Treasury: Planning for economic infrastructure*, National Audit Office, 2013, p. 34, retrieved 26 May 2017, <https://www.nao.org.uk/report/hm-treasury-planning-for-economic-infrastructure/>
- 116 Illott, O. and Norris, E., *Smarter Engagement: Harnessing public voice in policy changes*, Institute for Government, 2015, retrieved 26 May 2017, <https://www.instituteforgovernment.org.uk/publications/smarter-engagement>
- 117 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, retrieved 26 May 2017, <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
- 118 Haddon, C., *Loose Bindings: Collective cabinet responsibility and the Heathrow decision*, Institute for Government, 2015, retrieved 28 May 2017, <https://www.instituteforgovernment.org.uk/blog/loose-bindings-collective-cabinet-responsibility-and-heathrow-decision>
- 119 Coelho, M. and Ratnoo, V., *The Political Economy of Infrastructure in the UK*, Institute for Government, 2014, pp. 23-24, retrieved 26 May 2017 <https://www.instituteforgovernment.org.uk/publications/political-economy-infrastructure-uk>
- 120 Needham, D., *Maplin: The Treasury and London's Third Airport in the 1970s*, History & Policy, 2014, retrieved 26 May 2017, <http://www.historyandpolicy.org/policy-papers/papers/maplin-the-treasury-and-londons-third-airport-in-the-1970s>
- 121 Hansard, *House of Commons Debate: Third London Airport (Roskill Commission Report), 4 March 1971*, 1971, Hansard website, retrieved 28 May 2017, <http://hansard.millbanksystems.com/commons/1971/mar/04/third-london-airport-roskill-commission>
- 122 Department for Transport and Airports Commission, *Airports Commission Operating Protocols*, Gov.uk website, 2012, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission>
- 123 This is despite the fact that environmental impacts were addressed in Chapter 9 of the Airports Commission's final report. Airports Commission, *Airports Commission: Final report*, Gov.uk, 2015, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-final-report>
- 124 Parker, G., 'Zac Goldsmith warns Cameron against Heathrow "betrayal"', *Financial Times*, 2015, retrieved 28 May 2017, <https://www.ft.com/content/96b4fc00-9dc9-11e5-8ce1-f6219b685d74>
- 125 House of Commons Transport Committee, *Airport Expansion in the South East: Government response to the Committee's Third Report of Session 2015-16*, Parliament UK website, 2016, retrieved 28 May 2017, <https://www.publications.parliament.uk/pa/cm201617/cmselect/cmtrans/564/564.pdf>
- 126 Conservative Campaign Headquarters, *Hammond: An economy that works for everyone*, October 2016, retrieved 28 May 2017, <http://press.conservatives.com/post/151284663940/hammond-an-economy-that-works-for-everyone>
- 127 Greenpeace, *Greenpeace Joins Councils Preparing Heathrow Legal Challenge*, Greenpeace website, 2016, retrieved 28 May 2017, <http://www.greenpeace.org.uk/media/press-releases/greenpeace-joins-councils-preparing-heathrow-legal-challenge-20161017>
- 128 BBC, *Campaigners Lose Heathrow Third Runway High Court Challenge*, BBC News online, January 2017, retrieved 28 May 2017, <http://www.bbc.co.uk/news/uk-england-london-38800598>
- 129 Durrant, D., *The Role of Civil Society in Mega-transport Project Decision Making: The case of the proposed high speed rail connection, High Speed Two (HS2)*, University College London, 2016, retrieved 28 May 2017, <http://discovery.ucl.ac.uk/1493012/>
- 130 House of Lords, *Select Committee on the High Speed Rail: London – West Midlands Bill*, Parliament UK website, December 2016, p. 4, retrieved 28 May 2017, <http://www.parliament.uk/business/committees/committees-a-z/lords-select/high-speed-rail-london-west-midlands-bill-select-committee-lords/news-parliament-2015/hs2-bill-committee-publishes-report/>
- 131 Morse, A., *Progress with Preparations for High Speed 2*, National Audit Office, 2016, retrieved 28 May 2017, <https://www.nao.org.uk/report/progress-with-preparations-for-high-speed-2/>

-
- 132 Department for Transport and High Speed Two (HS2) Ltd, *HS2 Judicial Review: The challenges explained*, Gov.uk website, 2013, retrieved 28 May 2017, <https://www.gov.uk/government/publications/hs2-judicial-review-the-challenges-explained>
 - 133 House of Commons Briefing Paper, *High Speed 2 (HS2) Phase 1*, Parliament UK website, February 2017, p. 6, retrieved 28 May 2017, <http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN00316>
 - 134 Said Business School and Oxford University, *Major Projects Leadership Academy*, Said Business School, retrieved 28 May 2017, <http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN00316> <http://www.sbs.ox.ac.uk/programmes/execed/custom/clients-and-case-studies/major-projects-leadership-academy>
 - 135 Mann, N., *Major New Crossrail Initiative to Share Lessons Learned with the Wider Industry*, Crossrail, 2016, retrieved 28 May 2017, <http://www.crossrail.co.uk/news/articles/major-new-crossrail-initiative-to-share-lessons-learned-with-the-wider-industry>
 - 136 Centre for Cities, *HS2 Policy Briefing*, Centre for Cities, 2013, pp. 4-5, retrieved 28 May 2017, <http://www.centreforcities.org/wp-content/uploads/2014/08/13-10-30-HS2-Policy-Briefing.pdf>
 - 137 London & Continental Railways, *Economic Impact of High Speed 1*, London & Continental Railways, 2009, p. 25, retrieved 28 May 2017, http://www.lcrhq.co.uk/media/cms_page_media/32/HS1.final.report.pdf
 - 138 What Works Centre for Local Economic Growth, *Evidence Review 7: Transport*, What Works Centre for Local Economic Growth, 2015, p. 12, retrieved 28 May 2017, http://www.whatworksgrowth.org/public/files/Policy_Reviews/15-07-01-Transport-Review.pdf
 - 139 What Works Centre for Local Economic Growth, *Evidence Review 7: Transport*, What Works Centre for Local Economic Growth, 2015, retrieved 28 May 2017, http://www.whatworksgrowth.org/public/files/Policy_Reviews/15-07-01-Transport-Review.pdf
 - 140 Coyle, D., *A Land Built by Economists?* Enlightenment Economics, October 2016, retrieved 28 May 2017, <http://www.enlightenmenteconomics.com/blog/index.php/2016/10/a-land-built-by-economists/>
 - 141 Department for Transport, *Monitoring and Evaluation Programme*, Gov.uk website, October 2015, retrieved 28 May 2017, <https://www.gov.uk/government/publications/dft-monitoring-and-evaluation-programme-2015>
 - 142 Kell, M., Athanasopoulou, A., Bradburn, P., Hodgson, H., Jennings, A. and Williams, T., *Evaluation in Government*, National Audit Office, 2013, retrieved 28 May 2017, https://www.nao.org.uk/wp-content/uploads/2013/12/10331-001-Evaluation-in-government_NEW.pdf
 - 143 Department for Transport, *Strengthening the Links between Appraisal and Evaluation*, Gov.uk website, July 2016, retrieved 28 May 2017, <https://www.gov.uk/government/publications/strengthening-the-links-between-appraisal-and-evaluation>
 - 144 Highways England, *Research at Highways England*, Gov.uk website, no date, retrieved 28 May 2017, <https://www.gov.uk/government/organisations/highways-england/about/research>
 - 145 What Works Centre for Local Economic Growth, *Evidence Review 7: Transport*, What Works Centre for Local Economic Growth, 2015, pp. 34-36, retrieved 28 May 2017, http://www.whatworksgrowth.org/public/files/Policy_Reviews/15-07-01-Transport-Review.pdf
 - 146 Highways England, *Post Opening Project Evaluation (POPE) of Major Schemes: Executive Summary*, 2015, pp. 6-7, retrieved 28 May 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/497240/POPE___Meta_2015___summary___final.pdf
 - 147 *Ibid*, p. 6.
 - 148 *Ibid*, p. 7.
 - 149 Bottini, N., Coelho, M. and Kao, J., 'Infrastructure and Growth', *Investing for Prosperity*, 2013, pp. 153-154.
 - 150 Calderón, C., Moral-Benito, E. and Servén, L., *Is Infrastructure Capital Productive? A dynamic heterogeneous approach*, World Bank, 2011, retrieved 28 May 2017, <http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-5682>
 - 151 The Confederation of British Industry (CBI) and AECOM, *Thinking Globally, Delivering Locally: Infrastructure Survey 2016*, CBI website, 2016, pp. 50-53, retrieved 28 May 2017, <http://www.cbi.org.uk/insight-and-analysis/thinking-globally-delivering-locally/>

-
- 152 Bottini, N., Coelho, M. and Kao, J., 'Infrastructure and Growth', *Investing for Prosperity*, 2013, pp. 168-170.
- 153 Airports Commission, *Airports Commission: Interim report*, 2013, p. 133, retrieved 28 May 2017, <https://www.gov.uk/government/publications/airports-commission-interim-report>
- 154 British Infrastructure Group, *Gate Now Closing: A final call for UK Airport expansion to protect Britain's businesses, economy and jobs*, British Infrastructure Group, 2016, retrieved 28 May 2017, <http://www.britishinfrastructuregroup.uk/reports-and-briefings/gate-now-closing/>
- 155 Said Business School and Oxford University, *Major Projects Leadership Academy*, Said Business School, retrieved 28 May 2017, <http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN00316> <http://www.sbs.ox.ac.uk/programmes/execed/custom/clients-and-case-studies/major-projects-leadership-academy>

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