Economic Insight

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Economic Insight Ltd

REGULATORY OPTIONS FOR COMPLEX PROJECTS

A REPORT FOR THAMES WATER

CONTENTS

1. Introduction and summary

This report, written for Thames Water, examines the case for differential regulatory treatment of large and complex infrastructure projects. We explore both the 'in principle' and 'in practice' case for such treatment, finding both to be compelling. We also emphasise the need to limit overall risk exposure, both to protect bill payers and ensure vital investment is delivered. The report further identifies practical options for deploying a differential approach, with both regulatory (price control) and competition-led models considered. In all cases, the crucial need to recognise the high degree of uncertainty and risk (associated with delivery and cost), whilst also recognising the desire to maintain incentive power, is central to any solution. Moreover, we highlight that differential approaches have the potential to provide Ofwat with practical and pragmatic ways of meeting its goals for PR24 and beyond (and, indeed, are likely essential to its objective of seeing 'game-changing' and 'innovative' approaches).

1.1 Executive summary and key findings

A DIFFERENTIAL REGULATORY MODEL FOR LARGE AND COMPLEX PROJECTS IS ESSENTIAL. WITHIN THIS, THERE NEED TO BE LIMITS ON RISK EXPOSURE, BOTH TO PREVENT WINDFALL GAINS, BUT ALSO TO ENSURE VITAL INVESTMENT PROCEEDS. AMONGST OTHER OPTIONS, WE ADVOCATE AN 'ENHANCED' VERSION OF OFCOM'S 'FAIR BET' FRAMEWORK FOR THIS PURPOSE.

1.1.1 The industry needs new approaches to meet its, and Ofwat's, goals

Economic regulation in the water industry has been successful in helping deliver significant investment; driving large cost efficiencies; and (more recently) incentivising improved service levels. This has largely been done by promoting cost minimisation (and outcomes performance) within the context of prevailing business models, and over five-yearly price review periods.[1] However, and as Ofwat has noted: (i) those 'easy gains' have likely now been exhausted; and yet (ii) in the context of climate change and population growth, further material gains are needed, in order to mitigate a future affordability challenge - and to ensure that the wider social and environmental value of water is appropriately priced to protect future generations.

To achieve the above, a shift towards incentivising larger productivity gains over time is needed.[2] Such gains typically come from (amongst other things) significant technological change and / or radically different operating and delivery models. Commonly, in 'heavy infrastructure industries', this change: (i) requires significant capital investment; (ii) is relatively high risk; and (iii) is best facilitated by stable and transparent rules that allow costs and benefits to accrue over the long-term.

In short, the prevailing model of regulation in the water industry is calibrated to a 'low-risk / low-return' environment. Whilst this has been appropriate (and successful) to date; some re-calibration is now required. There are a number of ways

[1] *What economists call 'technical efficiency.'*
[2] *What economists call 'dynamic efficiency.'*

to address this, including revising the incentives *within* the existing model. However, because investments capable of delivering against the above likely have a very different risk profile than the prevailing average: (i) the 'optimal' model of regulation for said new investments may be sufficiently different that 'tweaks' within the existing approach are simply inadequate; and (ii) a different 'type' of investor may also be needed.

The first point is critical. Any regulatory framework is designed to be appropriate for the existing 'average' mix of projects (where, by this, we mean that both the *'allocation of risk'*, and *'risk-reward balance',* reflect the risk profile, and therefore characteristics, of projects *'on average'*). Consequently, if there are a subset of large new projects with a very different risk profile, simply incorporating them within an existing (common) regulatory model may lead to significant detriment. Two obvious concerns are:

- **Incentives will not be as well aligned, as under a more tailored approach.** This is because risk will not be allocated as efficiently as it could be. With reduced incentive power, costs will be higher and / or outcomes will likely be poorer, relative to a more nuanced approach.
- **Critical investment may not occur at all.** The more fundamental concern must be that, without properly recognising the differences inherent in large and complex projects, the types of projects or programmes now necessary in order to meet the needs of customers / society at large - and address critical environmental issues, will not proceed.

As we explain further subsequently, in light of the above, Ofwat's own objectives depend on getting the approach to large and complex projects right. Specifically, Ofwat's key aims for PR24 and beyond are: increased innovation; delivering environmental and social value; and delivering for the long-term. These intrinsically require the industry to implement some quite different approaches (again, because the 'easy wins' on efficiency under existing operating models have now gone).

There is, therefore, a strong 'in principle' case for a differential regulatory approach; in that it can create significant benefits by mitigating (or removing) the above two sources of harm. The size of these benefits is clearly contingent on: (i) 'how different' said projects are in risk profile (ergo, characteristics) from the prevailing average; and (ii) the size of those projects. These benefits of course need to be considered against the costs associated with applying a differential approach.

1.1.2 What makes large and complex projects different?

The key question that follows from the above is: *'what should any differential approach look like in practice?'* Clearly, every project is unique, with its own characteristics and risk profile. Hence, the *optimal* regulatory approach would also logically vary by project (i.e. what is 'right' for one, may not be 'right' for another). However, whilst true, to make practical choices around future regulation, one must come to a view as to the characteristics of said projects *'in the round'*[3] (or, put another way, what is it that makes them 'sufficiently different' from the average to warrant a differential approach?)

Following from the above, our conclusions and recommendations regarding future regulatory approaches reflect our own assessment of the probable characteristics of

[3] *Noting that this does not preclude case-by-case refinements, which may also be necessary. A further important point is that we cannot, by definition, observe projects that have not been implemented, but would have been under a differentiated approach.*

these large and complex projects. This, in turn, has been informed by a review of a range of evidence (both within the water industry, and more broadly). It is therefore important to be clear as to the characteristics we have assumed in reaching our views. In our judgement, future large and complex projects will likely have the following characteristics:

- **Long construction and operational phases** – with the former itself potentially spanning multiple Asset Management Plan periods (AMPs).
- **Construction risk will be high** for these projects – and significantly higher than for the average. This includes in relation to deliverability[4] and associated cost risks.
- **Procurement / contracting risk will also be high**.
- **Environmental and external risks will be high.**
- **The controllability of the above risks by companies and other stakeholders is inherently limited** - and difficult to determine.
- They will be associated with **significant externalities.** For example, in many cases, their underlying aims will include mitigating: water scarcity (the impact of climate change); or improving the natural environment.
- Related to the above, the **projects may be considered 'highly important', if not 'necessary',** both in order to meet collective objectives *within* the water industry (including Ofwat's), but also to address *wider* societal / environmental concerns.

The magnitude and lower controllability of risks points above are particularly pertinent. Indeed, our analysis of large and complex projects shows that they are often subject to considerable cost and delivery overruns – but where the assessment of responsibility for that (even after the event) is ambiguous. Ultimately, the nature of the projects makes their delivery highly unpredictable – and events can develop in a way that results in costs being much higher (or sometimes lower) than expected, for reasons that no party can reasonably be said to have significant control over. In the context of said projects also being highly important, or necessary, for society (i.e. we 'want' delivery to occur), it is this feature that must be considered with particular care, when determining regulatory approaches.

1.1.3 Our findings and recommendations

With the above characteristics in mind, and based on the evidence and analysis in this report, our recommendations are as follows:

- **There is a compelling case for a differential regulatory approach to apply to large and complex projects.** Without this, certain critical investments will either not proceed; or will be sub-optimal in terms of either the 'mix' of projects that go forward, or the time periods in which they occur. The latter is a particular concern, in the context of population growth and climate change.
- **The '<u>option</u>' for sharing risk with taxpayers (on a <u>contingent basis</u>) is likely to be important.** This is because: (i) the risk may be so high that, without it, private investment would not be forthcoming in some cases; (ii) insurance markets may not cover the risks; and (iii) because at the heart of the challenges that need to be addressed (climate change; population growth) are externalities that affect wider society, both now and in the long-term (not just water billpayers today). For example, the Government Support Package (GSP) provided to Thames Tideway Tunnel was essential, in order to ensure investment was forthcoming for

[4] *Which primarily relates to the 'timescales' and risks around delay; as the 'essential' nature of said investments (usually) means they are ultimately delivered.*

this high-risk project. Again, it is important to highlight that each project is unique – and so said support may not *always* be required. However, based on the project characteristics we have assumed (i.e. which would be consistent with considerable, if not in some cases unlimited, cost risks, and where risk controllability is limited) forms of taxpayer support would be an important consideration. Thus, we recommend that said support should be an *'option'.*

- **Overall risk exposure should be limited for billpayers and investors.** This is both to preclude the possibility of 'windfall gains', but also (and consistent with the above) to avoid the possibility of potentially unlimited downsides, which in our judgement (and from market feedback we have received from investors and stakeholders) could also preclude investment. This is particularly important in the context of the delivery of said projects being vital, both to water customers and society.
    - There are various ways of doing this, but under one of our preferred options, we suggest what we term **an 'enhanced' version of Ofcom's 'fair bet' framework**[5] (which applies to fibre broadband). The spirit of our proposal here is to recognise that there can be relatively wide deviation from a 'central' expectation of returns (or performance more broadly) in more complex, innovative projects – and that this can arise for various reasons. Hence, a risk-reward balance and regulatory design that reflects this is needed.
    - Nonetheless, one must also recognise that there should be limits to upside and downside exposure, if the objective is to see essential investments in infrastructure realised (i.e. because if investors observed firms struggling, due to a large project failure, it would undermine their confidence to support similar projects in future. Likewise, if one observed an investor making a very high return, for reasons outside of firm control - and beyond any allowed outperformance incentives from their regulatory settlement - that would undermine trust in regulation).

Taking a pragmatic approach, we are proposing two models that could be taken forward (which are not mutually exclusive). These are described more fully in Chapter 5 of this report.

- **Phased price control model.** Here, the incumbent remains responsible for identifying needs and options; the design; construction; and operation of the relevant asset. However, the 'asset' in question is subject to a separate price control (and, optionally, separate price controls may apply to each 'phase' – i.e. construction; operation etc). Under this option, total risk exposure is mitigated by setting overall 'limits' on the rate of return that can be earned from the asset in question / within the separate price control (both minimum and maximum thresholds).[6]

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[5] *Ofcom's specific approach is described in detail on page 37. In brief, Ofcom 'holds off' from regulating until: (i) the project is successfully delivered; (ii) it finds Openreach has significant market power; and (iii) it believes Openreach has the ability / incentive to earn significantly > WACC (i.e. where the extent of outperformance is likely not the outcome of a 'fair bet'). Key issues underpinning Ofcom's approach, relevant to our considerations here are: (i) that returns may naturally be > < the WACC for reasons that simply reflect the outcome of a 'fair bet'; (ii) but beyond a certain point, this may not be likely; and (iii) for large and complex projects in the water industry, the envelope for returns is wide – and controllability of risk is limited and unclear. Therefore, whilst one may make best endeavours to correctly identify which risks are most controllable by which party, and allocate them accordingly – this is especially challenging for large and complex projects. Hence, whilst allowing for greater upside and downside potential (relative to the 'average' project) may be appropriate, one may nonetheless need tools to prevent undue variation in returns.*

[6] *The rationale being that without an upper limit, firms may earn returns that are (or are perceived to be) excessive, or 'windfall' in nature (being due to reasons not within management control); and without a lower limit, the extent of downside risk exposure means the (essential) investment would simply not occur.*

- **Integrated open competition model.** Here, a single competition is run in relation to the design; build; and operation of the assets (including financing costs). Both incumbents and alternative suppliers are free to participate (i.e. making it an 'open' competition). Overall risk is limited through the application of 'equity tramlines' (our enhanced 'fair bet' framework), whereby the 'winner' of the competition initially levies prices in line with their tender – but if returns fall outside of the agreed tramlines, prices are able to be adjusted up or down (but only sufficient to return within the tramlines). Companies may adjust prices voluntarily where this occurs; or, if not, face the threat that Ofwat may mandate they do so.

A DIFFERENTIAL REGULATORY APPROACH CAN PROVIDE PRACTICAL AND PRAGMATIC OPTIONS BY WHICH OFWAT CAN MEET ITS STATED AIMS.

1.1.4 By delivering significant benefits, a differential approach will help Ofwat achieve its aims

A differential approach to the regulation of large and complex projects, in line with our proposals, has the potential to unlock significant benefits for customers; society; and the environment. This is further helpful to Ofwat, given its own objectives. Specifically:

- By facilitating the delivery of these projects, a differential approach unlocks larger efficiency gains over time, which (as noted above) are now vital to ensuring a resilient; high quality; and affordable water supply in the long-term – particularly in the context of climate change.
- Competition-led approaches may be appropriate in some instances – allowing further efficiency gains to be realised, which may not otherwise occur.
- Customers further benefit from an allocation of risk that is more tailored to the features of these projects. There are two dimensions to this:
    - Because these projects are long-lived, a 'differential' approach allows the costs of delivery and operation to be 'smoothed' across generations of customers, better balancing intergenerational fairness, whilst retaining the core 5-yearly price controls for average projects.
    - Because the extent and controllability of risk is different for large and complex projects, a differentiated approach should mean a more optimised alignment of incentives that drives lower costs and better outcomes over time (relative to the counterfactual). For Ofwat, in practical terms, it means it can focus on honing the existing price control model, without concern for how any very large and risky projects impact it (including any impacts on the appointee WACC, for example). Rather, it can think about that subset of projects on a more standalone basis, considering the right risk / reward balance, and incentives, for those as appropriate.[7]
- A more tailored approach allows for a greater level of scrutiny and review – allowing Ofwat to focus its efforts proportionally in a way that should maximise value for customers.

These upper and lower limits could be viewed as a hybrid of RPI-X and 'rate of return' regulation, the latter of which is commonplace in the USA and elsewhere.

[7] *For example, that includes having flexibility to adopt either 'higher' or 'lower' risk models (i.e. the latter providing more certainty over returns over longer periods of time, perhaps with less regulatory risk, which might then be consistent with a lower rate of return; the latter implying the opposite).*

1.2 Introduction and context

1.2.1 Ofwat's objectives for PR24

In May 2021, Ofwat set out (for consultation) its initial views on the framework for PR24.[8] In doing so, the regulator outlined the following strategic objectives it wants to achieve, through its approach to the next price control:[9]

- **Focusing on the long term.** Ofwat wants companies to continue to enhance their networks and link their work with their long-term strategy. In particular, Ofwat is proposing an *adaptive planning* approach for companies' long-term strategies, which accounts for future uncertainties and affordability constraints.[10] Importantly, Ofwat wishes the price review process to be more focused on the long term.
- **Delivering greater environmental and social value.** Ofwat recognises that valuing environmental and social impacts is challenging. It expects companies to work to achieve this, as well as incentivise better solutions that tackle some of the key environmental challenges and help meet the challenge of net zero.
- **Reflecting a clearer understanding of customers and communities.** Over the years, customer views have fed in more and more into the price review process. Ofwat wants to streamline this for PR24; and make the process simpler and more targeted and effective.
- **Driving improvements through efficiency and innovation.** Ofwat considers productivity in the water sector to have been weak since 2011; and so it expects companies to develop ways to efficiently improve services. The regulator also notes that markets can drive innovation and efficiency, and therefore it will, where possible, develop markets for developer services; bioresources; water resources; and (of relevance to this report) the provision of large infrastructure in PR24.

1.2.2 Challenges facing the industry

Ofwat's consultation also acknowledged the significant (and well-known) challenges currently facing the industry, which set the context against which its wishes to meet the above objectives. These include: the pressure being placed across the value chain (and on water resources in particular) by: (i) population growth and climate change; (ii) increasing customer expectations; (iii) affordability; and (iv) the need to maintain resilience.

1.2.3 Implications for investment and the role of major projects

In light of its ambitious objectives (and industry challenges) Ofwat has made it clear that it sees PR24 as an opportunity to look again at the fundamentals of how it regulates – and how the industry delivers, noting that: ***"this is the moment for fresh thinking and real change."***[11]

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8 *'PR24 and beyond: Creating tomorrow, together'. Ofwat (May 2021).*
9 *'PR24 and beyond: Creating tomorrow, together'. Ofwat (May 2021); page 3.*
10 *'PR24 and beyond: Long-term delivery strategies and common reference scenarios'. Ofwat (November 2021).*
11 *'PR24 and beyond: Creating tomorrow, together'. Ofwat (May 2021); page 2.*

Whilst Ofwat's consultation document was wide ranging in its scope, the regulator specifically noted that: *"meeting the future needs of customers and the environment relies on the delivery of significant infrastructure projects."*[12] Ofwat characterised such **'major projects'** as being costly; complex; and often long-lived in nature. Specific potential reforms raised by Ofwat relating to its approach to major projects include:

- increasing the long-term visibility of projects to help better facilitate procurement;
- increased use of (and incentives for) direct procurement for customers (DPC);
- investigating the further award of project licences; and
- developing incentives and approaches for 'multi-party assets'.

Beyond the above specific proposals, Ofwat suggested that it was open to alternative delivery routes (and regulatory approaches more broadly) in relation to major projects.

1.2.4 Thames' consultation response

In its response to Ofwat's consultation, Thames Water (Thames) highlighted the issues relating to the regulation of large and complex infrastructure projects. Issues and themes raised by the company in its response included that:

- the allowed return on equity for said projects should accommodate the scale, risks and complexity of large investments in the construction phase;
- the risk profile of an individual company's investment programme could be different from the industry average;
- some projects span multiple price controls, and risk (as well as deliverables and outcomes) may vary over time; and
- it may be appropriate to have a differential allocation of risk for certain specific projects (i.e. relative to the allocations applied within the price control areas in general).[13]

Notwithstanding any issues relating specifically to the allowed return, Thames set out its view that *'innovative'* and *'different'* approaches to regulating infrastructure projects are now required.

1.2.5 Scope of our work

In the above context, Thames commissioned Economic Insight to examine the regulatory approach for large and complex projects (or programmes) at PR24 and beyond. Specifically, Thames asked us to consider the following questions:

- What are **the reasons 'why'** a differential approach to large and complex projects may be warranted?
- **How should one determine 'which' projects** (or programmes) qualify for a differential treatment?
- **What are the options** for any differentiated approach?

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[12] *'PR24 and beyond: Creating tomorrow, together'. Ofwat (May 2021); page 82.*
[13] *'Response to PR24 and beyond: Creating tomorrow, together.' Thames Water (July 2021); page 78.*

- **Which option** (or shortlist of options) are best suited to the water industry - and so warrant further consideration?

Accordingly, this report explores fresh alternatives for real change to help deliver the key long-term solutions customers need in an affordable way. In addressing this critical topic, we have sought to be pragmatic and helpful – recognising the priorities and aims of Ofwat. Our work is not, therefore, focused on the issue of allowed returns. Indeed, the question of 'whether' and 'by how much' returns might need to vary for said projects is outside the scope of this report. Rather, the purpose of this work is to 'step back' and look at the fundamentals. Further, potential financing models for projects are also out of scope (the underlying assumption is that the most appropriate regulatory model(s) identified in this report are also the most effective way to secure fit-for-purpose / lowest cost financing in the customer interest).

In reaching our views, we primarily draw on:

- **A first principles** consideration of 'why' one would apply a differentiated approach – with particular reference to the objectives Ofwat has said it wants to achieve at PR24 and beyond.
- **A review of existing approaches** to the treatment of large and complex projects in other industries, in order to understand what the possible 'options' might be, and assess their effectiveness and suitability for the water industry.
- **An analysis of actual large and complex projects** – allowing us to consider what specific features they have - and the implications of this for regulation.
- **Investor and wider stakeholder interviews** – we engaged with a total of six equity and debt investors (and related stakeholders) in order to obtain key insights into how they think about investment choices in the real world.

Our report is structured as follows:

- **Chapter 2** sets out the issues that determine the 'need' for a differential approach.
- **Chapter 3** reviews regulatory approaches used elsewhere, as well as large projects more broadly.
- **Chapter 4** examines the characteristics of large and complex projects.
- **Chapter 5** examines and evaluates the different regulatory options.
- **Chapter 6** provides an overview of our recommendations.
- An **Annex** sets out the investors' perspectives.

2. The case for a differential approach

This chapter sets out the case for a differential regulatory approach for large and complex projects in the water industry. We firstly set out the 'in principle' arguments for applying a different approach to said projects; and then explore the evidence relevant to informing whether they apply in practice. In short, as immediate post-privatisation efficiency gains have been largely realised, investments in more innovative projects and programmes are likely needed, to drive larger productivity gains in future. This is essential if one wishes to avoid affordability issues for customers given the pressures of climate change and population growth, and in light of the desire for environmental improvements and sustainability. Thus, a framework that appropriately facilitates and incentivises these investments is now required.

2.1 The 'in principle' case for a differential approach

In the first instance, it is important to be clear about what we mean by a *'differential approach'* (i.e. approach to *'what'?*). In practice, and as we subsequently explain, we currently observe multiple, overlapping, policy tools that apply to larger, more complex projects (for example, in the water industry, DPC; gated funding / approvals; separate price controls; and Specified Infrastructure Project Regulations, known as SIPR). These overlapping tools arise because a *'package'* of measures is required to address the key issues associated with delivering said projects.

Therefore, in the following we set out:

- why one might consider a differential approach;
- a framework for assessing a differential approach; and
- the 'in practice' case for a differential approach in the water industry.

2.1.1 Why consider a differential regulatory model?

A helpful lens to consider *'why'* one might want to regulate certain projects differently from others is to think about how any regulatory model for an industry is designed in the first place. Specifically, in designing a regulatory model one must decide:

- whether (or to what extent) price regulation is appropriate – and, if so, its scope (as opposed to alternatives, such as competition);
- the 'form' or 'model' of price control (for example, price cap; revenue cap etc);

- the regulatory mechanisms within any form – such as specific outcomes incentives (which determines the allocation of risk);
- the targets / values for each parameter within the design (i.e. 'what' level of outcomes targets to set, cost efficiency targets, the rate of return, etc);
- what customer outcomes / benefits need to be provided; and
- the length of the price control.

A DIFFERENTIATED REGULATORY MODEL MAKES SENSE IF THE KEY CHARACTERISTICS OF A PROJECT DIFFER SUFFICIENTLY FROM THE AVERAGE.

In turn, these choices largely depend on the following **characteristics of the activities undertaken by the industry:**

- nature of risk;
- extent of risk;
- degree to which the risk is controllable – and by whom;
- presence of negative or positive externalities; and
- balance between whether welfare is maximised through allocative; technical; or dynamic efficiency.

In any industry, companies undertake a mix of activities (and accordingly, invest in a range of projects or programmes, to deliver desired outcomes) where there will be inherent variation in the above characteristics. Accordingly, regulators generally take an approach that they consider to be appropriate, *given that mix.* Or, put another way, the model (i.e. both the design and application) will be appropriate, *'on average'.*

Take, as a simple example of this, the WACC. By definition, it is a measure of the *average* opportunity cost of a firm's capital employed, reflecting the risk incurred across all of the projects it invests in, *on average.* Within that mix of projects, some will have a lower opportunity cost than the WACC (i.e. they would attract investment at a rate of return *below* the WACC); and for others, the opposite would be true.

Seen through the above lens, the question at hand is: 'when', or 'under what circumstances', does it make sense to adopt a differential regulatory approach that regulates certain projects or programmes in a different manner to the overall model? The general answer to this must be as follows:

When the project / programme is <u>sufficiently different</u> in characteristics from the 'average', <u>and is of a sufficient scale</u>, such that the benefits of moving to a more targeted approach (through creating incentives better aligned to those characteristics) offset the costs.

The scale (or size) dimension matters because, if a project was *'very different'* from the average, but also *'very small'* in scale, the gains from implementing a unique regulatory approach would likely not be sufficient to offset the cost (being mindful that increased regulatory complexity is costly and undesirable).

Following from the above, it makes sense to pro-actively consider differential approaches in the water industry if we think that, in future, we are going to see greater differentiation in the profile of investment projects. If so, two practical questions that must be addressed in any approach are:

- What is **"sufficiently different"**? (i.e. what is it about these projects that makes them different?)
- What is **"of a sufficient scale"**?

2.2 Framework for a differential regulatory model

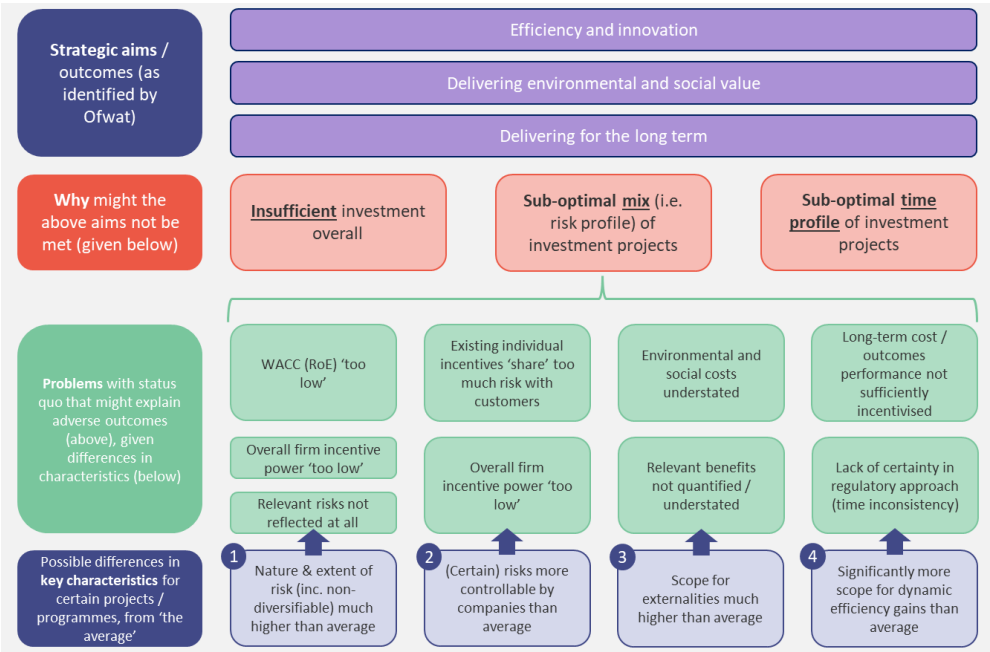
Following from the above, one can consider what the implications might be if projects or programmes with very different characteristics from the average were considered important, or even necessary, but remained subject to the prevailing regulatory model. Accordingly, in the framework below, we show how this could logically lead to:

'A failure to recognise 'differences' would reduce the prospects of meeting the regulator's stated aims for PR24 and beyond.'

(i) **underinvestment** in the industry 'overall';
(ii) a **sub-optimal 'mix' of investment** (i.e. investing in the 'wrong things', relative to what would maximise wider welfare overall); and / or
(iii) a **sub-optimal 'time-profile' of investment** (i.e. investing at the 'wrong times', relative to what would maximise wider welfare overall).

Importantly, from the perspective of Ofwat, a failure to recognise differences would reduce the prospects of meeting the regulator's stated aims for PR24 and beyond.

Figure 1: Framework – the case for a differentiated approach



Source: Economic Insight

Expanding briefly on the above, the following bullets explain why, for each project characteristic, a failure to recognise the *difference* might be problematic.

- **Suppose a set of projects were materially higher risk than 'the average' and that this included a non-diversifiable component.** Here, the most obvious problem is that the prevailing WACC might be insufficient for investors to support said project(s), resulting in them not going ahead, even if they were significantly net-beneficial for customers, relative to the alternative. In addition, (or in the alternative) one could characterise this as the 'expected return' being too low – such that the projects were **not a 'fair bet' for investors.** In the context of an individual project, this might mean there is insufficient incentive power and / or that certain relevant risks are simply not recognised, but should be. In either case, again, the net result would likely be the project not going ahead.
- **Next, suppose a project is characterised by risks that are 'more controllable' by companies than the average**. In this case, by applying the existing regulatory model, we know the incentive mechanisms will share 'too much' risk with

customers. This would mean customers face inappropriate bill volatility and, again, companies are not appropriately incentivised to perform. Some such projects may go ahead under the existing model (although 'marginal' ones would likely not). However, the main problem is that they would be unlikely to deliver the full scope of benefits they could, had the approach to incentives been more targeted to reflect their actual risk controllability. In practice, we find that large and complex projects typically have a materially greater amount of risk (than the average) and that a (significant) proportion of this may not be controllable, to any meaningful degree, by any party (i.e. there is more uncontrollable risk in large and complex projects, relative to the average).

- **Another possibility is that a project has significantly more scope for externalities (positive or negative) than the average**. Here, the problem with the existing model is that it would unlikely 'price in' those externalities (or, at least not fully). In turn, this would mean that, from a social or environmental point of view, certain net beneficial projects would not proceed (or, indeed, the opposite). Relatedly, seen through this lens, one might think about risk allocation very differently for a project associated with large positive externalities – where, for example, it might make sense for society to bear some risk and cost, rather than it just being shared between billpayers and companies. Indeed, it may even be *essential* in some cases, for a project to proceed.
- **Finally, suppose a project had more scope to deliver 'dynamic efficiency gains' than the average**. That is to say, it would not necessarily help deliver cost minimisation or improved outcomes over a short time period (e.g. PR24). Rather, suppose it was a large investment that included an innovative technology (or, more likely perhaps, a radically different operating model), which might help fundamentally 're-set' the cost base to a lower floor – or similarly, allow for large gains in future outcomes performance. In this case, the project may not proceed at all under the existing model, insomuch that there is an inadequate weight placed on longer term efficiency gains. As a result, the current regulatory framework may prioritise *technical* efficiency (i.e. through cost minimisation for business-as-usual activities), as opposed to *dynamic efficiency* (i.e. through innovation). A further problem might be the lack of certainty around the approach to regulation more broadly. This is because large-scale technological investment (or new operating models) tends to be best facilitated where the *'rules of the game'* are clear and stable for a long periods of time.

'One might think about risk allocation very differently for a project associated with large positive externalities – where, for example, it might make sense for society to bear some risk and cost, rather than it just being shared between billpayers and companies.'

Collectively, one can see that the (in principle) 'problems' could give rise to the three adverse outcomes summarised in the figure above. It is further clear, why (if these adverse outcomes occurred) the likelihood of achieving Ofwat's objectives from PR24 and beyond would be reduced.

2.3 The 'in practice' case for a differential approach in the water industry

Following from the above, the need for a differential approach for large and complex projects in the water industry in practice turns on whether we think: (i) certain projects will be optimal / needed in future, **but will have very different characteristics from the existing average**; and (ii) whether the variance in those characteristics **will persist or, indeed, become more prevalent** (i.e. so that it is not about the overall 'mix' of projects changing gradually; but, rather, that there are clear, and separable, 'different' projects, which are nonetheless essential).[14]

There are a number of reasons, supported by evidence, to suppose that both of the above are true. Most obviously:

- Large efficiency gains (costs and outcomes) have been achieved post-privatisation, but productivity performance has been lower in more recent years in the water industry.[15]
- Affordability remains a challenge for customers. Hence, despite *'low hanging fruit'* (the easier gains) having been banked (as per the previous bullet) further gains are required for bills to remain affordable.
- Large productivity gains tend to be the product of investment in technology / technological change – or new operating models (i.e. because this can drive 'dynamic efficiency', which shifts production costs down / outcomes performance up).
- Investment in innovative technology / new operating models tends to be more uncertain / higher risk.
- The combination of climate change and population growth, as well as the desire for environmental improvements and sustainability, means the scarcity value of water must be increasing over time. There is, therefore, an essential need to 'price this' and think carefully about the balance of any burden (and benefits) across generations of customers and society more widely. Thus, projects with a greater potential to mitigate these negative externalities (or create positive externalities) become increasingly valuable. The increased scarcity of water also creates a further reason why more productivity gains are important. It also strengthens the case for a longer-term approach to cost recovery.

In the following, we summarise the evidence relating to each of the above key issues.

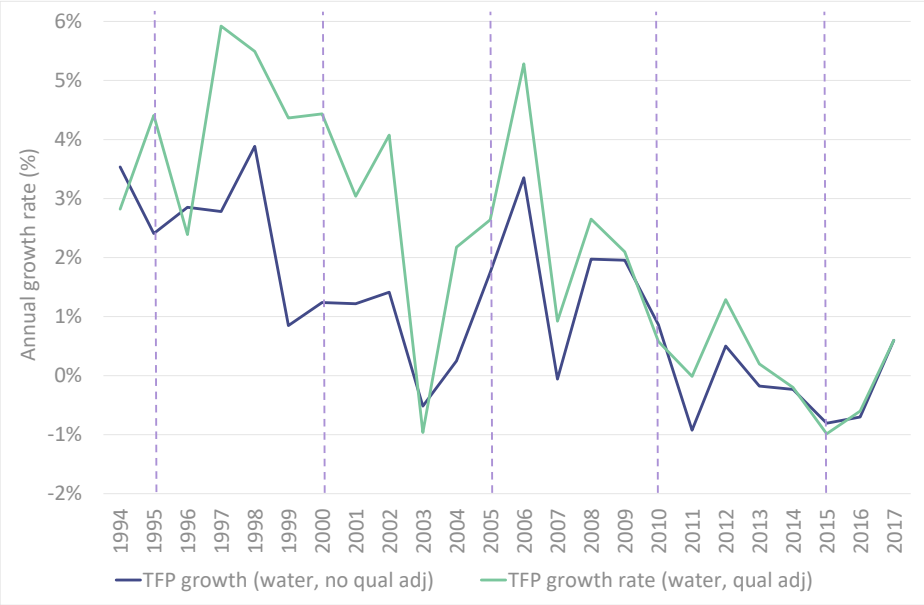
[14] *Because, if it was just the former, there would be a less strong case for a differential approach. Rather, it would more point to the need to gradually adjust the risk-reward balance within the existing regulatory framework, to reflect a change in overall risk over time.*

[15] *This must be interpreted with care, however, given the overall picture of UK productivity as a whole follows a not dissimilar pattern.*

2.3.1 Productivity performance has been lower in recent years

Previous analysis by Frontier Economics shows that productivity growth in the water industry has been lower in recent years, compared to the period immediately post-privatisation.[16] This is illustrated in Figure 2, which shows total factor productivity (TFP) growth in the UK water and wastewater industry between 1994 and 2017.[17]

Figure 2: Annual productivity growth estimate, UK water sector, 1994 - 2017



Source: 'Productivity Improvement in the Water and Sewerage Industry in England since Privatisation: Final Report for Water UK'. Frontier Economics (September 2017); page 2.

As can be seen, the initial high productivity growth was followed by some years of intermediate growth, which then reduced significantly – post the 2007/08 financial crisis.[18]

There are many factors that likely explain the slowdown in industry productivity, and we note that a similar trend can be observed for the UK economy as a whole (thus, the much debated UK *'productivity puzzle'*). However, one factor of relevance is that (as is generally accepted) in regulated industries, efficiency gains are expected to reduce over time, as regulators *'squeeze out'* inefficiency through repeated price controls. For example, the National Audit Office (NAO) found that *"[i]n the water industry, as in many other privatised industries, efficiency improvements were easier to find in the first years after privatisation, when there was a bigger efficiency gap between the best- and worst-performing companies."*[19] In simple terms, the easy wins have already been banked through regulatory incentives working as intended.

A logical inference from the above is that *'business as usual'* approaches (by both companies in supplying water and wastewater services; and Ofwat in its approach to regulation) will likely yield only modest further efficiency gains.

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16 *'Productivity Improvement in the Water and Sewerage Industry in England since Privatisation: Final Report for Water UK'. Frontier Economics (September 2017).*

17 *Frontier Economics consider that estimates from 2015 onwards should be viewed more cautiously as they are influenced by data inconsistencies due to changes in reporting. This is why they applied quality adjustments particularly conservatively in this period due to lack of data.*

18 *The industry argued that some of this decline was due to the approach used not reflecting improvements in environmental quality, which increased significantly throughout the period.*

19 *'The economic regulation of the water sector'. NAO (2015); page 27.*

2.3.2 Affordability remains a challenge for some customers – hence further productivity gains are needed

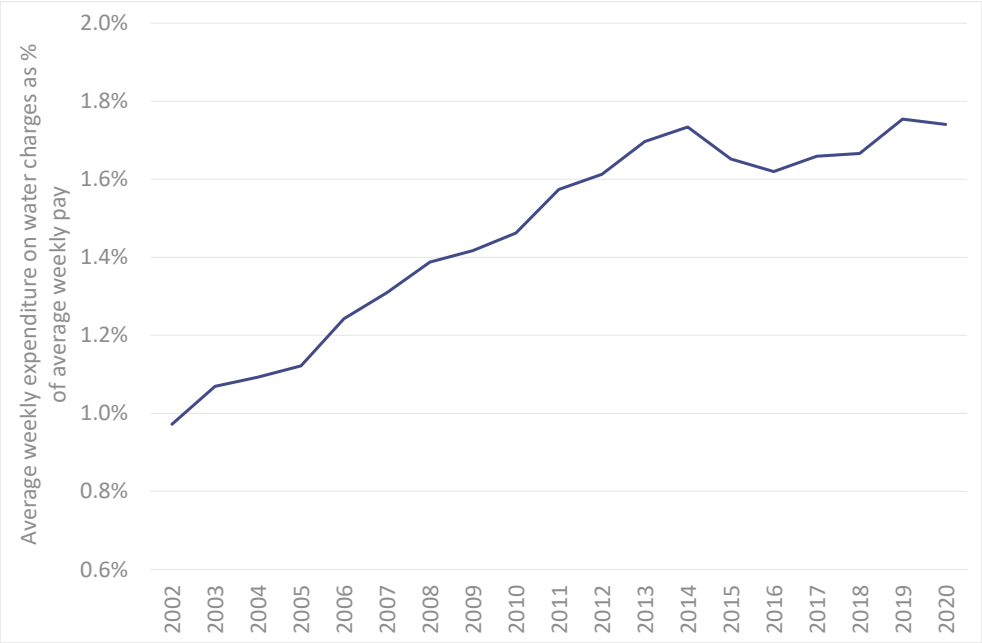
Water poverty – which describes the situation where a household struggles to pay their bill, due to low income – remains a challenge for some customers. The Consumer Council for Water (CCW) considers that low-income households spending more than 5% of their income (after housing costs) can be considered to be facing water poverty; and are in need of help with their bill.[20] Key findings for 2019-20 from the CCW's *Water Affordability and Vulnerability* report include: [21]

'Almost 900,000 financially vulnerable households in England and Wales were receiving help through reduced water bills in 2019/20– 28% more than the previous year.'

- Almost 900,000 financially vulnerable households in England and Wales were receiving help through reduced water bills – 28% more than the previous year.[22]
- The number of households supported through social tariff schemes rose by 35% to 723,192.
- The number of customers in vulnerable circumstances registered for support increased by 42%, to 595,839.
- 1 in 10 customers consider their water and sewerage bills are not affordable (1 in 8 in Wales).

Further to the above, data shows that the proportion of household spending on water / wastewater bills has almost doubled since 2002 (see Figure 3 below). This trend may have amplified affordability issues for some particularly vulnerable households.[23]

Figure 3: Average weekly expenditure on water charges as % of average weekly pay



Source: Economic Insight analysis of ONS data.

The evidence therefore shows *'why'* Ofwat and the industry are particularly concerned about affordability at this time. When seen in the context of low recent productivity gains (as per the last subsection) this raises the question of *'how'* these concerns can be addressed.

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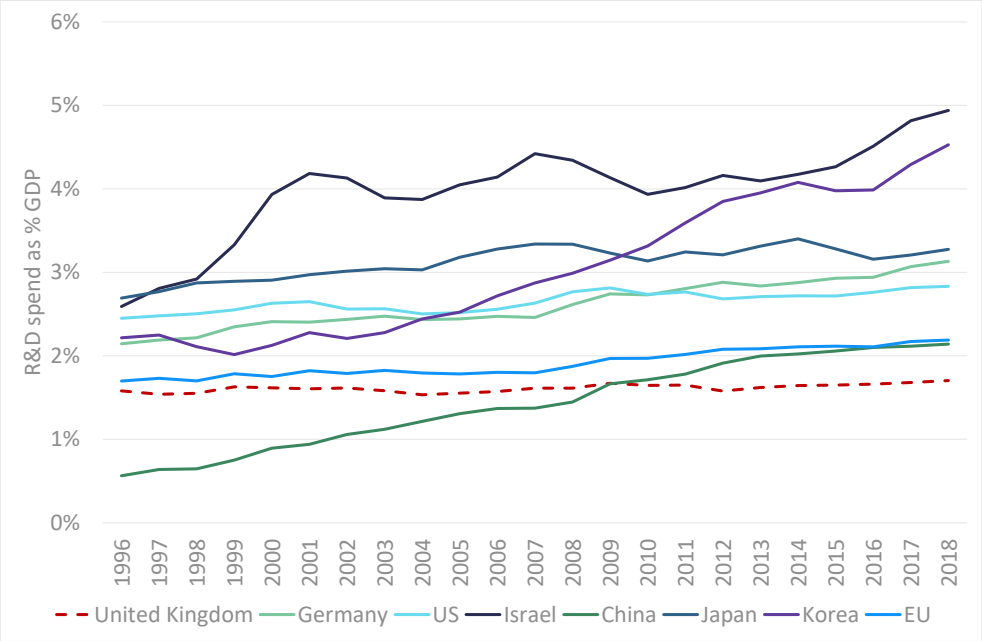
20 *'Independent review of water affordability'. CCW (2021).*
21 *'Water Affordability and Vulnerability Report 2019-20'. CCW (2020).*
22 *This increase is likely due to more focus in this area, rather than an underlying increase in vulnerability.*
23 *'PR24 and beyond: Future challenges and opportunities for the water sector'. Ofwat (December 2020). Critically, the private price of water may not fully reflect its scarcity value which, as noted previously here, must be increasing over time, given environmental pressures and population growth.*

Investors frequently mentioned that Ofwat's short-term focus on bill reductions could hinder long-term resilience and climate change objectives – as to achieve the latter significant investment is required. One investor noted that "*low level investment now destroys the benefits of future generations*".

2.3.3 Large scale gains (step changes) in productivity are likely contingent on investment in innovative solutions and technology

Following from the previous two subsections, it seems that larger (step-changes) in productivity may be needed to address affordability concerns. In practice, evidence suggests that achieving this is contingent on investment in innovative solutions (e.g. new operating models and technology). Indeed, the link between innovative approaches, technology, and economic performance (productivity at a country, or firm, level) is long established – going back to Solow's work, who found that **complex technological changes represent the most important source of economic growth**.[24] Consistent with Solow's findings, over time, numerous economic growth; firm; and industry level performance models incorporate technological progress (and / or new ways of doing business) and innovation as the central source of increased productivity.[25] In other words, economic theory clearly establishes that technology and innovation help explain increases in productivity (and large gains in particular). Consistent with theory, the UK's low (and flat) gross expenditure on R&D, as a percentage of GDP, is often referenced as a contributory factor to the country's low productivity performance over recent decades – see Figure 4.

Figure 4: R&D expenditure as a % of GDP, 1996 - 2018



Source: Economic Insight analysis of World Bank data.

Setting to one side the UK's productivity performance, a range of empirical studies confirm the strong association between technology and / or innovative business approaches and productivity more broadly, as illustrated in Table 1 overleaf.

[24] *'A contribution to the theory of economic growth'. Solow, R. Quarterly Journal of Economics (1956).*

[25] *See: 'Endogenous technological change'. Romer, P. Journal of Political Economy, (1990); 'A contribution to the theory of economic growth'. Solow, R. The Quarterly Journal of Economics (1956); 'Capitalism, socialism and democracy'. Schumpeter, J. (1942).*

Table 1: Empirical evidence linking technology / innovation with productivity

Paper title	Author(s)	Journal	Year	Key findings
From ideas to growth: Understanding the drivers of innovation and productivity across firms, regions and industries in the UK	National Institute for Economic and Social Research (NIESR)	BEIS research paper	2021	Both R&D investment and innovation significantly boost productivity growth. On average, the research suggests that an increase in R&D investment by £1 would yield an economic return of up to £0.20.[26]
R&D expenditure and economic growth: EU28 evidence for the period 2002–2012	Svetlana Sokolov-Mladenović, Slobodan Cvetanović & Igor Mladenović	Economic Research	2016	Increase in R&D expenditure as a percentage of GDP by 1% is associated with an increase in real GDP growth of 2.2%.[27]
Innovation and productivity	Hall, Bronwyn	NBER working paper	2011	They found strong links between innovation and productivity performance across a panel of UK firms.[28]
Innovation and Research Strategy for Growth	BIS	BIS economics paper	2011	A strong correlation between product innovation and labour productivity was found. On average, a 1% increase in firms' innovation sales per employee was associated with a productivity increase of 0.5% across countries. For the UK this figure was 0.55%.[29]
Mapping the two faces of R&D: Productivity growth in a panel of OECD industries	Griffith, R., S. Redding and J. Reenen	The Review of Economics and Statistics	2004	There is a strong association between R&D and productivity at a national level, using panel data. [30]
Why did UK manufacturing productivity growth slow down in the 1970s and speed up in the 1980s?	Cameron, G.	Economica	2003	A 1% increase in R&D in UK manufacturing (closely related to innovation) raised TFP by 0.2 to 0.3%.[31]

Source: Economic Insight review of multiple sources.

[26] *'From ideas to growth: Understanding the drivers of innovation and productivity across firms, regions and industries in the UK'. BEIS Research Paper Number: 2021/041 (October 2021); page 7.*

[27] *'R&D expenditure and economic growth: EU28 evidence for the period 2002–2012'. Svetlana Sokolov-Mladenović, Slobodan Cvetanović & Igor Mladenović. Economic Research (2016).*

[28] *See for example: 'Innovation and productivity'. Hall, Bronwyn H. (2011); 'Investigating the links between innovation and productivity: an analysis of UK firms', BIS (2010); 'Innovation and Productivity: Estimating the core model across 18 Countries' in OECD 'Innovation in Firms – A Microeconomic Perspective', Paris: OECD (2009).*

[29] *'Innovation and Research Strategy for Growth'. BIS (December 2011); page 12.*

[30] *See: 'Issues in assessing the contribution of research and development to productivity growth'. Griliches, Z. The Bell Journal of Economics (1979); 'Mapping the two faces of R&D: Productivity growth in a panel of OECD industries'. Griffith, R., S. Redding and J. Reenen. The Review of Economics and Statistics (2004); 'Do trade patterns and technology flows affect productivity growth?'. Keller, W. The World Bank Economic Review (2000); 'Real effects of academic research'. Jaffe, A. American Economic Review (1989).*

[31] *'Why did UK manufacturing productivity growth slow down in the 1970s and speed up in the 1980s?'. Cameron, G. Economica (2003); page 22.*

INVESTMENT IN INNOVATIVE APPROACHES AND R&D IS LIKELY ESSENTIAL TO DRIVE LARGER FUTURE GAINS IN PRODUCTIVITY.

Of particular relevance to the issues we are considering in this report, the evidence further shows that innovation / R&D is not only positively associated with productivity, but can drive large gains (in relative terms).

In summary, to the extent that 'larger' gains in productivity are now required in order to manage affordability, the evidence strongly suggests that unlocking innovation, through technology, R&D and new operating models for delivering water and wastewater services, is essential. This is consistent with Ofwat's views at this time, who have emphasised the need for transformational innovation and the adoption of *'game-changing'* solutions across the industry.[32]

2.3.4 Investment in innovative business models and technology tends to be more uncertain / higher risk

The impact of any innovation, new operating model, or technological development cannot be known in advance – otherwise it would not be novel. Thus, innovation or the use of innovative technologies, usually has two key defining features:[33]

- **risk** – that is, the probability of certain outcomes materialising or not; and
- **uncertainty** – that is, we do not know from the outset what the *possible* outcomes might be; and therefore cannot easily attribute probabilities to them.

The investment and processes required to achieve innovative outcomes are, therefore, highly uncertain and risky. For example, the Department for Business, Energy & Industrial Strategy (BEIS) notes that "*R&D activities, as a key input to the innovation process, are* ***highly costly, risky and volatile***." [34]

Investors' willingness to accept higher degrees of risk is an important facilitator of the technological changes, and new ways of supplying services, that drive the innovation process.[35] In particular, given the risk of failure associated with innovation, investors need to be comfortable carrying more risk and uncertainty than they otherwise would (i.e. were they investing in more established or standard technologies or business operating models). For example:

- **19 out of 20 product / service innovations fail.**[36] Product and service innovations are often not successful. However, to find that one successful innovation, one needs to undertake (and pay for) the unsuccessful ones, too.
- **9 out of 10 start-ups fail**.[37] With start-ups generally being considered relatively innovative enterprises (often trialling new operating models), this illustrates the risk of failure inherent with innovation - not just at the product, but also at the firm-level.

In the context of the water industry (and as we subsequently describe) large complex projects may carry significant delivery risks. This, then, is the flipside of the coin, when pursuing transformational innovation or seeking game-changing solutions

32 *'UK 2050: Water Innovation Strategy'. (September 2020).*
33 *'Innovation and Research Strategy for Growth'. BIS (December 2011); page 102.*
34 *'From ideas to growth: Understanding the drivers of innovation and productivity across firms, regions and industries in the UK'. BEIS Research Paper Number: 2021/041 (October 2021); page 10.*
35 *'Capitalism, Socialism and Democracy'. Schumpeter, Joseph (1942); 'A Model of Growth through Creative Destruction'. Aghion, Philippe, and Peter Howitt.. Econometrica (1992).*
36 *'Why Is Innovation So Hard?'. Viima (2019).*
37 *'Startup Failure Rate: Ultimate Report + Infographic [2021]'. Failorly (2021).*

across the industry.[38] **We should emphasise, however, that this does not imply that the key issue here is one of the WACC per se.** Rather, it just means that the characteristics (and consequently, therefore, the risk profile) of more innovative projects are likely very different from the average. Hence, the existing regulatory approach is unlikely to be sufficient to secure their delivery.

The link between high-risk investments, innovation and the required higher returns was frequently mentioned by investors as a deterrent to invest in innovation in the UK water sector, as it is seen as "low-risk; low-return" sector; whereas innovative projects require a "high-risk; high-return" profile. Generally, existing investors said they are – in principle – willing to take on higher risks for innovative projects, but that to do so, "*higher returns need to be up for grabs*". That is, if the right framework conditions are set, and if investors are confident they can earn higher returns than currently, they would be willing to invest in riskier projects. In particular, one investor noted that "*there is still enough appetite and money for different risk and return profiles*". Thus, if the 'right' risk and return profile is set for the UK water sector, the 'right' types of investors will also be attracted into the sector and / or the current ones might be willing to take those risks – when given the chance for earning the commensurate returns for those risks.

2.3.5 Climate change means the scarcity value of water is increasing

In 2017, the Committee on Climate Change (CCC) highlighted shortages in water supply as one of five priority climate change risks that needed stronger policies and urgent action. Research estimated the demand for water in England will exceed supply by between 1.1 billion and 3.1 billion litres per day by the 2050s, depending on two critical factors: the extent of climate change; and population growth.[39]

Climate change is projected to reduce the amount of water in the environment that can be sustainably withdrawn, whilst increasing the demand for water during the driest months. In addition, the growing population will create additional demands on already stretched resources in some parts of the country. Whilst there is significant action already underway, there is an urgent need for longer-term water resource planning, to assess the scale of risks and consider strategic and more sustainable options (and a need for more co-ordinated action).

'Even low population growth and modest climate change scenarios will result in severe water supply deficits.'

The research commissioned by the CCC indicates that **even low population growth and modest climate change scenarios will result in severe water supply deficits**; and with high population growth and more severe climate change these deficits deepen – and by the 2050s, extend across the UK.

[38] *'UK 2050: Water Innovation Strategy'. (September 2020).*
[39] *'The UK Climate Change Risk Assessment 2017.' Committee on Climate Change (July 2016).*

2.3.6 Therefore, to achieve Ofwat's objectives, companies will have to become more innovative – and regulation will need to adapt

Recapping, the 'in-practice' case for a differential regulatory approach in the water industry appears strong, given that:

- The productivity performance of the water industry has declined in recent years – and with early post-privatisation gains exhausted, the scope to squeeze more out *within existing business models* may be limited.
- However, affordability issues (which affect some particularly vulnerable consumers) remains a challenge for the industry. Thus, larger productivity gains are likely needed to address this.
- Theory and evidence suggests innovation (new business operating models, new technology etc) is the key to unlocking these larger gains.
- A key feature of innovation and technological change is that it is inherently risky and uncertain – as all novel approaches are. The nature of the projects / programmes that deliver them will likely be different from historical investments in the industry. Thus, something 'different' is required, in order to facilitate and incentivise those investments.
- Climate change (and an aim to further improve environmental outcomes) not only heightens the need to deliver efficiency gains, but raises important questions around how costs and benefits should be shared – both across stakeholders (including wider society) and over time. Thus, ensuring that positive externalities are achieved is likely to require enhanced efficiency gains.[40]

We note that Ofwat introduced the Innovation Fund competition worth £200m to foster innovative projects; and hence the regulator recognises that there is a need to take these forwards. However, some of our interviewees questioned whether the sums allocated to the Innovation Fund were sufficient to foster genuinely step-change innovations.

2.4 A differential approach will help Ofwat achieve its aims by delivering significant benefits

In summary, a differential approach to the regulation of large and complex projects, in line with our proposals, has the potential to unlock significant benefits for customers; society; and the environment. This is further helpful to Ofwat, given its own objectives. Specifically:

- By facilitating the delivery of these projects, a differential approach unlocks larger efficiency gains over time, which are now vital to ensuring a resilient; high quality; and affordable water supply in the long-term – particularly in the context of climate change.
- Competition-led approaches may be appropriate in some instances – allowing further efficiency gains to be realised, which may not otherwise occur.
- Customers further benefit from an allocation of risk that is more tailored to the features of these projects. There are two dimensions to this:

[40] *Which requires all stakeholders to act differently – including customers who may require more information / education in order to better understand the benefits of saving water.*

- Because these projects are long-lived, a 'differential' approach allows the costs of delivery and operation to be 'smoothed' across generations of customers, better balancing intergenerational fairness, whilst retaining the core 5-yearly price controls for average projects.
- Because the extent and controllability of risk is different for large and complex projects, a differentiated approach should mean a more optimised alignment of incentives that drives lowers costs and better outcomes over time (relative to the counterfactual). For Ofwat, in practical terms, it means it can focus on honing the existing price control model, without concern for how any very large and risky projects impact it (including any impacts on the appointee WACC, for example). Rather, it can think about that subset of projects on a more standalone basis, considering the right risk / reward balance, and incentives, for those as appropriate.[41]

- A more tailored approach allows for a greater level of scrutiny and review – allowing Ofwat to focus its efforts proportionally in a way that should maximise value for customers.

[41] *For example, that includes having flexibility to adopt either 'higher' or 'lower' risk models (i.e. the latter providing more certainty over returns over longer periods of time, perhaps with less regulatory risk, which might then be consistent with a lower rate of return; the latter implying the opposite).*

3. Review of existing approaches and complex projects in other industries

Having established why one might apply a differential approach to large and complex projects in the water industry, we must next consider 'what' that might be. To inform this, in this chapter we examine evidence on regulatory approaches in other industries; and broader evidence on the delivery of large infrastructure projects. We find that regulatory approaches vary significantly – but that measures to mitigate overall risk exposure (including avoiding windfall gains) are often used – as per Ofcom's 'fair bet' framework. A review of large projects reveals that cost overruns are significant and commonplace. However, assigning responsibility (and thus contracting to align incentives) is challenging; potentially requiring a balance to be struck between ensuring delivery (especially where assets are essential) and cost or performance incentives.

3.1 Overview of key findings from our review

We reviewed eight regulatory approaches used elsewhere, as well as wider evidence form nine large scale projects. From our review, we can see that in relation to **regulatory approaches** to large and complex projects:

- **There is no 'one size fits all' model**. For example, even within one approach – such as Ofgem's Strategic Wider Work / Large Onshore Transmission Infrastructure (SWW/LOTI) approach – there is an option for various delivery models. What is 'right' for one project may not be 'right' for another one. However, once a project need has been identified (and validated), typically delivery *does* occur, one way or another.[42]
- **There are often mechanisms to limit the extent of risk exposure.** The approaches all recognise that large and complex projects can be 'high risk' and, in various ways, set a risk-reward balance that reflects this. Hence, we observe regulatory models that are permissive of more variation in outturn returns, relative to smaller / less complex projects (including the potential for higher returns, where projects are considered socially desirable).[43] Notwithstanding this,

[42] *That is to say, we observe significant delivery risk in terms of timescales; costs; and so on. But ultimately, most often said projects 'are' delivered, in the end.*

[43] *In addition to variation in risk, allowed returns may reflect the relative 'importance' of investment (particularly in the context of externalities and future generations). For example, the CMA 'aimed up' the rate of return in its recent decisions, recognising that not accounting for positive externalities could lead to worse outcomes for current and future customers. See: 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final Report.' CMA (March 2021); 'Aiming up on the WACC and prices – the welfare and incentive impacts for the water industry.' Williamson, B., Ofwat publication regarding PR19 CMA submission (October 2020).*

there are often mechanisms that limit overall risk exposure. This stems from: (i) a concern that without limits, projects would not attract investment / would not proceed at all; and / or (ii) that beyond certain amounts of variation, performance might be considered a *'windfall'* or *'bad luck'* (i.e. this is part of the rationale for the Ofcom 'fair bet' framework).

- **Clarity over investment recovery path.** The *'rules of the game'* are clear and, with the largest projects, are often relatively simple. This includes, in some cases, allowing costs to *'pass through',* (akin to *'rate of return regulation'*) unless demonstrably inefficient (e.g. elements of Heathrow). Most approaches recognise that determining the efficient cost *ex-ante* for one-off projects is extremely challenging. The revenue stream also needs to be clear, whether that is via user charges, or something else.
- **Longer timeframes and certainty.** An important aspect of some of the approaches reviewed includes providing certainty over longer timescales (than is typical for regulated industries) – which not only provides investors with more security (such as, for example, Ofgem's OFTO approach) but also provides for intergenerational equity. That is, future beneficiaries of these projects will not only reap their benefits, but will also contribute towards the cost of their existence (again, be this through user charges, or through other mechanisms)**.**

Setting formal regulation aside, our review of the **delivery** of large and complex infrastructure projects more broadly highlights the following key issues:

- **Through their uniqueness, projects can be very unpredictable - and therefore cost overruns are highly likely**. Undertaking unique and complex projects carries risks that either cannot be quantified, or that have been inappropriately quantified. For example, 'unquantifiable' risks arise from unknown or unexpected events, such as the issues at London Bridge station during the Thameslink programme. Risks that have been inappropriately quantified involve those that are subject to high optimism bias at the commissioning stage, or because the situation has changed during the project lifecycle. For example, the Jubilee Line extension's labour costs increased, as the economy recovered from the recession. Given these different sources of unpredictability, cost overruns can be substantial.
- **Determining responsibility for cost overruns, or delays – and therefore contracting and setting incentives – is challenging.** Whilst commercial incentives for efficient, high quality, and on time, delivery of infrastructure, are important, in practice it is also difficult. In the examples we reviewed, overruns occurred for a multitude of reasons. Some were outside of most parties' influence. In other cases, some degree of responsibility could be attributed, but even there, not wholly, and would not be uncontentious. At the heart of this issue is a balance between what is most important: (i) the <u>delivery</u> of said infrastructure (i.e. given its importance to society); versus, (ii) seeking to <u>minimise cost</u> / improve outcomes / delivery (in the near term). There need not necessarily be an outright 'tension' between these considerations – but nonetheless, the examples reviewed here suggest some balancing is required for large and complex projects.
- **Lack of coordination between multiple parties**. Large and complex projects will involve many stakeholders – that, in and of itself, poses a heightened risk for project delays. For example, on the Great Western Railway Modernisation, there was a lack of alignment and appreciation for the impact of various interactions on the project.
- **Where an asset is 'essential', it will be completed.** That is, where an 'essential' need has been identified (and parties have contracted to develop and operate any infrastructure asset) it tends to be completed, even if significant delays and cost

overruns occur. In some cases, the essential nature of said assets can lead to Government support. For example, the Jubilee Line Extension covered the cost overruns from additional funding from the banks - and Network Rail had to bear the penalties for cost overruns on the Thameslink programme.

- **There may be a 'point of no return', beyond which parties will not 'walk away'.** That is, where design or construction is so advanced, that stopping would mean an incomplete asset is stranded, or that alternative appointees would need to be commissioned to complete it, *'walk aways'* are unlikely. That is to say, even with significant delay / cost overrun / poor performance, the 'procurer' may consider that, beyond a certain point, no party other than the appointed organisation can complete the project. Similarly, from the commissioned party's perspective, beyond a certain point the project may be so strategically important that they remain committed, regardless.

The following two sections set out our review of: (i) regulatory approaches; and (ii) approaches for delivering large infrastructure projects more broadly.

3.2 Regulatory approaches used elsewhere

We have reviewed the approaches of other UK regulators in relation to large and complex projects / infrastructure. The following table provides an overview of the approaches we have examined. In the following subsections, we briefly expand on each approach, setting out *what* each entails and *why* those regulators have applied them.

Table 2: Overview of approaches and regulators

Regulator	Market / service	Approach
Ofgem	Electricity transmission offshore	OFTO
	Electricity transmission onshore	SWW/LOTI
CAA	Heathrow	Capex governance Capacity expansion
Ofcom	Fibre	'Fair bet'
ORR	Rail	Concession
NEB	Canadian oil and gas pipeline	Negotiated settlements

Source: Economic Insight

3.2.1 Ofgem – offshore electricity transmission

What is the approach?

In 2009, the UK Government introduced the regulatory regime for offshore electricity transmission to connect significant amounts of renewable offshore generation to the onshore electricity network (the OFTO regime).[44]

Ofgem appoints Offshore Transmission Owners (OFTOs) through a **competitive tender** process. OFTOs are granted an offshore transmission licence (OFTO Licence), in which they take responsibility for the transmission assets (normally cables, substations and transformers). In return for ensuring the assets are available for transmission of electricity, the OFTO is paid a fixed revenue for 20 years. The amount of revenue (Tender Revenue Stream, or TRS) is determined by Ofgem, based on the TRS set by the winning OFTO bidder in its tender. OFTO bidders price their TRS taking into account all their anticipated costs. Ofgem selects a successful bidder, based on the cost of their TRS and the deliverability of their tender submission.

Why is this approach used?

The objectives of the OFTO regime are threefold: (i) delivering fit for purpose transmission infrastructure to connect offshore generation with limited exposure to risk; (ii) providing best value for money to consumers; and (iii) attracting new entrants to the sector.[45]

(i) The OFTO's revenue stream is unrelated to the generating asset's performance, hence the need for performance incentives. The OFTO is only required to ensure the transmission infrastructure is available to transmit regardless of the power actually generated.[46]
(ii) The benefits to competition are expected to provide best value for money to customers.
(iii) Access to the sector is possible through the competitive tender exercise.

The OFTO regime has come into existence because Ofgem considered that the onshore Transmission Owners (TOs) did not themselves *need* to own the offshore transmission network. Rather, the regulator saw that there was scope for these to be owned / provided by new licensees, appointed via competitive tendering (i.e. Ofgem considered benefits from competition were important).

Notwithstanding this, generators decided that it is in their interest to maintain responsibility for building their offshore transmission links, with the focus being on transferring a built asset to a new owner / operator. Therefore, Ofgem's attempt to introduce an OFTO-build approach did not garner industry interest; and currently all OFTOs only finance and operate the assets.[47]

3.2.2 Ofgem – onshore electricity transmission

What is the approach?

For *onshore* network investments, Ofgem introduced specific arrangements for large electricity transmission network reinforcements, known as Strategic Wider Works

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44 *See: https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/offshore-electricity-transmission-ofto*
45 *'Offshore electricity transmission: updated proposals for the enduring regime'. Ofgem (May 2012).*
46 *'Offshore Transmission: An Investor Perspective – Update Report'. KPMG (2014)*
47 *'OFTO Build: Providing additional flexibility through an extended framework'. Ofgem (December 2014).*

(SWW) under RIIO-1, which are now known as Large Onshore Transmissions Projects (LOTI) under RIIO-2.

Under Ofgem's SWW/LOTI approach, Transmission Owners (TOs) can put forward projects that haven't been funded through the price control. To do this, they have to go through a process that consists of: (i) an eligibility assessment; (ii) an initial needs case (INC); (iii) a final needs case (FNC); and (iv) a project assessment. They must also submit information to justify their proposal and show that the costs of delivering the transmission project represent value for money. In essence, there are multiple 'gates' that TOs need to pass through, in order to receive approval for additional investment.

Ofgem further considered various *'delivery models'* for the SWW/LOTI projects, illustrated in Table 3. It should be noted that to date, Ofgem has not applied these to any SWW/LOTI projects. Rather, they have been delivered through the RIIO price control route.[48]

Table 3: Alternative delivery models considered by Ofgem

Delivery model	Description
CATO	Ofgem explored how to introduce competitive tendering to onshore electricity transmission (as is the case for offshore electricity transmission – see above) with a Competitively Appointed Transmission Owner (CATO) delivery model.[49] This model was abandoned, given legislative uncertainty to get it approved. Ofgem explored two alternatives – an early and a late CATO build model:[50] • **Early CATO build**: a tender would commence earlier in the project development process, to appoint a CATO to carry out the preliminary works, as well as construct, own and operate the asset. • **Late CATO build**: a tender would determine a CATO to construct, own and operate the asset, after completion of the preliminary works (e.g. design, consenting) for the project. At a high level, a CATO would: • have a transmission licence granted by Ofgem, and be subject to the obligations therein; • receive annual revenue from transmission system users via the System Operator (SO) in return for building, maintaining and operating their assets; • be a party to the System Operator-Transmission Owner Code (STC), and adhere to its procedures and requirements; • procure any necessary sub-contracts for construction work, operations and maintenance; and • comply with the conditions of relevant planning or environmental consents, in addition to other legislation, including health and safety.

48 *'Hinkley - Seabank: Updated decision on delivery model'. Ofgem (May 2020).*
49 *'Extending competition in electricity transmission: Decision on criteria, pre-tender and conflict mitigation arrangements'. Ofgem (November 2016).*
50 *These are very similar to the 'early' and 'late' Ofwat DCP tender models.*

Delivery model	Description
CPM	Under the **Competition Proxy models (CPM)** Ofgem would set the TO's allowed revenue for a project in line with the outcome the regulator considered would have resulted from an efficient competition for construction, financing and operation of the project.[51] Ofgem would fix this revenue for a defined period (in general 25 years would likely be appropriate). The revenue would be based on Ofgem's determination of a project-specific cost of capital for the construction and operational periods of the revenue term; and its assessment of efficient costs for the construction and operation of the project.
SPV	Ofgem envisaged that, under the **Special Purpose Vehicle (SPV)** model, the incumbent TO would run a competitive tender for the construction, financing and operation of the project (through a project-specific SPV). The SPV would deliver the project under the terms of a contractual arrangement (the Delivery Agreement or DA) with the TO. The TO would retain regulatory responsibility (under the terms of its transmission licence) for, and operational control of, the project. The SPV would finance, construct and operate the project for a fixed period (in general 25 years would likely be appropriate), in return for a defined revenue under its DA with the TO. Ofgem considered that the capital invested in the project assets would be fully recovered over this period, i.e. the equivalent of the RAB would be zero at the end of the revenue term. The competitive tender would be designed with Ofgem input - and run with Ofgem oversight. This tender would initially specify and ultimately determine the terms of the contractual arrangements between the SPV and the TO. The SPV competition would determine an annual revenue stream, reflecting the underlying capital and operational costs and WACC, which would be paid to the SPV by the TO, on behalf of consumers. The TO would recover these costs from consumers through its transmission licence.

Source: 'Extending competition in electricity transmission: arrangements to introduce onshore tenders'. Ofgem (October 2015); 'Update on competition in onshore electricity transmission'. Ofgem (January 2018); Update on the Competition Proxy delivery model'. Ofgem (September 2018).

Why is this approach used?

This approach is intended to be utilised in the case where funding was not awarded at the start of the price control period because of uncertainties surrounding the costs and timings of the project.[52] The SWW/LOTI approach is intended to manage this uncertainty; and assess large transmission projects during the price control that they are needed to extend and strengthen the transmission network (and also to transport electricity, from where new generation is built, to where demand is located).

This results in projects being able to be considered for funding as and when they are brought forward and in order to ensure that the necessary investment goes ahead at the appropriate time.

Large transmission projects could be considered, once more information was available to inform decisions on whether investment in the projects would be in the interests of existing, and future, consumers - which may not have been clear / certain at the price review stage.

Its main purpose is to ensure that crucial transmission assets get developed and constructed, even where there is uncertainty as to their need at the price review stage.

[51] *Set out in more detail subsequently.*
[52] *'Strategic Wider Works FAQ'. Ofgem (December 2013).*

3.2.3 Heathrow – Terminal 5

Heathrow Terminal 5 took almost 20 years from conception to completion.

What is the approach?

The CAA's Q4 regulatory settlement recognised the challenges that British Airports Authority (BAA) – then the owner of London Airports, including Heathrow – was facing; and ensured it received sufficient incentives to build Terminal 5 (through the use of revenue profiling and a robust, separate, cost of capital determination).

The CAA and the CC were both mindful that regulatory determinations on the cost of capital would have a significant bearing on the level of investment in a regulated airport in the Q4 regulatory settlement. Thus, the cost of capital was adjusted upwards to take account of risks associated with the Terminal 5 project (and uncertainty over the equity risk premium). This decision enabled BAA to commit to the Terminal 5 investment.[53]

Further, the regulatory settlement for BAA's Heathrow included the following features relating to capital expenditure triggers:

- **Capital expenditure triggers**. During Q4 and Q5, BAA would incur significant levels of capital expenditure, most notably in relation to Terminal 5. This raised several regulatory policy issues, given the costly and long-lived nature of these assets; namely:[54]
    - Q3 claw-back;
    - revenue advancement;
    - assets in the course of construction (AICC);
    - projections of operating expenditure, regulatory depreciation and other revenues; and
    - the cost of capital applied to the BAA London airports.

BAA had proposed that increases in airport charges should be related to project progress, giving it a strong incentive to complete T5 on schedule; and ensuring that airlines only paid increased charges as and when there was demonstrable progress.[55]

In setting the asset base for regulatory purposes (on which a return would be allowed) there were allowances for AICC—particularly BAA's key investment in T5 at Heathrow. There was also a further element of advancement of revenue for 'smoothing' of prices and returns between Q3 with a relatively high return, and lower rates of return in Q4 (although with a suggestion that price increases of RPI+2% would still be necessary in Q4, reflecting the increasing marginal cost of new investment, particularly of T5).[56] This was to avoid any sudden price increases.

Why is this approach used?

This approach was used to ensure efficient and timely delivery of Heathrow Terminal 5 - and to provide sufficient incentives (and certainty) for investment to occur.

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53 *'Select Committee on Regulators Minutes of Evidence: Memorandum by BAA'. Select Committee (February 2007).*

54 *'Economic Regulation of BAA London Airports (Heathrow, Gatwick and Stansted) 2003 – 2008: CAA Decision'. CAA (February 2003).*

55 *'Chapter 9: Capital Investment'. Competition Commission (November 2002).*

56 *'Chapter 2: Conclusions'. Competition Commission (November 2002).*

3.2.4 Heathrow – capex governance

What is the approach?

Since the Q6 price control period, Heathrow Airport Limited's (HAL's) capital investment projects follow a nine-phase gateway process, as shown in Figure 5. Capex in gateways 0 to 3 is known as *development* capex; and has an indicative allowance. After capex has passed gateway 3, it is classed as *core* capex, and has a fixed allowance. *Core* capex will have a higher definition in scope; timeline; risk; and cost than development capex,[57] and so is priced at the P50 level, whereas development capex is priced at P80.[58] Gateway 3 is the critical investment transition point as it is the point at which there should be confidence in the schedule, cost and risks prior to awarding a contract. It is at this point which the regulatory triggers are set.

The Independent Fund Survey (IFS) is a party that is not responsible for the delivery of the projects and rather provides an on-going assessment of the reasonableness of key decisions made on key projects and to ensure that capital is being used effectively to deliver the outcomes of the investments.[59] The IFS will report at all gateways and on a monthly basis during the delivery of the project.

At gateway 3, it may be agreed (between both Heathrow and the wider airline community or regulator) that the investment should not go ahead for various reasons. In this case, any investment money that has not been spent may either be returned to the airline community via a rebate or the money may be diverted to a new investment.

The key benefits of this approach are:

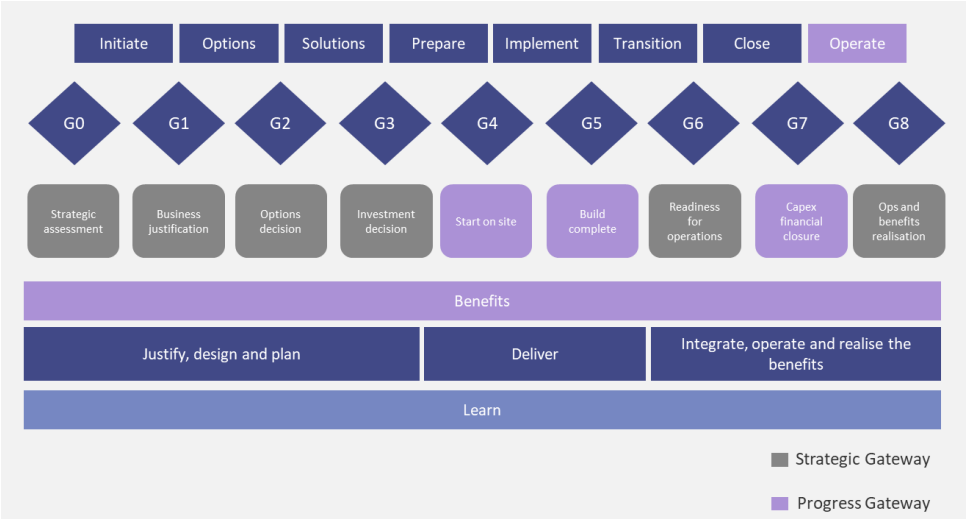
- the provision of real time feedback and reviews which are reported throughout the whole lifecycle of the project;
- adds value to the capital portfolio and ensures the correct behaviours and decisions are being made which provides an increased level of confidence to all parties;
- it significantly reduces the regulatory burden around Capex efficiency reviews; and
- avoids assessment in hindsight.

[57] *'Q6 Strategic Capital Business Plan'. HAL (July 2014).*

[58] *'Review of Heathrow Airport Q6 Capex Governance Framework'. CEPA (2017). P50 and P80 refer to a confidence level regarding the probability of the cost not being exceeded. That is, P80 is not a cost plus/minus 20% but instead it is a cost that will not be exceeded 80% of the time.*

[59] *'Strategic Capital Business Plan'. Heathrow (June 2020).*

Figure 5: HAL gated process



Source: 'Q6 Strategic Capital Business Plan'. HAL (July 2014).

Why is this approach used?

For Q6, HAL adopted this new approach to capex expenditure, based on projects planned for the Q6 price control period not all being equally developed and therefore not being classified in the same strategic and/or process gateway. This approach provided enough flexibility to respond to future changes and allowed sufficient time leading up to gateway 3 to engage with the airline community and build-up the confidence of investors through the systematic review of IFS.

3.2.5 Heathrow – capacity expansion

What is the approach?

When the CAA issued the final proposals for Q6 (2014 – 2018),[60] it was uncertain whether the planning for, and construction of, a major expansion of Heathrow could start during Q6. The CAA set out the following principles that would underpin regulatory decisions in relation to new runway capacity: [61]

- **Risk should be allocated to those parties who can best manage it.** There are a number of different players involved with capacity expansion - and each has an important role in managing risk. The CAA has a role in managing regulatory risk; and Government has a role in managing political risk. By allocating risk to those best able to manage it, users' interests are most likely to be protected by producing the lowest expected out-turn cost (as incentives to manage cost risk are maintained) and by revealing information about parties' valuation of risk.
- **Commercial negotiations should be encouraged, even where substantial market power is present.** If a commercial agreement to underpin expansion is possible, including an agreement reached where the CAA has set the broad parameters under which those negotiations should occur, it could: incentivise efficiency; ensure that risks are borne by those best able to manage them; reveal information about parties' valuation of risk; and avoid any unnecessary regulation.
- **Capacity can be paid for both before and / or after it opens.** The CAA considers the two main potential benefits of pre-funding are that it can: (i) help

60 *'CAP1103: Economic regulation at Heathrow from April 2014: final proposals'. CAA (October 2013).*
61 *'CAP1279: Economic regulation of new runway capacity'. CAA (March 2015).*

reduce the risk of a project, therefore reducing the financing cost; and (ii) lead to a smoother pattern of charges over time - both of which are in the interests of users. The CAA also considers that where there are capacity shortages, price rises can signal to market participants that additional capacity may be required.

The CAA further signalled that it would treat the various cost categories in relation to runway expansion differently. It placed costs into three broad categories and adopted differing approaches for the recovery of costs in each case: [62]

- **Category A costs**: Airports Commission-related and associated lobbying costs incurred by an airport operator or Heathrow Hub Limited (HHL). These are costs that the CAA considers will, in general, be incurred *before* a Government policy decision on capacity expansion is made.
    - The CAA considered that Category A costs were generally not recoverable, unless they could subsequently be reclassified as Category B costs.
- **Category B costs**: capacity expansion costs that are, in general, incurred by an airport operator *after* a Government policy decision and are associated with seeking planning permission.
    - Category B costs up to £10m per annum would be automatically recoverable by an airport operator; and costs over £10m per annum would be subject to an efficiency review. These costs may be recovered by an airport operator, subject to them being efficient, and there being risk sharing arrangements in place that mean such charges are (in whole or in part) returned to airlines in the event that planning permission is not granted, or is rescinded.
- **Category C costs**: these are costs incurred by an airport operator, typically after planning permission is granted, in connection with the implementation and construction of new capacity, up to entry-into-operation. Category C costs can be recovered through payments for new capacity which can be made before and/or after it opens/the project is operational. Pre-funding (front-loading) can help to reduce the risk and therefore the cost of financing the project and will typically lead to smoother patterns of charges across time.

Later, the CAA also considered other delivery models for the expansion. However, as a runway is not as separable as other investment types, the CAA considered there were also some potentially significant differences between the capacity expansion at Heathrow airport and the examples where SPVs were previously introduced. For example, the circumstances and characteristics of the investments funded by the associated SPVs was such that the risks and financing could be genuinely ringfenced.[63]

Moreover, in setting previous price controls, the CAA had allowed HAL to recover the returns on assets that are either *in operation,* or in *the course of construction* – as was the case with Heathrow Terminal 5. This has been called the 'Assets In the Course of Construction' (AICC) approach. On the other hand, for the SPV approaches, regulatory depreciation is only recovered on the RAB from the point at which assets are operational.

The AICC approach was used to help support the efficient financing of Terminal 5 and Terminal 2. It was also an approach that has been used by other economic regulators

[62] *'CAP1279: Economic regulation of new runway capacity'. CAA (March 2015).*
[63] *'CAP1510: Economic regulation of the new runway and capacity expansion at Heathrow airport: consultation on CAA priorities and timetable'. CAA (January 2017); page 32.*

for large scale infrastructure projects. For instance, Ofwat included similar arrangements in the framework to support the financing of the Thames Tideway Tunnel. Thus, HAL was allowed to recover returns and regulatory depreciation, where this was consistent with broader commitments made by HAL that airport charges would not increase in real terms. If HAL were to seek higher charges to support the financeability of its expenditure programmes, then it would need to provide persuasive evidence to the CAA and stakeholders that this would be in the interests of consumers.[64]

HAL's current Category B policy, set out in the CAA's Planning Cost Recovery Policy Statement,[65] has four key elements:

- scope of policy and the materiality thresholds that will trigger a review of the policy;
- the recovery mechanisms including the treatment of costs that will ultimately be added to HAL's regulatory asset base (RAB);
- incentive arrangements including the treatment of risks around whether HAL will be granted a Development Consent Order (DCO); and
- the governance processes, including the role of the Independent Planning Costs Reviewer (IPCR).

Since the Planning Cost Recovery Policy Statement was published, there has been a very significant escalation in the overall level of Category B costs that HAL expects to incur. HAL's most recent Category B cost estimate, made in December 2018, includes a total spend of over £500 million, significantly more than its original £265 million estimate.[66] In light of this increase in estimated costs, the CAA proposed to tighten the future governance of Category B costs by:

(i) **Strengthening reporting requirements**: HAL will be required to commit to a governance process that delivers specific objectives.

(ii) **Establishing a recovery cap**: the CAA will establish a new recovery cap, by assessing HAL's overall revised budget (currently about £500 million) for reasonableness (including building on the findings of HAL's Steer report and other evidence including the findings of the IFS and IPCR reviews). At regular intervals (and at the same time as it updates its Category B budget) HAL should explicitly consider and report on whether it is likely to breach this recovery cap. If it considers that a breach is likely, it will need to seek stakeholder approval for spending in excess of the cap, through its existing approach to engaging stakeholders as specified in its governance protocol (with disputes being arbitrated by the CAA). Unless airlines agree to the spending proposed by HAL, or, in the event of a dispute, the CAA considers that such spending is appropriate, no costs above the new recovery cap will be recoverable.

(iii) **Increasing cost scrutiny**: the CAA will aim to improve the scrutiny of Category B costs, although it recognises that in a new and relatively novel programme (such as capacity expansion) this assessment remains relatively difficult.

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64 *'CAP1510: Economic regulation of the new runway and capacity expansion at Heathrow airport: consultation on CAA priorities and timetable'. CAA (January 2017); page 35.*

65 *'CAP1469: The recovery of costs associated with obtaining planning permission for a new northwest runway at Heathrow Airport: final proposals'. CAA (November 2016).*

66 *'CAP1819: Economic regulation of capacity expansion at Heathrow: consultation on early costs and regulatory timetable'. CAA (July 2019).*

The CAA also proposed to tighten the regulatory incentives. Specifically, it changed the risk sharing from 105/85 to 100/85, in the case that HAL is not successful at the DCO application.

'The importance of combining incentives for efficiency with protections for HAL from undue risks, such that the regulatory framework should allow capacity expansion to be financeable and while also incentivising delivery at the lowest overall cost to consumers.''

In January 2020, the CAA stated "*the importance of combining incentives for efficiency with protections for HAL from undue risks, such that the regulatory framework should allow capacity expansion to be financeable and while also incentivising delivery at the lowest overall cost to consumers. It is also important that we avoid any undue complexity in developing the regulatory framework for HAL and have regard to the principles of better regulation, such that our approach is proportionate, targeted and transparent.*"[67] Relatedly, it also stated the importance of taking a holistic approach to financeability, in order to develop a price control that incentivises the delivery of capacity expansion for the lowest overall cost. Key to this is providing proportionate incentives for efficiency, while allowing HAL to retain access to relatively low cost investment grade debt finance on the scale required to meet the challenges of capacity expansion. This requires a careful approach to risk allocation and the calibration of incentives, in the context of the financing challenges associated with successfully delivering new capacity.[68]

Meanwhile, significant changes occurred, including: (i) the severe impact of the COVID-19 pandemic on the aviation sector as a whole, and passenger numbers at Heathrow airport; (ii) the Court of Appeal's decision, setting aside the Airports National Policy Statement; and (iii) HAL's subsequent decision to pause its programme for expanding Heathrow airport, in the light of these developments (although it is appealing against the Court of Appeal's decision).[69] This led the CAA to re-focus its price control planning to a two-runway airport.

Notwithstanding the focus on a two-runway price control, the CAA further consulted on the regulatory treatment of the early costs of expansion (i.e. the costs that HAL has *already* incurred in respect of expansion); licence conditions relating to financial resilience; ring fencing; and the regulatory treatment of the alternative arrangements for expansion proposed by Heathrow West.[70]

- In the light of HAL's decision to pause its work on expansion, the CAA plans to simplify its policy on early costs - as a number of aspects of the previous policy proposals are no longer appropriate. These include: recovery caps; enhanced reporting requirements; and a new licence condition on governance arrangements.
- Risk sharing arrangements also no longer seem appropriate, as these had been designed to encourage HAL to make a high-quality planning application. Therefore, the CAA proposes that the regulatory treatment of the early expansion costs that HAL has incurred up to the end of February 2020 (which are in the region of £500 million) is consistent with the established regulatory principle that costs should be added to HAL's RAB, unless there is evidence of inefficiency or misallocation. Therefore, while efficiently incurred expansion costs will be added to HAL's RAB (and HAL may provisionally recognise them in its regulatory accounts), the CAA does not propose to allow HAL to start to recover these costs before 2022. Consistent with its previous policy, it intends to make an allowance for financing costs in the period up to 2022 using: (i) the Q6 cost of capital of

[67] *'CAP1876: Economic regulation of Heathrow Airport Limited: further consultation on regulatory framework and financial issues'. CAA (January 2020); pages 7-8.*
[68] *'CAP1876: Economic regulation of Heathrow Airport Limited: further consultation on regulatory framework and financial issues'. CAA (January 2020).*
[69] *'CAP1914: Economic regulation of Heathrow: programme update'. CAA (April 2020).*
[70] *'CAP1940: Economic regulation of Heathrow: policy update and consultation'. CAA (June 2020).*

5.35% for the period up to the end of 2019; and (ii) the iH7 cost of capital of 4.83% for 2020 and 2021.[71]

Why is this approach used?

The high degree of political (and regulatory) uncertainty – combined with the COVID-19 pandemic - has meant the 'approach' has evolved significantly over time. Prior to the pandemic, the key issues determining the approach were: (i) the *essential* need for capacity; (ii) very high degree of uncertainty around costs; (iii) high degree of uncertainty around construction – including timescales; and (iv) the need to limit the extent of overall risk exposure to which HAL might be exposed in some way.

OFCOM'S 'FAIR BET' APPROACH TO FIBRE ROLL-OUT ALLOWS FOR RETURNS ABOVE (OR BELOW) THE WACC, SO LONG AS THEY LIE WITHIN ITS VIEW OF A 'FAIR BET' RANGE. IT INTERVENES / REGULATES ONLY WHEN RETURNS ARE OUTSIDE OF THOSE PARAMETERS.

3.2.6 Ofcom – fibre roll-out (the 'fair bet')

What is the approach?

Ofcom holds off from regulating the prices of new, risky, investments made by Openreach – the incumbent network operator – until the investments have proved to be successful. Even then, the regulator only regulates prices if Openreach has market power - and if Ofcom considers Openreach would have the ability to earn returns some way above its WACC.

Each investment will have a different risk profile. Moreover, many investments are made in stages; and each of these stages is also likely to have a different risk profile. For example, investing in a new service for the first one million customers will be riskier than investing in the same service three years later, to increase availability from 10 to 15 million. This is because both supply and demand conditions will be better understood for the later tranches of investment.

The best way to illustrate Ofcom's 'fair bet' approach is to consider the regulatory approach it took to Openreach's superfast broadband investments. Here, Openreach benefitted from a period of pricing flexibility on superfast services from 2008/09, when it began its superfast broadband investment, through to March 2018. Here, for the first time, Ofcom imposed a charge control, limited to Openreach's '*up to 40 Mbit/s*' wholesale service. The regulator decided it made sense to introduce said control, after determining that the 'fair bet' criteria had been met and that, absent regulation, Openreach would have the incentive and ability to set charges for wholesale superfast services at an excessively high level, with the potential to distort competition.[72]

As a result of this pricing flexibility policy, Openreach had achieved cumulative returns significantly higher than the 11% cost of capital, relevant at the time of those investments.

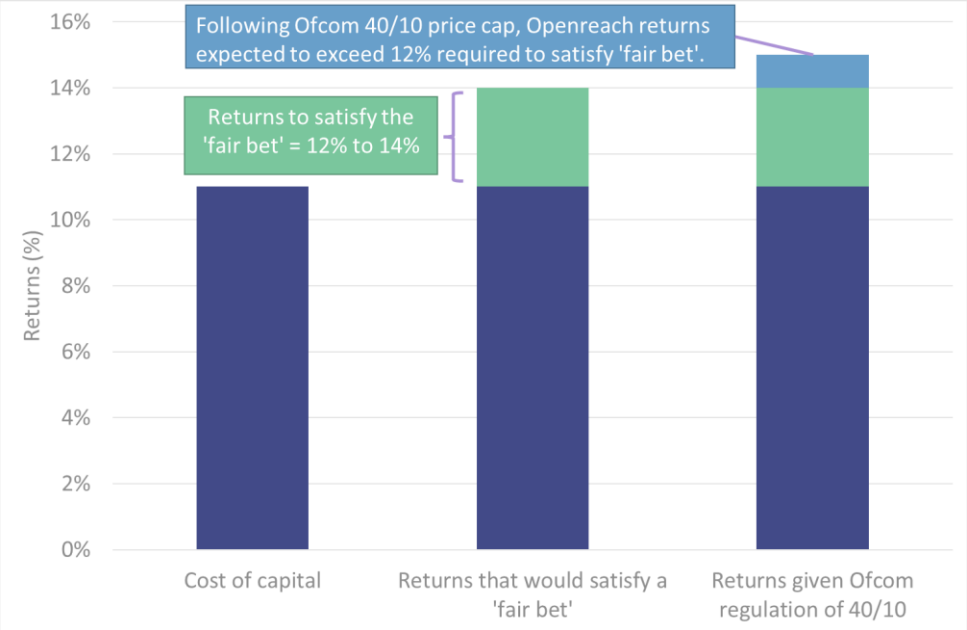
Despite Openreach's market power, Ofcom was careful to not intervene too early. The decision to set a charge control on Openreach's 40 Mbit/s wholesale service (the 40/10 price cap) took full account of the upfront risks that Openreach had faced. Ofcom concluded that, given the nature of these particular investments, Openreach should be given the ability to earn cumulative returns in the range 12% to 14%, to compensate it for the upfront risks and provide a 'fair bet'. Even with the introduction of a charge control on the 40 Mbit/s service, the regulator estimates that Openreach's

[71] *'CAP1940: Economic regulation of Heathrow: policy update and consultation'. CAA (June 2020); pages 74-75.*

[72] *i.e. the 'fair bet' test was met in the sense that Ofcom was concerned Openreach would earn returns not consistent with the outcome of a fair bet.*

actual returns on these investments will be around 15%. This is illustrated in Figure 6, below.

Figure 6: Openreach's 'fair' bet on its superfast broadband investments



Source: 'Wholesale Local Access Market Review: Statement: Annexes 1-9'. Ofcom (March 2018).

The additional returns equate to only a £1.15 increase in the customer bill (if Openreach were to earn a 15% return instead of 12%) while the benefits include a much faster roll-out and faster broadband speeds.[73] Ofcom intends to apply a similar approach to ensuring that Openreach has a 'fair bet' on its future full-fibre investments, where these involve significant downside risks.

In principle, it could be possible to give more certainty to investors within the 'fair bet' framework – and Ofcom is considering how it might do this. For example, the regulator might seek to reach a conclusion on the appropriate WACC that should be used when undertaking any future 'fair bet' assessment. Alternatively, Ofcom could seek to evaluate the risks that Openreach faces in its full fibre investments *'up front'*. Based on any upfront analysis, it might then be possible to pre-specify the long run period over which Openreach will have pricing flexibility. There may also be other ways of providing more detailed guidance on the circumstances in which the regulator might conclude in future that the *'fair bet'* had been met.

Why is this approach used?

Ofcom recognised that Openreach needs the opportunity to make higher than expected returns when a risky investment is successful, to compensate it for the chance of a risky investment failing and making less than expected returns. However, whilst accepting that there is greater downside and upside risk, Ofcom felt it appropriate to effectively 'limit' that (i.e. reserve the right to regulate) based on its best view of a range that would be consistent with a *'fair bet'*. That is to say, once returns get above (or below) a certain point, Ofcom takes the view that it is no longer the outcome of a 'fair bet' – and so regulates.

[73] *This is based on some simplified assumptions and an average broadband bill of £44 and a total of 27.5m UK broadband connections.*

3.2.7 ORR – HS1

What is the approach?

High Speed 1 (HS1) is a 109km high-speed rail line, connecting London St Pancras through Kent to the Channel Tunnel. It is currently the UK's only high-speed rail line, serving four stations (St. Pancras, Stratford, Ebbsfleet and Ashford) along the route. It cost £6.1bn to build and opened in November 2007.[74]

The line was transferred to government ownership in 2009, with a 30-year concession for its operation being put up for sale in 2010.[75] The line concession was awarded to a consortium of Borealis Infrastructure (part of Ontario Municipal Employees Retirement System) and Ontario Teachers' Pension Plan in November 2012.[76]

In July 2017, HS1 Ltd was acquired by a consortium of funds advised and managed by InfraRed Capital Partners Limited and Equitix Investment Management Limited, where participants included HICL Infrastructure and South Korea's National Pension Service.[77]

HS1 Ltd holds the concession (until 2040) to operate, maintain and renew the whole line. The primary business of HS1 Ltd is to provide high-speed rail access to domestic and international passenger and international freight services. HS1 Ltd's revenue comes from access charges, which are paid by train operators to use HS1 Ltd's track and stations. HS1 Ltd also receives income, which is not regulated, through its retail facilities and car parking at stations. Unlike Network Rail Infrastructure Ltd (NRIL, who operate the mainline railway network), HS1 Ltd does not receive any government grant.

The concession approach means it is regulated differently to Network Rail. For example, it is not, therefore, funded through a Regulated Asset Base, nor by a direct grant from the government like Network Rail. Instead, repairs and maintenance are funded from an Escrow account, jointly held by HS1 Ltd and the government (i.e. taxpayers). Operators pay into this account, as they use the network, which means that future operators will not bear the cost of replacing parts of the network, while current users get the benefit. HS1 Ltd has to estimate what it thinks those costs are, and the ORR assesses this as part of its determination.

Why is this approach used?

This approach has been used to ensure there is very low cost risk, as well as ensuring that costs are spread across the current and future users of HS1. This is intended to address the key issue of intergenerational fairness, which is a common issue when considering how best to fund large scale infrastructure assets.

3.2.8 International examples: negotiated settlement

What is the approach?

Across the USA and Canada, negotiated settlement is often the preferred approach to achieve regulatory outcomes for certain large, one-off, projects. For example, negotiated settlements have been used in the Canadian oil and gas pipeline sector

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74 *'The completion and sale of High Speed 1'. NAO (March 2012).*
75 *'High-speed London to Folkestone rail link up for sale'. BBC News.)21 June 2010).*
76 *'High Speed 1 concession awarded to Canadian pension consortium'. Railway Gazette International. (5 November 2010).*
77 *'Canadian owners sell Britain's High Speed 1 to consortium of funds'. Smith, Rebecca (14 July 2017).*

extensively since 1985.[78] The National Energy Board (NEB), the Canadian economic regulator of the oil, gas and electric utility industries, has been using negotiated settlements to determine prices; operating and capital cost projections; return on equity; service quality improvements; and information requirements.

In relation to Canadian oil and gas pipelines specifically, other than the pipeline operators / owners themselves, other interested parties in regulatory issues include: producers; shippers; and consumers. Producers get involved in the regulatory proceedings by way of their private entities, as well as industry associations, such as the Canadian Association of Petroleum Producers (CAPP). Shippers are often also producers, as well as other commercial operators. Consumers include large industrial consumers; local distribution companies; and refineries.

From 1994 onwards, NEB approved various multi-year negotiated settlements, which generally included incentives to reduce costs; and provisions to share savings between the pipeline and its shippers.

Similarly, the prices that North American (US and Canada) consumers pay for essential services, such as electricity, are usually determined under rate-of-return regulation through formal contested proceedings.[79] Under this regulatory framework, the public utility commission considers views by interested parties, including the regulated utility and consumer representatives.

Why is this approach used?

Negotiated settlements have been used as they tend to provide more flexibility regarding the type of agreements that can be reached, and may better reflect local circumstances. They also frequently involve considerable innovation.[80,81] Negotiated settlements also provide greater legitimacy, as all parties are involved in reaching the agreement and provide direct inputs in the process. This can then lead to reduced regulatory burden – both for companies, but also the regulator – as it focuses efforts on the more important questions for all parties involved.

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[78] *'Negotiated Settlements and the National Energy Board in Canada'. Joseph Doucet and Stephen Littlechild (November 2006).*

[79] *'A Study of Negotiated-Settlement Practice in Regulation: Some Evidence from Florida'. Shourjo Chakravorty (December 2014).*

[80] *'Negotiated Settlements and the National Energy Board in Canada'. Joseph Doucet and Stephen Littlechild (November 2006).*

[81] *'A Study of Negotiated-Settlement Practice in Regulation: Some Evidence from Florida'. Shourjo Chakravorty (December 2014).*

3.3 Wider evidence from large scale projects

In addition to reviewing regulatory approaches, we have examined the delivery of major infrastructure projects in the UK and elsewhere more broadly. This is because they provide a useful source of evidence regarding:

- the nature and extent of risks associated with said projects;
- issues associated with their delivery and financing; and
- successes and failures.

From our review, it is clear that cost overruns on 'megaprojects' are common around the world. It is estimated that more than 98% of construction projects worth over $1 billion are late or overbudget, with the average delay being nearly two years - and the average cost overrun being 80%.[82] A notable exception of a project which has been delivered on time, and on budget, is Heathrow Airport's Terminal 5.

The following table provides a brief overview of the projects we reviewed, which we expand on in the subsequent subsections.

[82] *Please see 'https://www.economist.com/britain/2018/12/08/britains-engineering-reputation-goes-down-the-tube'.*

Table 4: Summary of large-scale infrastructure projects

Project	Total cost (£m in 2020 prices)	Cost overrun (£m in 2020 prices)	Construction delay	Other issues / reasons for cost or time overruns
The Channel Tunnel	£10,210	£5,618 (122%)	12 months	Despite extensive exploratory work leading up to the initiation of the project, the Tunnel Boring Machines (TBMs) still ran into unexpected wet and blocky ground. This required major changes to the design of the TBM systems, which added significantly to the cost overruns. In addition to this, water inflow was a major problem during construction.
The London Limehouse Road Tunnel	£475	£246 (107%)	Delivered on time	Additional cost was due to a specialist plant; environmental constraints; the need for added reinforcement to the tunnel; and higher than anticipated inflation.
London Jubilee Line extension	£5,282	£2,052 (64%)	20 months	Complexities of building an underground railway through London, as well as changes in the political, financial and regulatory environment.
National Programme for IT (NPfIT)	£10,852	£6,518 (151%)	Discontinued	The implementation process of NPfIT allowed little time for consultation with key stakeholders and failed to address confidentiality concerns. This resulted in: (i) an unrealistic timetable; (ii) failure to test systems; and (iii) inadequate preliminary work.
Heathrow Terminal 5	£4,000	0%	Delivered on time	There were operational issues upon opening which resulted in: (i) numerous flights being cancelled; (ii) long wait times for passengers; and (iii) delays in the luggage system. British Airways shares fell by 3%, equivalent to approximately £9 million in income.[83]
Carrier Strike (MoD)	£7,347[84]	£3,403 (86%)[85]	84 months	The NAO noted an overestimate of savings from a scaling down in electromagnetic technology; design changes costs and the impact on industry.[86]
The Thameslink programme (DfT & Network Rail) [87]	£5,787	£526 (10%)	47 months	Cost overruns occurred, due to site-inappropriate designs at London Bridge station which required extra construction work.
Great Western Railway Modernisation (DfT & Network Rail)	£6,136	£2,320 (60%)	24 months	The project proceeded haphazardly, with planning permission often not gained on time; and with insufficient consideration of related projects overrunning.
Astute Class submarines (MoD)	£10,900	£1,600 (17%)	28 months	There was a lack of skilled people, with many retiring or moving on. US designers had to be brought in to assist. It was assumed that parts of the previous submarines would be suitable however it turned out that much of this equipment was no longer procurable.

Source: Economic Insight review.

[83] *'Operational Management Analysis | British Airways'. UKEssays (November 2018). Available from: 'https://www.ukessays.com/essays/tourism/operational-management-analysis-of-british-airways-tourism-essay.php'.*
[84] *'MoD Government Major Projects Portfolio data, 2019'. MoD (2019).*
[85] *'Carrier Strike'. NAO (July 2011); page 4.*
[86] *Carrier Strike: The 2012 reversion decision'. NAO (May 2013); page 7.*
[87] *'Update on the Thameslink programme'. NAO (2017); page 4.*

3.3.1 The Channel Tunnel

The Channel Tunnel, which connects the United Kingdom and France, is the longest underwater rail tunnel in Europe - and the third longest in the world. It is 31 miles in distance and at its deepest point it is 377 feet below sea level.[88]

It was developed by a collaboration between the British *Channel Tunnel Group*, which consisted of two banks and five construction companies, and the French *France-Manche*, which consisted of three banks and five construction companies. The banks' role was to advise on financing and secure loan commitments. Prior to construction beginning, the two groups formed Channel Tunnel Group/France-Manche (CTG/F-M).

The design and construction was done by the ten construction companies in the CTG/F-M group. The two groups were linked by a bi-national project organisation called TransManche Link (TML). TML designed and built the tunnel, but financing was through a separate legal entity – Eurotunnel. Eurotunnel signed a construction contract with TML; and the British and French Governments gave Eurotunnel a 55-year operating concession to repay loans and pay dividends. The private funding for this project was of unprecedented scale: (i) an initial equity injection of £45 million was raised by CTG/F-M; (ii) £206 million was raised through a private institutional placement; (iii) £770 million through a public share offer that included press and television adverts; and (iv) a syndicated bank loan and letter of credit amounting to £5 billion. The significant cost overruns were financed through additional bank loans - and the issuing of new shares.[89]

Construction began in 1988 and it was opened in 1994, at a construction cost of £4.6 billion, with near bankruptcies caused by construction cost overruns, as well as financing costs, which were 220% higher than forecasted.[90]

Despite extensive exploratory work leading up to the initiation of the project, the Tunnel Boring Machines (TBMs) still ran into unexpected wet and blocky ground. The tunnel design was established for 'dry conditions'. This required major changes to the design of the TBM systems, which added significantly to the cost overruns. In addition to this, water inflow was a major problem during construction - and the prior investigations did not identify the various structural zones along the tunnel route and failed to assess the effect of minor folding on tunnel stability.

Comparing projected construction and finance costs and actual construction and finance costs, we are able to see the degree of cost overruns. The breakdown is as set out in Table 5.

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[88] *Please see: 'http://www.ferryto.co.uk/ports/Folkestone.html'.*

[89] *These figures are all in 1987 prices. Please see: 'https://www.gihub.org/resources/showcase-projects/the-channel-tunnel/#:~:text=The%20project%20was%20financed%20entirely,2%20billion%2C%201994%20prices).'.*

[90] *'Digging beneath the iron triangle: the Chunnel with 2020 hindsight'. Goldsmith, H., and Boeuf, P. (2019). Journal of Mega Infrastructure & Sustainable Development.*

Table 5: Channel Tunnel cost overruns

	Forecasted costs (£m)	Actual costs (£m)	Cost difference (£m)	Cost overrun (%)
2019 prices				
Construction costs (2019 prices)	£2,842	£4,650	£1,808	64%
Financing costs (2019 prices)	£1,708	£5,466	£3,758	220%
Total costs (2019 prices)	£4,550	£10,116	£5,566	122%
2020 prices				
Construction costs (2020 prices)	£2,868	£4,693	£1,825	64%
Financing costs (2020 prices)	£1,724	£5,517	£3,793	220%
Total costs (2020 prices)	£4,592	£10,210	£5,618	122%

Source: Goldsmith & Boeuf (2019).

3.3.2 The London Limehouse Road Tunnel (Limehouse Link)

In May 1993 the Limehouse Link, the longest cut and cover tunnel in Britain, was opened.[91] It links the City of London to the Isle of Dogs; and provides access to the Royal Docks. The 1.8-kilometre-long tunnel cost £293 million to construct which, when compared to the pre-tender estimate in August 1988, was £152 million over budget (cost overrun of 107%).[92] The London Docklands Development Corporation (the Corporation) is of the view that the increased cost of the Link must be seen in the context of the project's special engineering requirements; environmental constraints; and against the background of the national and local economic climate.

In 1989 the construction contract was let to Balfour Beatty Fairclough.[93] At this stage, the project was estimated to cost £228 million (which was £76 million higher than the pre-tender estimate of £142 million). This increase was attributed to the additional cost of a specialist plant; environmental constraints; the need for added reinforcement to the tunnel; and higher than anticipated inflation.

All sections of the Limehouse Link were opened, as originally scheduled, on 17 May 1993. However, the final cost had increased to £293 million.

The cost overruns were due to various factors, including:

- The need for the Corporation to increase the contract price due to a transfer in risk to the contractors.

[91] *Cut and cover is the oldest method of tunneling and involves the digging of a trench, the construction of a tunnel and then returning the surface to its original state.*
[92] *'London Docklands Development Corporation: The Limehouse Link', NAO (1995).*
[93] *'London Docklands Development Corporation: The Limehouse Link', NAO (1995).*

- Unexpected noise restrictions - which contributed to cost increases in the project – the disruption caused by this led to a substantial claim for extra costs, which amounted to £35 million.
- The Corporation offering a bonus, which amounted to £18 million, to avoid a delayed schedule.

The details of the cost overruns are provided in Table 6.

Table 6: Limehouse link cost overruns

	Forecasted costs (£m)	Actual costs (£m)	Cost difference (£m)	Cost overrun (%)
1995 prices	£142	£293	£152	107%
2020 prices	£229	£475	£246	107%

Source: NAO (1995).

Of the above cost overruns of the Limehouse Link, 90% was funded by grant-in-aid, which is supplied by the UK Government and ultimately is sourced from taxpayers. The cost overruns were publicly funded due to the external nature of the risks being outside the contractors' scope of control.

3.3.3 The London Jubilee line extension

The Jubilee Line Extension is the extension of the London Underground Jubilee line from Green Park to Stratford, through the south and east areas of London. In 1989 parliament estimated the project would cost £884 million (1989 prices); by 1990 this had increased to £1.9 billion (1990 prices); and in 1999 the total cost amounted to £3.5 billion (1999 prices).[94] This was attributable to the complexities of building an underground railway through London, as well as changes in the political, financial and regulatory environment.[95]

Construction started in December 1993 and was expected to take 53 months (and open in June 1998). However, tunnelling was delayed after a collapse during the Heathrow Express project in October 1994, which was using the same tunnelling method. The final phase of the Jubilee line was eventually opened in Autumn 1999 – a delay of 20 months.[96] Several factors contributed to delays, including the initial funding difficulties. Construction conditions were also complex, due to the proximity to other lines and the Houses of Parliament. The new state of the art signal system had to be abandoned, as a result of technical problems. Towards the end of construction, labour costs increased, as the economy recovered from the recession. The delay in the project is estimated to have contributed £0.6 billion to the total cost overruns.[97] Table 7 summarises the cost and time overruns of the London Jubilee Line Extension.

[94] *'Jubilee Line Extension from concept to completion'. Mitchel, R. (2003). p344.*
[95] *'Project management of the Jubilee Line Extension'. East, R.W., and Mitchell, R.F. Proceedings of the Institute of Civil Engineers – Civil Engineering (1999).*
[96] *'Jubilee Line Extension from concept to completion'. Mitchel, R. (2003). P322.*
[97] *Please see: 'http://www.omegacentre.bartlett.ucl.ac.uk/wp-content/uploads/2014/12/UK_JLE_SUMMARY.pdf'.*

Table 7: London Jubilee Line Extension cost and time overruns

	Estimated cost (£m)	Actual cost (£m)	Cost difference (£m)	Cost overrun (%)
1999 prices	£1,221	£3,500	£2,279	187%
2020 prices	£1,843	£5,282	£3,439	187%
Estimated duration (months)		**Actual duration (months)**	**Time difference (months)**	**Time overrun (%)**
53		73	20	38%

Source: Mitchel (2003).

The project was financed primarily by a grant from central government (£2 billion was agreed in 1993) as well as London Underground's own funds. The private sector proportion amounted to only approximately 6% as the department had borne the construction risk.[98,99]

3.3.4 UK National Health IT Service

The ultimate objective of the National Programme for IT (NPfIT) was to create a single, centrally-mandated, electronic care record for patients - and to connect 30,000 general practitioners to 300 hospitals. It was the largest public sector IT program ever attempted in the UK; and the original contract was worth £3.8 billion (2012 prices).

After multiple delays, stakeholder opposition and implementation issues, the programme was discontinued in 2011 - almost 10 years after it was initiated in 2002. The Government (and ultimately the taxpayers) incurred enormous costs for the project, which amounted to approximately £10 billion.[100]

The implementation process of NPfIT allowed little time for consultation with key stakeholders; and failed to address confidentiality concerns. This resulted in: (i) an unrealistic timetable; (ii) failure to test systems; and (iii) inadequate preliminary work.[101] In order to try to reduce costs and promote rapid uptake at local levels, the Government was criticised for pursuing a centralised model that was overambitious at the time. This resulted in insufficient attention being paid to of the risks and limitations of big IT projects. Cost overruns were significant, at 151% overall, as illustrated in the table overleaf.

98 *Please see: 'http://www.omegacentre.bartlett.ucl.ac.uk/wp-content/uploads/2014/12/UK_JLE_SUMMARY.pdf'.*

99 *'Potential exposure of the taxpayer'. Please see: 'https://publications.parliament.uk/pa/cm200506/cmselect/cmpubacc/727/72707.htm#note11'.*

100 *'Review of the final benefits statement for programmes previously managed under the National Programme for IT in the NHS'. National Audit Office. (2013)*

101 *Please see: 'https://www.henricodolfing.com/2019/01/case-study-10-billion-it-disaster.html'.*

Table 8: NPfIT cost overruns

	Estimated cost (£m)	Actual cost (£m)	Cost difference (£m)	Cost overrun (%)
2013 prices	£3,899	£9,800	£5,901	151%
2020 prices	£4,307	£10,825	£6,518	151%

Source: House of Commons Committee of Public Accounts (2013).

The Public Accounts Committee (PAC) called the project one of the "*worst and most expensive contracting fiascos*" in public sector history.[102]

3.3.5 Heathrow Airport Terminal 5

Heathrow Airport Terminal 5 opened in 2008; and is the largest free-standing structure in the United Kingdom. The terminal was designed to handle 35 million passengers a year - and in 2018 it was the busiest terminal at Heathrow airport, measured both by passenger numbers and flight movements.[103]

The building cost approximately £4 billion and took almost 20 years from conception to completion.[104] Planning for the terminal began in 1998; and on 20 November 2001, the British Government announced its decision to grant planning permission.

Construction was undertaken by Laing O'Rourke, commencing in September 2002.[105] During its peak, there were around 8,000 people working on the construction site and over the entire lifetime of the project over 60,000 people were involved in the construction.

Between 2000 and 2002, BAA carried out analysis of every major UK construction project in the previous 10 years, and every international airport that has been opened in the previous 15 years. This revealed that no UK construction project of significant size had been delivered on time, on budget and to the pre-determined quality; as well as not a single international airport had operated properly on its opening day.[106]

In response to this, BAA took the decision to hold all the risks associated with the Terminal 5 project, rather than transferring them to external suppliers. BAA financed the project through bonds; intercompany loans; as well as an investment from the European Investment Bank of £250 million.[107,108]

In contrast to the success of the construction of Heathrow Terminal 5, the operation of the terminal upon opening was not as smooth. The issues began when the staff were unable to locate the staff parking, due to unclear road signage, and therefore, many arrived late to work on the first day. There was an additional delay in the security

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[102] *Please see: 'https://www.bbc.com/news/uk-politics-24130684'.*
[103] *Please see: 'https://www.heathrow.com/company/about-heathrow/performance/airport-operations/traffic-statistics'.*
[104] *'Heathrow Terminal Five'. 2020. Please see: 'https://mediacentre.britishairways.com/factsheets/details/86/Factsheets-3/11?category=1&pgck=L2ZhY3RzaGVldHM-'.*
[105] *Please see: 'https://www.building.co.uk/news/terminal-5-must-have-union-official-on-site-says-ucatt/1021293.article'.*
[106] *'Learning to Manage Mega Projects: The case of BAA and Heathrow Terminal 5'. Brady, T., Davies, A., Gann, D.M., and Rush, H. Centre for Research and Innovation Management (2006).*
[107] *Please see: 'https://www.eib.org/en/projects/pipelines/all/20010590'.*
[108] *Please see: 'https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/investor/reports-and-presentations/annual-accounts/finance/BAA-SH-Limited-Annual-Report-31-December-2008.pdf'.*

screening of staff, which left passengers waiting in long queues to check in. The computer systems did not recognise the baggage handlers' IDs; and the handling system failed to log on, which resulted in three flights taking off without luggage; delays in the luggage system for landing flights; and countless pieces of misplaced luggage. These operational issues resulted in 38 flights being cancelled.[109]

Table 9: Heathrow Airport Terminal 5 cost overruns

	Total costs (£m)	Cost overrun (£m)	Cost overrun (%)	Construction delay
2008 prices	£4,300	£0	0%	0 months
2020 prices	£5,523	£0	0%	

Source: British Airways (2020).

3.3.6 Carrier strike

Carrier Strike[110] provides the ability to launch fixed-wing aircraft from a ship to undertake a range of military tasks. The Ministry of Defence (MoD) also bought a new airborne radar system, Crowsnest, to help protect a carrier strike group. Depending on the type of deployment, the carriers will be accompanied by at least one destroyer, an anti-submarine warfare frigate, and ships for support and resupply.

The estimated cost of the carrier project has consistently exceeded the MoD's budgetary provision. It increased from £3.6bn, when the main investment decision was made, to £6.8bn in 2019 (2016 prices).

Table 10: Carrier Strike cost overruns

	Total costs (£m)	Cost overrun (£m)	Cost overrun (£m)	Cost overrun (%)	Construction delay
2016 prices	£3,650	£6,800	£3,150	86%	84 months
2020 prices	£3,944	£7,347	£3,403	86%	

Source: Hutton (2019).

Since Carrier Strike was funded through the overall MoD's budget, it was the taxpayers who financed the extensive cost overruns. The public accounts committee found that in 14 out of 20 cases the MoD handed out contracts wholly or partially to a small group of suppliers without going through competitive tendering processes, even when there was no national security ground for doing so.[111]

[109] *'Operational Management Analysis | British Airways'. UKEssays (November 2018). Available from: 'https://www.ukessays.com/essays/tourism/operational-management-analysis-of-british-airways-tourism-essay.php'.*

[110] *'Carrier Strike: The 2012 reversion decision'. NAO (May 2013).*

[111] *'Improving the performance of major defence equipment contracts'. House of Commons Committee of Public Accounts (October 2021).*

3.3.7 The Thameslink Programme

The Thameslink programme[112] was a complex investment in rail infrastructure and new trains, and a significant change to services, sponsored by the Department for Transport (DfT).

The objectives of the programme were to increase passenger capacity on the Thameslink route, by running higher frequency, more spacious trains on an expanded network. The programme's objectives included achieving net passenger benefits of £1.9 billion (2010 prices) through: reduced crowding; relief of congestion on London Underground; reduced journey times through quicker interchanges; and more frequent services for passengers on major routes in the region.

The programme involved two phases of infrastructure works carried out by Network Rail, at a total cost of £5.5 billion (2017 prices):[113]

- **Phase one** included the redevelopment of Blackfriars and Farringdon stations, and was **completed to time and budget in 2011**. It cost £2.4 billion (2017 prices).
- **Phase two** began in 2013, and included redeveloping London Bridge station and introducing new track and signalling technology in central London. It had a **budget of £2.6 billion** (2017 prices).

In 2015, Network Rail completed a budget re-forecast that revealed the cost of the infrastructure programme to be £5.5 billion, £474 million (2017 prices) higher than originally anticipated. Given phase one was completed to time and budget, it was the budget for phase two that had increased by 19% from £2.6bn to £3.1bn.

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[112] *'Update on the Thameslink programme'. NAO (2017).*

[113] *It further involved leasing a fleet of 115 new trains, with lease costs of £1.7 billion (present value, 2017 prices), and two new maintenance depots to service them, with lease costs of £0.3 billion (present value, 2017 prices); and the combined Thameslink, Southern and Great Northern (TSGN) franchise to maintain passenger services on the Thameslink routes during disruption from the infrastructure works, bring the new trains into service and develop and introduce a new timetable for the extended Thameslink route network.*

Table 11: The Thameslink programme cost overruns

	Estimated cost (£m)	Actual cost (£m)	Cost difference (£m)	Cost overrun (%)
2017 prices				
Phase 1 (2017 prices)	£2,400	£2,400	£0	0%
Phase 2 (2017 prices)	£2,600	£3,100	£500	19%
Total (2017 prices)	**£5,000**	**£5,500**	**£500**	**10%**
2020 prices				
Phase 1 (2020 prices)	£2,525	£2,525	£0	0%
Phase 2 (2020 prices)	£2,736	£3,262	£526	19%
Total (2020 prices)	**£5,261**	**£5,787**	**£526**	**10%**

Source: NAO (2017).

This increase was largely associated with the works at London Bridge station. Whilst developing its detailed design and accessing the site, Network Rail found that conditions at the station were not as expected. This required changes to the design; additional work; and an acceleration of other works, to keep to schedule.

The DfT specifies the outputs of rail infrastructure projects over five-year periods, as part of its High Level Output Specifications. Network Rail then delivers the projects, overseen by the Office of Rail and Road, the economic regulator. For the Thameslink programme, the DfT also decided to put in place a protocol agreement, with payment milestones and financial penalties to incentivise Network Rail to deliver the infrastructure work to time and cost. This approach was intended to better manage the risk of cost increases and enable it to monitor the works more directly over several planning periods.

In February 2016, the DfT approved a budget increase for the programme, authorising Network Rail to spend these monies to complete the infrastructure works. However, the penalty arrangements in the DfT's protocol agreement were still based on the original 2012 budget. Thus, Network Rail had to bear penalties of £59 million, if it delivered to this revised budget.

The main causes of the cost increase included: (i) **design changes**, which led to extra construction work; (ii) **design costs**, given the volume of design changes, which took 18 months longer than planned; (iii) **programme acceleration**, following the design delays, to avoid missing the blockade dates when London Bridge would be closed; (iv) **national traffic management programme cancellation**, resulting in extra payments for developing its own traffic management technology requirements; and (v) **construction inflation**, as there was greater demand in the London construction market, which increased contract prices.

Network Rail failed to fully anticipate the complexity of the London Bridge site, and the pressures this would place on cost. The need to maintain passenger services prevented Network Rail from carrying out intrusive surveys in advance; and complicated the reconstruction of the station.

3.3.8 Great Western Railway Modernisation

The Great Western Route Modernisation[114] involved complex infrastructure works; new trains and service changes; and was sponsored by the DfT. The objective was to provide faster, greener trains, improved services, and more seats for passengers throughout the Great Western rail network.

The NAO found that before 2015, the programme had not been managed in a sufficiently joined up way. Moreover, the schedule for the works was considered unrealistic, given the characteristics of where the works would take place. Thus, cost increases arose, in part, because the assumptions in Network Rail's 2014 cost estimate were unrealistic. Network Rail was too optimistic about the productivity of new technology; and it underestimated how many bridges it would need to rebuild or modify. It also underestimated the time (and therefore costs) needed to obtain planning permission and other consents for some works (for example, those which could affect protected species or listed buildings).

Table 12: Great Western Railway Modernisation cost overruns

	Estimated cost (£m)	Actual cost (£m)	Cost difference (£m)	Cost overrun (%)
2013 prices	£3,480	£5,580	£2,100	60%
2020 prices	£3,844	£6,163	£2,320	60%

Source: NAO (2016).

3.3.9 Astute Class submarine

The Astute Class is the latest class of nuclear-powered fleet submarines in service by the Royal Navy. The Astute class is the replacement for the Trafalgar Class fleet submarines in Royal Navy services. The 8 boats are being manufactured by BAE Systems Submarines, the largest defence contractor in Europe.

Astute Class submarines are required to perform a range of military tasks, in order to provide global reach, endurance, covertness, sustained high speed and the ability to conduct unsupported operations in hostile environments.

The complexities of this project were greatly underestimated; and it became clear that the Astute Class was a far more complicated design than the Trafalgar Class. Problems multiplied, due to a shortage of experienced workers as many skilled individuals had moved on or retired. The problems resulted in the first boat, HMS Astute, only being commissioned into the Royal Navy in 2010 – 5 years later than planned.[115]

[114] *'Modernising the Great Western railway'. NAO (November 2016).*
[115] *'Learning from Experience: Volume III: Lessons from the United Kingdom's Astute Submarine Program'. RAND (2011).*

The project was initially estimated to cost £8.2 billion (2015 prices) and is currently forecasted to exceed £8.9 billion in construction costs upon completion.[116]

Table 13: Astute Class submarine cost overruns

	Estimated cost (£m)	Actual cost (£m)	Cost difference (£m)	Cost overrun (%)
2015 prices	£8,230	£9,650	£1,420	17%
2020 prices	£8,954	£10,499	£1,545	17%

Source: NAO (2015).

[116] *'Major Projects Report 2015 and the Equipment Plan 2015 to 2025', National Audit office (2015).*

4. Understanding differences in large and complex projects

In this chapter we set out an assessment of the characteristics of large and complex projects, to further inform our identification and evaluation of regulatory options. The purpose of this is to better understand in what dimensions they are most different from other (i.e. 'average') projects water companies may undertake. Based on this (and amongst other factors) we find that these projects have substantially higher risks in both the: (i) construction phase; and (ii) procurement / contracting phase. This is due, in part, to the investment value. As a result, uncertainty over the costs and delivery time scales is high, which further increases the risk of cost and time overruns. In addition, these types of risks are less controllable compared to a portfolio of 'average' projects.

4.1 Overview of key findings

Our key findings, based on the evidence set out subsequently, are as follows:

- **Construction risk is substantially higher for large and complex projects, compared to the 'average' portfolio of projects.** This is for several reasons. Firstly, the nature of the projects means that construction may take place in environments / locations that inherently give rise to increased uncertainty. The nature of construction methods; their effectiveness; and associated costs, are harder to predict. Secondly, large and complex projects can often use non-standard technologies, which companies are less familiar with (or can be entirely new to the industry). Thirdly, a large number of stakeholders can be involved in the construction phase of such projects, which further increases complexity in management. Finally, the fact that construction can last over multiple AMP periods increases the regulatory and planning aspects of construction related risk. This is because the project is more likely to become subject to unforeseen changes in the regulatory framework, or to unforeseen changes in wider economic factors (i.e. input prices, labour market conditions, etc).
- **Procurement risk is high for large and complex projects.** This is because: (i) these projects involve many contracting parties; (ii) it is difficult to identify and assign risk to relevant parties; and thus (iii) standard contract structures often cannot be used.
- **The scope for impacting Thames's overall costs and benefits is substantially higher.** The sample of large and complex projects analysed have an NPV value of capex of at least £0.4bn (in 2017-18 prices), while most Thames projects incur totex of around £20m - £30m, on average. This implies that the cost impact of any failures in the design, planning and construction process of these projects is significant. This large size may also be consistent with them having large societal

/ environmental benefits and costs (including those that continue beyond the successful completion of said projects).

- **They will be associated with significant externalities.** For example, in many cases, their underlying aims will include mitigating water scarcity (the impact of climate change); or improving the natural environment. Related to this, they will be considered 'highly important', if not 'necessary', both in order to meet collective objectives within the water industry (including Ofwat's, as previously explained), but also to address wider societal / environmental concerns.
- **The extent to which risk is controllable is relatively low in large and complex projects.** This is because the type of risks in large and complex projects are not well understood, due to a combination of factors: using non-standard technology; using new contracting mechanisms; the number of stakeholders involved; the long time span from design to operation; and high exposure to external factors (i.e. receiving DCO approval for the project, or approval for acquiring land). More fundamentally, however, when talking about 'unique' projects, often taking place in the context of environmental settings in which no similar assets have been constructed, there are clearly many uncertainties that cannot be well understood (or influenced) by any relevant party. As a result, the extent to which these risks can be mitigated in advance is limited. However, there are some mitigation mechanisms, such as for example gated approaches, in advance of a specific project stage.

In our subsequent analysis, we focus on four projects that are being progressed through the existing regulatory framework, to further inform our understanding of large and complex projects (and also inform our assessment of how they differ from the 'average' project). Our analysis is limited to these projects, given we face an 'unknown counterfactual' problem (i.e. we cannot observe large and complex projects that might have gone forward, had the regulatory framework been different).

These four projects include two that are being progressed through the RAPID gated process; and two projects that are still in the planning stage. Below, we set out why these are relevant proxies for large and complex projects for which there is a case for a differential approach; namely:

- The two projects being progressed through the RAPID gated process are Strategic Resource Option (SRO) projects. We consider that these are good examples for large and complex projects that warrant a differential approach, as Ofwat introduced the RAPID gated process at PR19 in recognition that they are sufficiently large and complex projects, that they would not have been taken forward otherwise (i.e. under the 'standard' price control settlement).
- The two projects that are still in the planning stage are both high value and involve innovative technologies and operational approaches, as well as spanning multiple AMPs. Thus, they have some characteristics similar to the SRO ones currently being progressed through the RAPID gated process.

In the following sections we provide more detail on what the projects entail, as well as how we assessed the differences between large and complex projects compared to the 'average project.

4.2 Project assessment

As outlined in the previous chapters, if a project is substantially different from the *average* undertaken at the company level, a differential approach to regulating it may be warranted. As also noted previously, the size of the project is also relevant, as the benefits of a differential approach are more likely to exceed the costs for larger projects.

The above raises the issue of exactly *how* said projects are different – and the extent of that difference. Hence, the purpose of this chapter is to inform these matters, by way of a review of some large and complex projects. To facilitate this, Thames provided us with data and information on four projects it considered relevant, some of which are being undertaken within the current framework.[117] The four projects are as follows:

- **Kennet and Pang system headroom**. The total project cost is estimated at an NPV of £500m (in 2017-18 prices). This project is intended to improve the resilience of the wastewater system to extreme weather conditions. This is done by reducing ground water infiltration; addressing customer misconnections; and preventing water from entering the sewage upfront. Currently, there are no clearly defined timelines for this project.
- **South East Strategic Reservoir Option (SESRO).[118]** Together with Affinity Water, Thames is building a new reservoir near Abingdon, in Oxfordshire.[119] The reservoir will store water for use during drier periods, to the benefit of customers in London and the wider South East. The scheme is run under the RAPID process, whereby the project stages need to meet certain criteria in order to progress to the next stage – as set out by Ofwat. The project has passed the first gate and has now moved on to the second gate.[120] The planning and design phase is expected to be concluded by 2028, with construction starting in 2028. The earliest available estimate for starting operations is April 2036. However, the most likely estimate is that operations will start in 2038. The preferred option of a 150Mm^3 reservoir has an NPV of around £1.4bn (in 2017-18 prices) in totex. This is approximately split as: £1.3bn in capex; and £0.1bn in opex.[121]
- **London effluent reuse Strategic Resource Option (SRO) – Beckton effluent reuse.** This project comprises four potential schemes to recycle effluent; and then discharge to the River Thames, or the River Lee Diversion.[122] The four schemes are the: Beckton effluent reuse; Mogden effluent reuse; Mogden South sewer; and the Teddington direct river abstraction. Here, we focus on the Beckton scheme. It includes construction of an advanced water recycling plant; and a conveyance tunnel. The project assumes a 7- to 8-year planning-design, development and construction phase. The planning and design phase is expected to start in 2024 to 2025. Construction is expected to start in 2027; and is expected to be completed by July 2032 at the latest (and at the earliest, in 2031). The Beckton scheme's

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[117] *It should be noted that some of these projects are currently being taken forward, two of them in the RAPID gated approach. As we discuss subsequently, given the nature of large and complex projects that warrant a different treatment is such that they are not currently being undertaken, these examples provide the closest reference points to the 'type' of project that would likely constitute part of this differential treatment.*

[118] *This is an SRO project.*

[119] *'Strategic regional water resource solutions: Preliminary feasibility assessment - Gate one submission for South East Strategic Reservoir Option (SESRO).', Thames Water (2021).*

[120] *'Strategic regional water resource solutions: Standard gate one final decision for Thames Water'. Ofwat (8 December 2021).*

[121] *'Strategic regional water resource solutions: Preliminary feasibility assessment - Gate one submission for South East Strategic Reservoir Option (SESRO).', Thames Water (2021), Table 11, page 29.*

[122] *'Strategic regional water resource solutions: Preliminary feasibility assessment - Gate One Submission for: London Effluent Reuse SRO', Thames Water (2021).*

largest option of effluent reuse of 300 Ml/d (and a 100% utilisation for 12 months of the year) has an NPV of around £2.4bn in totex (in 2017-18 prices).[123] £1.5bn of which is capex; and £0.9bn is opex. The smallest option of effluent reuse of 50 Ml/d (and a 20% utilisation for 12 months) has an NPV of around £0.5bn in totex (in 2017-18 prices).[124]

- **Mitigating landbank recycling – advanced thermal disposal of biosolids**. This project will look into options of thermal disposal of biosolids, to better protect the environment. The design and planning phase is expected to start in AMP8 (2025-26) and construction is expected to start in AMP9 (2030-31). Phased operation is planned towards the end of AMP9. The project capex is estimated at an NPV of around £360m (in 2017-18 prices) over 18 years.

We note that these four projects are, of course, currently being progressed through the existing regulatory framework. However, this does not mean that an alternative model, if applied to these projects, would not deliver superior outcomes for both companies and customers. These four 'actual' projects have been used to help get a sense of the characteristics of large and complex projects, because we face an 'unknown counterfactual' problem (i.e. we cannot observe large and complex projects that might have gone forward, had the regulatory framework been different). For example, the following box illustrates several projects that have not been taken forward, for various reasons, including the suitability of the regulatory framework. These examples are more high-level, and we are not able to undertake a detailed financial assessment of these projects, as they never became more developed.

Box 1: Projects not being taken forward in the current regulatory framework

The following projects have not been taken forward, in part due to the current regulatory framework. Generally, they all demonstrate the difficulty of setting out in advance the costs to a sufficient level of certainty; as well as identifying the customers benefits, so that a reasonable enhancement case can be made. In particular, the current regulatory framework may not take a sufficiently long-term perspective - required to advance with some of these projects. For example, Ofwat's cost models take a '40 years' view, which for some projects will not cover the whole life – and thus, not all of the project's benefits will be able to be accounted for.

- **Moving Kempton from a slow sand filter (SSF) works to a chemical works**. Thames faces an issue where demand and climate change will see greater / quicker swings in demand, which is currently a challenge through having *biological* works in London. Therefore, it needs to move to a *chemical* process at a site like Kempton. This site is the fourth largest water treatment works in the UK and requires significant investment, given its age. However, making the case for this investment is hard, as it is difficult to illustrate the customer benefit / risk mitigation for what would be an expensive programme of works ca. £200-£300m. Specifically, the challenge lies in linking this investment to outcomes, as it is driven by growth and the ensuing short-term swings in use at the site.
- **Ring main extension**. The current ring main is constrained in flow, with Thames's raw water capacity being in West London and growth in London moving to the East. Therefore, there is a need for enhancing and extending this asset to enable growth in the East of London. Again, one of the key drivers for the need for this investment is the growth and the fact that around three quarters of water capacity are in the West and the existing pipes need to be expanded to deliver this to the East. However, the issue being that 'growth' gets funded out of botex. As above, making the case for this investment is hard, as it is difficult to illustrate the customer benefit / risk mitigation for what would be an expensive programme of works ca. £500m.
- **Relining all pipework whilst incorporating fibre into the asset base**. Thames cannot meet affordability criteria for customers whilst replacing its trunk main and distribution assets in line with the corporation ambition with current construction approaches. Therefore, it

[123] *'Strategic regional water resource solutions: Preliminary feasibility assessment - Gate One Submission for: London Effluent Reuse SRO', Thames Water (2021), page 30, Table 10-2.*

[124] *'Strategic regional water resource solutions: Preliminary feasibility assessment - Gate One Submission for: London Effluent Reuse SRO', Thames Water (2021), page 31, Table 10-3.*

needs to find a new innovation to enable a more cost-effective solution, in which fibre optics could be a commercial opportunity to enable this cost to be lower. This project links to the mains replacement works set out subsequently and provides an opportunity to develop more innovative solutions.

- **Internal metering.** By 2035, Thames's strategy is to meter all customer connections. However, it needs to meter every customer to enable 110l/p/d for PCC, and the cost for internal metering with today's technology is a challenge. This is because it is extremely costly to access every property to install a meter. Therefore, Thames needs to find a way of metering customers in their property that meets affordability constraints.
- **Mains replacement**. This links to the issues around relining all pipework, whilst incorporating fibre into the asset base. Here, one of the key issues is about meeting short-term cost pressures from the 5-yearly benchmarking against least whole life costs, i.e it is cheaper to use 'find & fix' and so allows a company to stay within the botex allowance, but ultimately this approach is higher cost in the long run.
- **Environmental destination and WINEP.** WINEP needs are decreasing the resilience for customers, as Thames moves to less feeds / works supporting a system. Therefore, it needs to apply firmer design criteria at preventing this, which will undoubtedly increase cost. For example, Bexley WINEP scheme is ca. £32m but to maintain resilience it's really ca. £80m. There are issues around resilience and in particular that in some instances there is a decrease in resilience to reduce obstruction to the environment – and thus balancing competing demands and long-term views.
- **SRO.** The 5 SROs are huge programmes, with large costs. This raises questions around how supply chains to deliver these works are secured, when the South East's labour market is constrained. The capability of delivery is seen as a cross-cutting issue for all large projects.
- **Sludge programme around alternative thermal disposal outlets** will be innovative and complex and a significant change in direction for the business with difficult to estimate costs.

Source: Economic Insight discussions with the Thames Water Team.

For each of the four projects we have information for, key dimensions we examined within the scope of our review include:

- **Size of investment.** A relatively large investment value indicates that the overall project portfolio is less diversified; and thus increases the overall portfolio risk. This is because a relatively large size of capital will be tied up in one project, compared to using the same size of capital for several smaller investments, with different risk profiles.
- **The extent of externalities**. Projects that include more scope for externalities compared to the 'average' project might warrant a differential approach. This is because the current model is unable to account for substantial positive and negative externalities (which is an increasingly critical issue in the context of climate change; environmental outcomes; and intergenerational fairness).
- **The time horizon of the planning, design and construction phase**. The longer the planning, design and construction phase of a project, the higher the risk that the project is subject to unforeseen circumstances.
- **The extent of construction and operational risk.**
    - The extent of **construction risk** is largely influenced by the complexity of such projects. That is, the higher the complexity, the more likely are cost and time overruns.[125] Factors that increase complexity are, for example:

[125] *'Project Complexity and Risk Management (ProCRiM): Towards Modelling Project Complexity driven Risk Paths in Construction Projects', Qazi, Quigley, Disckson and Kirytopoulos, International Journal of Project Management (2016).*

a. the use of **non-standard technology**, which includes risks associated with the complexity of the design; and the extent to which new and innovative technologies are used;

b. the **number of stakeholders and contractors** involved, which can lead to an increase in complexity in the contracting / procurement of the projects, where, as more entities are involved, and the more complex the contract structure, the higher the risk.;

c. **environmental factors**, which include risks in relation to the physical environment of the project site and unforeseen changes to the environmental conditions. Here, a wide range of factors give rise to uncertainty and risk, whether that is: (i) the nature of the physical environment being different from expected; (ii) issues around preserving natural habitat; (iii) topographical characteristics of the site; and (iv) archaeological discoveries. All of these can clearly give rise to delivery and / or cost related risks; or

d. the presence of **strict quality requirements**,.

The extent to which these risks are expected to materialise (and the scale of costs involved) can influence the extent of cost overruns.

- **Operational risk** can arise due to **failures in internal processes** (i.e. failures in the design of the process); systems (i.e. inadequate testing prior to production) due **to human error**; and due to **external factors** (i.e. changes in the regulatory or natural environment).[126] For example, a desalination plant has a relatively higher operational risk than a reservoir. This is because the operation of a desalination plant is dependent on relatively more human processes and external factors (i.e. availability of enough energy) compared to a reservoir, hence increasing the inherent risks.

INVESTORS WE SPOKE TO TENDED TO AGREE THAT PROJECTS WITH THE FOLLOWING CHARACTERISTICS MIGHT WARRANT A DIFFERENTIAL REGULATORY APPROACH: (i) OF SIGNIFICANT SIZE; (ii) ABILITY TO DISTRUPT THE EXISTING NETWORK; (iii) COMPLETELY NEW ASSETS / GREENFIELD PROJECTS; (iv) WITH HIGH CONSTRUCTION RISKS; (v) WITH HIGH OPERATIONAL RISKS; (vi) WITH HIGH COST VARIABILITY; AND (vii) SPANNING MULTIPLE AMPS.

- **The extent of other risk types.** There are various other types of risk that need to be acknowledged when undertaking large and complex projects.[127] These include wider risks, such as **political, economic and regulatory risks**. For example:
  - Economic risks may increase the longer the project's planning and development stage is, as input costs; demand; etc, all have more scope to change. Hence, there is greater scope for costs to vary, relative to *ex-ante* expectations.
  - Regulatory risk may increase to the extent that more innovative approaches are used – as said approaches will be less well known to the regulator / relevant legislative bodies (e.g. approvals may be needed for new technologies – say, if associated with drinking water standards).
  -
- **The extent to which risk is controllable.** The controllability of risk by various parties is pertinent to determining the case for a differential approach, as it informs the appropriate alignment of incentives.

126 *'Principles of Operational Risk Management and Measurement.', CRO Forum (2014), page 4-5.*
127 *'Cost Consistency Methodology: Technical Note and Methodology.', Matt Macdonald (2021).*

4.3 Overview of our assessment

Table 14 shows the characteristics of Thames's four large and complex projects we reviewed. In summary, their key features are as follows:

- **NPV of investment (in 2017-18 prices).** This helps us gauge the size of the investment and therefore whether it is – in principle – 'large'. We also consider the NPV relative to RCV (i.e. as a % of RCV) as this gives a sense of *relative scale* (i.e. proportionate to a company's existing size – namely, what is 'large' for one company, may not be for another).
- **Extent of externalities.** Here, we set out the extent to which the project is likely to address any negative externalities / provide positive externalities. We do this by applying a rating scale of *'Low'* to *'High',* where:
    - '*Low'* indicates that the extent of positive or negative externalities is limited (i.e. we consider the impact of the project on costs and benefits beyond the 'private' cost or benefit of providing water to the company's own customers to be very limited).
    - '*Medium'* indicates that the project may affect costs and benefits beyond the narrow provision of water / wastewater services; and beyond the company's own customers. Wider impacts of this kind often arise in relation to resilience and environmental protection projects. A '*medium'* impact nonetheless indicates that there are some limits to these wider (*spillover*) impacts - and that they are not a predominant feature of the project.
    - '*High'* indicates the project is expected to result in significant externalities, affecting wider costs and benefits well beyond the private provision of water / wastewater - and affecting stakeholders beyond the company's own customers. For example, constructing a shared reservoir by definition affects water supply for customers of both participating water companies. In addition, such a project would also impact other sectors (such as the residential / commercial construction sector, by reducing the land available for developments). In this example, positive environmental externalities may arise, say through: (i) creating a social amenity value to people living close to the reservoir; and (ii) mitigating the impacts of climate change in the long-run. A '*high'* impact for externalities means we consider their presence to be an important feature of the overall cost-benefit case for the project.
- **Time horizon (design to end of construction).** This provides the time horizon in years from design to end of construction.
- **Extent of construction and operational risk.** Here, we also apply a rating scale from '*Low'* to '*High'*, where:
    - '*Low'* indicates that construction / operational risk is limited. This is the case if no / minor construction requirements are needed. Alternatively, the construction requirements are well understood by Thames. Operational risk is low if system and human processes are familiar.
    - '*Medium'* indicates that there is a mix of factors that could increase construction / operational risk (relative to the average). This is the case, for example, if standard technology is used, whilst at the same time there are third-party assets, or a large number of stakeholders involved.

- '*High'* indicates that there are multiple factors that indicate increased construction / operational risk, such as many stakeholders, or a highly uncertain / unique environment in which the construction / operation will take place – and so on.

- **Extent to which risk is controllable**. Finally, given all of the above types of risk, as well as their extent, we ultimately assess the extent to which overall project risk is controllable. We do this on a rating scale from '*Low'* to '*High'* where:
  - '*Low'* indicates that there is a limited extent to which any of the above risks can be mitigated. This is often the case, for example, if environmental risk is high or the project site is not owned by Thames. This is because project approval is dependent on multiple parties.
  - '*Medium'* indicates that some of the identified risks can be mitigated, while others cannot be mitigated.
  - '*High'* indicates the identified risks can be mitigated to a large extent if, for example, the risks are limited or the risks are familiar from previous project experience.

Table 14: Evaluation of Thames' projects

Project name	NPV of investment (in 2017-18 prices)	Extent of externalities	Time horizon (design to end of construction)	Extent of construction and operational risk	Factors resulting in risks	Extent of risk	Other risks (political and other external influences)	Extent to which risk is controllable
Kennet and Pang system headroom	Capex: £0.5bn Capex as % of total RCV: 3%	**Medium** as a result of: Environmental and system resilience benefits (i.e. reduction of hydraulic floods; reduction in spills; and reduction of pollution)	Not defined yet	Construction risk: expected **medium** as a result of involvement of multiple stakeholders, however, using standard technology Operation risk: expected **low** if technology well tested and human processes limited	Contracting / Procurement complexity	**High** as third-party assets and multiple contracting parties involved	**Low** if the design, planning and construction phase is short (i.e. less than 5 years) and since technology is standard	Expected **medium** as a result of: Site currently used by Thames and known; but Approval needed from multiple stakeholders
					Technology	**Low** as a result of using standard technology		
					Environment	**Medium** as site information seems well understood (currently used by Thames), however, some environmental impacts are likely		
South East Strategic Reservoir	Totex: £1.4bn Capex: £1.3bn Opex: £0.1bn	**High** as a result of: Over 10% increase in biodiversity units	15-16 years	Construction risk: **High** as a result of non-standard technology used, multiple stakeholders involved (10 groups)	Contracting / Procurement complexity	**High** as non-standard contract structures are used (i.e. DPC delivery) and contractors potentially inexperienced in this type of project	**High** as the design, planning and construction phase is relatively long and the regulator is not familiar	**Low** as a result of: Site not owned by Thames and thus not as well known

Project name	NPV of investment (in 2017-18 prices)	Extent of externalities	Time horizon (design to end of construction)	Extent of construction and operational risk	Factors resulting in risks	Extent of risk	Other risks (political and other external influences)	Extent to which risk is controllable
	Capex as % of total RCV: 14%	High social amenity value Slight increase in drinking water quality Shared resource with Affinity Water Some adverse impacts (i.e loss of habitat, loss of commercial properties etc.) High carbon footprint		and long construction phase (~10 years) Operational risk: **Low** as a result of limited human processes	Technology	**High** as non-standard technology and complex design is involved (i.e. embankment works)	with the technology	Need for DCO approval including permission to acquire land
					Environment	**High** as likely discovery of archaeological sites, presence of unknown topographical features of site and need for mitigation to loss of habitat		
London effluent reuse SRO - Beckton	Totex: £0.5bn - £2.4bn Capex: £0.46bn - £1.5bn Opex: £0.04bn - £0.9bn Capex as % of water total RCV: 2%	**High** as a result of: Resilience to climate change More sustainable water resource management Improve drinking water quality Adverse effects (i.e. changes to freshwater fish structure and other wildlife;	8 years	Construction risk: **High** as a result of non-standard technology used, multiple stakeholders involved (11 groups), potential change in plan (i.e. re-routing of conveyance options) and long construction phase (~4-5 years) Operational risk: **High** as a result of dependency on external factors (i.e. high energy needs)	Contracting / Procurement complexity	**High** as non-standard contract structures are used (i.e. DPC or JV delivery) and contractors potentially inexperienced in this type of project	**Medium** as the design, planning and construction phase is less than 10 years, however, the regulator is not familiar with the technology	**Low** as a result of: Site not owned by Thames and thus not as well known Need for DCO approval including potential permission to acquire land
					Technology	**High** as non-standard technology and complex design is involved (sewage recycling plant and conveyance tunnel)		

Project name	NPV of investment (in 2017-18 prices)	Extent of externalities	Time horizon (design to end of construction)	Extent of construction and operational risk	Factors resulting in risks	Extent of risk	Other risks (political and other external influences)	Extent to which risk is controllable
		energy intensive project)		and high maintenance requirements of technology	Environment	**High** as need for mitigation of loss of habitat and likely presence of unknown topographical features of site		
Mitigating landbank recycling - advanced thermal disposal of biosolids	Capex: £0.4bn Capex as % of total RCV: 2%	**Medium** as a result of: Potential carbon benefits Adverse effects (i.e. potential loss of habitat)	20 years	Construction risk: **High** as a result of non-standard technology used, multiple stakeholders involved, potential changes in schedule (i.e. uncertainty over delivery timeframe) and long construction phase (at max. ~10 years) Operational risk: **Medium** as a result of high maintenance (i.e. monitoring and controlling of emissions), however, low dependencies on external factors	Contracting / Procurement complexity	**High** as non-standard contract structures are used (i.e. DPC or JV delivery) and contractors potentially inexperienced in this type of project	**High** as the design, planning and construction phase is relatively long and the regulator is not familiar with the technology	**Low** as a result of: Site not owned by Thames and thus not as well known Need for planning permission
					Technology	**High** as non-standard technology and complex design is involved (incinerators)		
					Environment	**High** as need for mitigation to loss of habitat and likely presence of unknown topographical features of site		

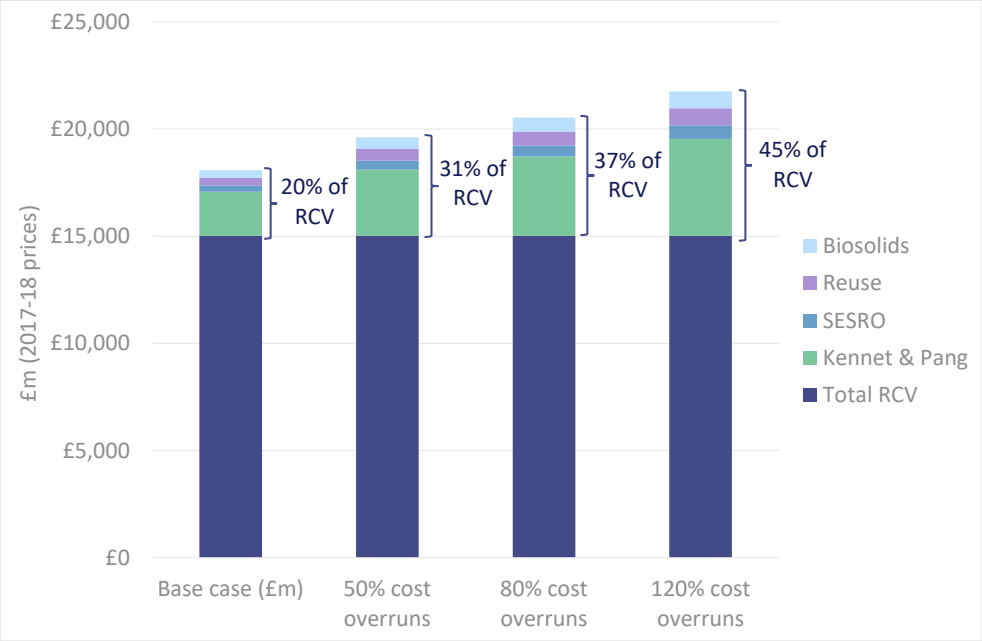
Source: Economic Insight review.

In summary, the above large and complex projects have the following characteristics in common:

- There are **large cost variations** across the projects compared to the 'average' project at Thames. For example, the NPV value of capex varies from £0.4bn to around £1.4bn (in 2017-18 prices). Moreover, the relative size of the projects compared to total RCV ranges from 2% to 14% (with much larger proportions when considering the RCV of the relevant price control areas, i.e. water resources and bioresources RCV).
- Projects are likely to **span multiple AMP periods**.
- **Construction risk is high** for most projects. This is because, being unique in nature and often in environmental setting – there is inherently considerable uncertainty as to 'how' construction will develop. Relatedly, sometimes non-standard technology is used that neither Thames, nor the water sector more broadly, have utilised before. In addition, construction risk is high as it is necessary to manage multiple stakeholders.
    - Moreover, as these projects often cannot be procured through the 'standard' route, **procurement / contracting risk is high**. Instead, new mechanisms need to be put in place to identify suitable contractors, or new procuring methods altogether are used (e.g. DPC).
- **External risks are high**. Due to the long lead times of these projects, external risks are also high (i.e. political; regulatory; and / or economic factors may be subject to more uncertainty).

These characteristics mean that there is a higher likelihood of cost overruns – due to the increased riskiness of these projects. To put this into perspective – and in line with general large infrastructure project overruns (as set out in chapter 3) – we find that were all four projects to complete according to the projections, their total value would make up 20% of the RCV. This increases to 31% of the total RCV were they to overrun by 50%, and 37% if they were to overrun by 80% (which, on average, most large and complex projects do – as per our review in chapter 3). In an extreme case, should risks be so large that cost overruns across the four projects were to be 120%, then they would make up almost half of the RCV, at 45%. Thus, the higher the risk of the projects, the higher the risk of cost overruns and the larger impact on Thames's RCV (with potentially ensuing impacts on financeability and financial resilience). This is illustrated in Figure 7 overleaf.

Figure 7: Cost overrun impact compared to total RCV, 2017-18 prices



Source: Economic Insight analysis of Ofwat and Thames data.

4.4 How these projects compare to the average

In addition to understanding the key characteristics of large and complex projects, we also want to understand how different they are from the 'average' projects undertaken by water companies. There is no single, straightforward, way to do this, as several dimensions can only be measured qualitatively.

Nonetheless, we have used publicly available sources, such as Thames's business plans and PR19 final determination documents – and held extensive conversations with project managers of various projects at Thames – to understand the differences between large and complex projects; and the 'average' projects across the various dimensions outlined in section 4.1.

Table 15 provides our assessment of the characteristics of the 'average' project in a water company's portfolio.

Table 15: Characteristics of the 'average' portfolio projects

'Average' portfolio project examples	NPV of investment (in 2017-18 prices)	Extent of externalities	Time horizon (design to end of construction)	Extent of construction and operational risk	Factors resulting in risk	Extent of risk	Other risks (political and other external influences)	Extent to which risk is controllable
Capital maintenance projects Enhancement projects (i.e. North East London Resilience) Operational improvements (i.e. installing smart meters)	£20m - £30m	**Low** to **Medium** as a result of: Most projects do not include benefits / costs to non-Thames customers. Some projects result in more benefits / costs to non-Thames customers and other sectors (i.e. preserving river water quality also benefits other sectors such as agriculture close to the river).	Up to 2 – 3 years (all within one AMP)	Construction risk: **Low** overall, as construction of greenfield / new assets is limited; the stakeholders involved are known; and / or the number is limited; and standard technology is used Operational risk: **Low**, as often technology is well tested; and system and human processes are well defined	Contracting / Procurement complexity	**Low** as procurement route follows standard processes and contracting parties' experience is well understood	**Low** as often, project lead times are relatively short (i.e. less than 5 years) and technology is well understood by the regulator	**High** as a result of: Extent of risk is known and can be mitigated Site under Thames's ownership Planning approval not needed or easily obtained
					Technology	**Low** as standard technology is most often involved and the design is standard		
					Environment	**Low** as limited construction needed which limits extent of unknown topographical/ archaeological factors		

Source: Economic Insight review.

5. The options for a differential approach

In this chapter, we identify the key options available for the regulation of large and complex projects in the water sector. In doing so, we have taken a pragmatic approach, focusing on what 'could' be done in practice, given the key issues identified elsewhere in this report. We find that either 'regulation' or 'competition' models could be effective; and that there are inherent limits on the ability of regulators to design effective incentives in the face of considerable uncertainty. For one of our preferred options, we suggest what we term an 'enhanced' version of Ofcom's 'fair bet' framework (which should act to mitigate both the risk of windfall gains, and overexposure to downside risks – thus balancing the needs of billpayers, investors, and wider society).

5.1 The existing regulatory framework

Before setting out our proposed options for a differential regulatory approach, it is helpful to briefly recap the *current* regulatory framework (and how this relates to large and complex projects). In turn, we address:

(i) how funding is provided through Ofwat's price controls and within that;

  a. the role of Direct Procurement for Customers (DPC);

(ii) the use of asset-specific price controls;

(iii) Specified Infrastructure Projects Regulations (SIPR); and

(iv) additional mechanisms to provide allowances, including:

  a. gated processes;

  b. the Innovation Fund; and

  c. Green Recovery allowances.

We also briefly set out why this current approach is not sufficient to foster the investment needed for these large and complex projects.

5.1.1 Price controls

Currently, Ofwat applies a five-yearly price control to incumbent water companies (licence holders / appointees). Within its price determinations, Ofwat provides said companies with revenue allowances for enhancement expenditure. Therefore, where large and complex projects are already well-defined at the price review process stage, incumbents can obtain revenue allowances through that route. In addition, *within* its method for PR19, Ofwat introduced different mechanisms to both procure projects

(by way of DPC), and ensure they are delivered efficiently (by way of gated approaches), as we explain below.

5.1.1.1 Direct Procurement for Customers (DPC)

DPC involves a company putting certain large infrastructure projects out for competitive tender. Where this occurs, it results in the selection of a third-party competitively appointed provider (CAP). The current approach allows companies to determine what tendering model is used in each instance (by which Ofwat refers to the activities included within the scope of the tender). However, in principle, it could include any of (or, indeed, all of): design; build; finance; operate; and maintain.[128]

Ofwat sets three criteria for projects to qualify for DPC delivery:

- **Size**. To be eligible for DPC delivery, projects need to meet a threshold of £100m whole-life totex.
- **Discreteness**. Projects need to be of a suitable level of technical discreteness to allow them to be delivered, owned and operated by a CAP.
- **Value for money**. Delivery via DPC must offer better value for money to customers, when compared to delivery by the appointee.

5.1.2 Separate price controls

Within the existing framework, Ofwat can make use (and has made use) of separate price controls as a means of supporting the delivery of larger, more complex projects. For example, at PR19, Ofwat decided to apply a separate price control for Portsmouth Water's Havant Thicket reservoir project.[129] This approach does not require a new licence / project licence. Instead, changes can be accommodated within existing licences / conditions of appointment (which was the approach used in the Havant Thicket case). This allows Ofwat to separately determine the relevant timescales; cost and risk sharing; and incentives for the asset in question.

5.1.3 Specified Infrastructure Projects Regulations (SIPR)

Also within the existing regulatory and legal framework, English water companies can put out competitive tenders to finance the delivery of *"[…] projects or works that in the Minister's opinion are of size or complexity that threatens the undertaker's ability to provide services for its customers"*.[130] Under these regulations, also known as 'SIPR', large infrastructure projects can be delivered by independent providers that are either: (i) regulated by Ofwat under a Project Licence; or (ii) appointed by the incumbent, following a competitive procurement. One example where this framework has been applied is the Thames Tideway Tunnel (TTT). For TTT, Thames conducted the tender process and selected Bazalgette Tunnel Ltd (Bazalgette) as the winning bidder. Ofwat then designated Bazalgette as an Infrastructure Provider (IP), and subsequently issued it with a Project Licence. Then, Ofwat made two price control determinations, based on two distinct phases of the project:

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128 *'Delivering Water 2020: Our methodology for the 2019 price review Appendix 9: Direct procurement for customers'. Ofwat (December 2017).*
129 *'PR19 final determinations: Havant Thicket appendix'. Ofwat (December 2019).*
130 *Section 36A(4) WIA91.*

- The **construction phase** (up until end March of the First Periodic Review). Ofwat was required to make the following determinations:
  - the **weighted average cost of capital** (WACC) of the IP undertaking the TTT Project;
  - the **level of any Additional Allowable Project Spend**, i.e. allowable spend above a 'threshold' level (named Threshold Outturn); and
  - the **incentive mechanism** that will apply to either expenditure incurred in excess of the threshold, or as a result of delays beyond the planned systems acceptance date.
- The **operational phase** (from April following the First Periodic Review). Ofwat was required to determine the ongoing WACC for the IP.

5.1.4 Additional mechanisms to provide allowances over and above PR19 settlement

Ofwat has further implemented various separate allowances over and above companies' five-yearly PR19 packages, by way of funds from gated approaches; an Innovation Fund; and Green Recovery allowances to fund innovative projects. Below, we set out what they are.

5.1.4.1 Gated approaches

Where large and complex projects are not sufficiently well developed (or just too uncertain) at the price review stage, Ofwat can overlay a 'gated process' (e.g. Thames's conditional allowances; and the RAPID gated process for collaborative projects between incumbents in relation to water resources). That is, within a price control period, revenue for a project will be provided once certain project stages have been achieved, with the aim of having these projects 'construction ready' for the next price control.

5.1.4.2 Innovation Fund

Ofwat set up a £200m Innovation Fund to encourage innovation to transform water and wastewater services.[131] Through various competitions, Ofwat provides between £100,000 to up to £10m for individual entries.[132] The competitions are in five key areas, identified by Ofwat as the big challenges for the sector, requiring additional innovation.

5.1.4.3 Green recovery allowances

Ofwat allowed £793m green investment for five companies' new and innovative schemes, on top of their existing five-year PR19 packages. In July 2021, Ofwat published its final decision on the green economic recovery, which stemmed from the desire to "*build back greener from the pandemic: delivering lasting environmental*

[131] *See: https://www.ofwat.gov.uk/regulated-companies/innovation-in-the-water-sector/water-innovation-competitions/*
[132] *See: https://waterinnovation.challenges.org/*

improvements for current and future generations, while meeting the economic and social challenges England faces."[133]

These schemes ranged from accelerating environmental improvements through creating bathing rivers, to smart metering programmes. In terms of the values of these schemes, the smallest was worth £5m and the largest one was worth £168m. For Thames, Ofwat made an allowance of up to £71.917 million to allow the company to bring forward its smart metering programme to deliver a maximum of 204,700 additional smart meters to benefit customers and the environment by reducing leakage and customer demand.

5.1.5 Issues with the current approach(es)

By definition, the 'standard' price control is a 'one-size-fits-all' approach and is calibrated around the existing risk-reward balance. Thus, the main problem, in the context of large and complex projects needed to deliver a further 'step change', is that their investment profile is likely different from the profile of investments made historically in the industry, by:

(i) being more innovative;
(ii) spanning multiple price controls;
(iii) requiring significant capital investment;
(iv) being higher risk – and where the nature and extent of that risk might be an order of magnitude different from the average;
(v) having a lower controllability of risk (and where the identification of controllability is challenging);
(vi) (in some cases) potentially carrying a failure risk sufficiently high that private investment alone would not support them; and
(vii) being associated with significant externalities that impact wider society, not just bill payers.

Put simply, the extent to which these projects may differ to those funded through the 'standard' price control approach historically is such that it calls into question 'whether' they would occur.

As summarised above, we recognise that the existing regulatory model has been appended to incorporate a range of tools that (individually and collectively) may help facilitate the funding and delivery of large and complex projects. However, in our view, these mechanisms are not sufficient, in light of the above fundamental issues. Specifically:

- The RAPID gated approaches provide an avenue for innovative and complex *water resource management* projects to be brought forward. Thus, an expansion of the scheme to other areas – or alternative approaches – might be warranted to enable this approach to have a further reach and generate further benefits.
- The materiality of both the Innovation Fund and the Green Recovery allowances is not sufficient to fund 'step-change' innovations and does not recognise the additional risks associated with large and complex projects – rather they seek lower risk solutions, instead of facilitating / incentivising potential projects with a higher risk-reward trade-off.

[133] *'Green economic recovery: Final decisions'. Ofwat (July 2021); page 3.*

- In relation to the Innovation Fund, investors we spoke to pointed out that the size of the fund would be the equivalent to one large project, which our review of some of Thames's large projects also confirms. By splitting these £200m across several, smaller projects, the required step-change innovations are unlikely to materialise. Moreover, looking at Innovation Funds in other industries, we observe that larger sums are allocated to them. For example, Ofgem is providing £450m through the Strategic Innovation Fund for unlocking a new approach to energy network innovation.[134]
- In relation to the Green Recovery allowances, the same concerns as those listed above for the Innovation Fund arise. In particular, that the materiality of the competitions is not sufficient to bring forward a large and complex project.

Notwithstanding the above concerns with some elements of the current approach to fund large and complex projects, we consider that separate price controls and the SIPR provide an avenue to bring these forwards. In particular:

- We consider separate price controls to be a good alternative to the current framework, as we set out subsequently. Specifically, setting a separate price control for a large and complex project allows for a different risk and reward balance to be applied to certain projects. Thus, one of our preferred options envisages separate price controls for large and complex projects; not only at the project level, but also for the construction and operational phase.
- We consider SIPR to be a viable option for large and complex projects. However, this approach requires that the project be undertaken by an entity other than the appointee. We consider that this need not be the case, as often the appointee may be the best placed to price all relevant risks; and thus we provide options that address this subsequently.

Having briefly recapped the existing regulatory approaches, as well as why they are not sufficient to allow innovative ideas to come to the fore, in the next section we set out proposed alternative options for regulating large and complex projects.

5.2 Framework and overview of options

Here, we set out what we consider to be a credible shortlist of options for applying a differential approach to regulating large and complex projects in practice. In truth, and as per our review of approaches in other industries, there are an almost unlimited number of possible permutations to regulating discrete projects or programmes. Indeed, for this reason, we observe multiple overlapping regulatory tools (including within the water industry at present, as noted above). Thus, clearly, what is 'right' for one large and complex project may not be so well suited to another. Nonetheless, in order to avoid undue complexity, and to provide clarity as to 'how' such projects (or programmes) will be facilitated going forward, it is ultimately necessary to: (i) constrain what options are meaningfully evaluated; and ultimately (ii) provide guidelines as to what the 'preferred' approach will be (so that there is a shared understanding of this across key stakeholders – which will build consistency, and greater certainty).

[134] *See: https://www.ofgem.gov.uk/publications/new-ps450m-fund-unlock-cutting-edge-innovation-across-gas-and-electricity-networks*

'We have adopted a pragmatic approach in alighting on the options.'

With the above in mind, we have adopted a pragmatic approach in alighting on the options. That is to say, we have focused on what is:

a. **possible and practical to implement**;

b. **consistent with our analysis of the features of large and complex projects** and our framework for a differential approach; and

c. consistent with the **views of industry investors and other stakeholders.**

Accordingly, for an option to be credible, it must address the following key issues:

- The need for stability and simplicity in the construction phase.
- Providing certainty over the allocation of risk across a longer time period (at least 10 years).
- Allow for a different risk / reward balance than in the 'main' price control(s) – ensuring there is not an excessive upside or downside risk for the relevant parties (e.g. it must **limit the possibility of 'windfall gains' for companies / investors, but also mitigate their downside risk exposure).**
- Ideally allow for an approach that 'prices in' externalities (primarily climate change).
- Have a mechanism for allowing some risk to be borne by taxpayers.
- Recognise that each large and complex project is 'unique.'

We consider that there are four broad approaches most worthy of consideration. These are summarised in Figure 8 - and are expanded on in the following subsections.

Figure 8: Options for differential regulatory approaches

	Status quo		1	2	3	4
	Enhancement expenditure	SIPR	Price control (phased)	Hybrid price control / open competition	Open competition (integrated)	Open competition (phased)
	Incumbent identifies needs	Incumbent identifies needs	Incumbent identifies needs	Incumbent identifies needs	Incumbent identifies needs	Incumbent identifies needs
	Incumbent identifies and appraises options; selects preferred option	Open competition determines a single provider (separate project licence) for design; build; finance and operation. Project licence specifies 'value' of all phases and can include separate price controls	Incumbent identifies and appraises options; selects preferred option	Incumbent identifies and appraises options; selects preferred option	Open competition determines a single provider for: design; build; and operation – and also determines the 'value' of all phases	Open competition for options that best meet need, including detailed design
	Incumbent undertakes detailed design (potential for DPC)		Incumbent undertakes detailed design	Incumbent undertakes detailed design		
	Incumbent responsible for construction (potential for DPC)		Incumbent responsible for construction (subject to separate construction price control)	Incumbent responsible for construction (subject to separate construction price control)		Open competition determines constructor and 'value' of construction phase
	Incumbent operates relevant asset (potential for DPC)		Incumbent operates relevant asset (subject to separate operational price control)	Open competition determines operator and 'value' of operational phase		Open competition determines operator and 'value' of operational phase
Options for sharing risk with taxpayers	N/A	Contingent GSP	Contingent	Contingent	Contingent	Contingent
Options for mitigating overall risk exposure	Overall limit on maximum and minimum returns	Overall limit on maximum and minimum returns	Equity tramlines (enhanced 'fair bet' approach)	Construction – cost pass through Operation – Ofcom 'fair bet' approach	Equity tramlines (enhanced 'fair bet' approach)	Construction – equity tramlines (enhanced 'fair bet' approach) Operation – OFTO approach

Source: Economic Insight.

In the following subsections, we expand on 'how' we see each model working, being clear as to:

- **Who the licensed entity could be.** This is important, as the licensed entity is accountable to Ofwat and customers; and there are legal and financial implications that follow from the assignment of a licence.
- **How uncertainty around construction delivery is managed.** Uncertainty regarding delivery (both timing and success) in this phase can be high, and there need to be the right instruments in place to manage (and mitigate) this.
- **How cost risk in construction is managed.** Large and complex projects have a higher risk of cost overruns and there need to be mechanisms in place to deal with / mitigate this. Specifically, there is uncertainty around both: (i) what the 'efficient cost' is; and (ii) the ability of any organisation to successfully deliver at the efficient cost.
- **How cost risk in operation is managed.** Similarly, once the asset is completed, one needs to assess how best to manage operational risk (and cost risk in particular). This can vary significantly by 'type' of asset. In addition, operational cost risk may be high prior to construction completion (and may remain high during the initial operation phase); but might then decline over time (for example, as the operator becomes more familiar with the asset's operating parameters and performance).
- **How risks are allocated between parties.** To be able to have the best outcomes, the risks between companies; investors; the regulator; and customers need to be well balanced. Where some of these projects impact wider societal issues – for instance, climate change – there can be a strong case to allocate some risk to taxpayers. Notwithstanding externalities (such as climate change) broader government / taxpayer support may be required to mitigate risks. Thus, the question of 'how' this is achieved is raised.
- **Are outcomes / outputs incentivised – and if so, how?** One way to mitigate risks is to incentivise outcomes / outputs. For example, there could be several construction delivery outcome incentives, as well as operational ones. This again will depend on who is best placed to deal with the risks.
- **Who finances, and what.** Where different 'phases' are carved out, it is important to consider who is financing each element – and what exactly they are financing. For example, some investors may not have an appetite for large greenfield projects, whereas they may be more comfortable financing operational ones.

Before expanding on the options further, we firstly address some important overarching issues:

- allowing risk to be shared with taxpayers;
- mitigating overall risk exposure; and
- the role and form of competition.

5.3 Overarching issues

5.3.1 Overarching issue 1: allowing risk to be shared with taxpayers

There are two key reasons why we think it important that *all* options should allow for the *possibility* of risk being shared with taxpayers (rather than being the typical balance between companies, customers and investors). The first is the rationale that underpinned the Government Support Package (GSP) for TTT. Namely, the extent of certain risks may be so great that they would simply not be borne by the private market (e.g. cost overrun risk). There are also concerns around the capacity of the relevant insurance markets, given the scale of such risks. Hence, through this lens, the concern is that – without some sharing of risk with taxpayers – said projects would simply not proceed.

The second rationale is closely linked to the issue of externalities. That is to say, if a project / programme is supportable (in part) because of its ability to generate positive externalities (or mitigate negative externalities) such as climate change, it seems logical that society at large bears some of the risk / cost associated with that. Put simply, whilst certain environmental impacts of large and complex projects may be limited to an incumbent's immediate customer base, most such *spillovers* will be wider.

We recognise that the above rationale will not apply in every instance; and hence we have couched the allocation of risk to taxpayers as being an 'option' (i.e. we consider that any approach should allow for this possibility *to be considered* for all large and complex projects – and applied if appropriate – but not, if otherwise).

The practical question that follows from the above is *'how'* should risk be shared with taxpayers – that is, what mechanism(s) should be used to facilitate this? There are, broadly speaking, two main approaches to consider:

- **Contingent government support packages.** Such as the one used for TTT – under this approach, Government agrees to provide financial support if certain outcomes arise. The nature / scope of this would likely need to include: compensation for uncontrollable cost overruns (e.g. by way of equity injection); access to debt finance; insurer of last resort; project cessation risk; and potentially, insolvency risk.
- **Direct government support.** Under this approach, Government could either provide (i) equity finance 'up front'; and / or (ii) an ongoing revenue stream for the fixed period of time (i.e. contributing towards overall cost recovery).

WE THINK ALL OPTIONS SHOULD ALLOW FOR THE POSSIBILITY OF RISK BEING SHARED WITH TAXPAYERS – AND CONSIDER **CONTINGENT** SUPPORT TO BE MOST APPROPRIATE. FOR EXAMPLE, SUCH AS THE GSP FOR TTT.

The above two approaches broadly align to the two limbs of the rationale for sharing risk / cost with taxpayers.

- The 'contingency' approach is (mainly) about mitigating private sector risk, where the primary concern is about a project not proceeding at all.
- The 'direct' approach is better aligned to the funding of externalities, where society should contribute to these projects (irrespective of risk), as society is the ultimate beneficiary.

We consider that a contingent support approach is most appropriate. This is because: (i) valuing externalities remains difficult and carries a lot of uncertainty; and (ii)

forms of 'direct' support would likely be relatively contentious in most cases, making it a less practical option.

The precise 'form' of support (under either contingent or direct approaches) could include any of the following:[135]

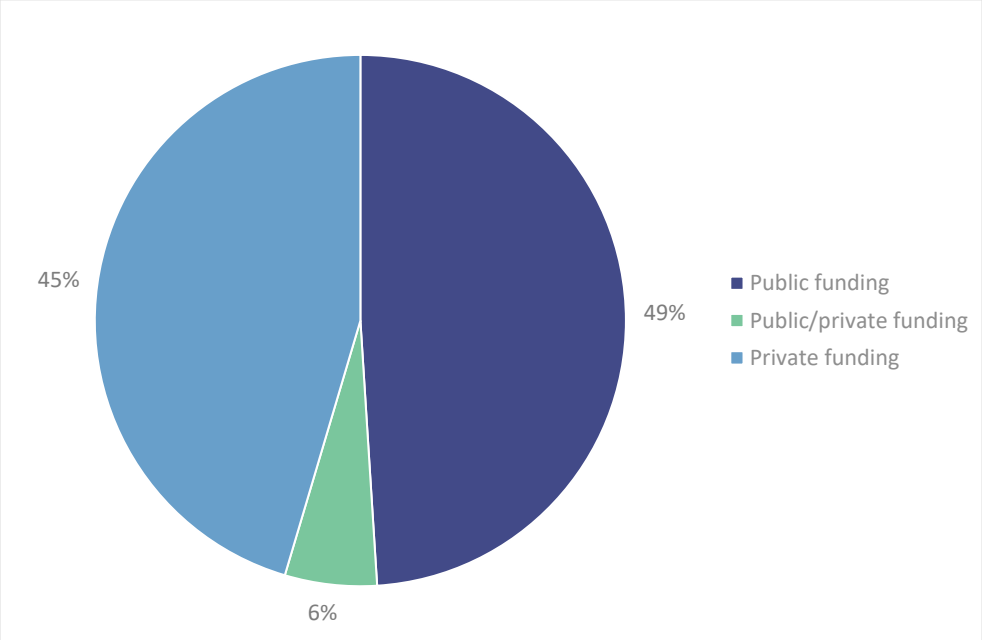
- **Grants.** These can be provided either during the construction, or operational phase, of the asset. If they are granted during the construction phase, the objective is (typically) to decrease capital contributions that lenders and equity holders give to the infrastructure providers. Contributions during the construction phase can also include the provision of public assets and / or the possibility to use public land for free (e.g. during a concession period). Where they are granted during the operational phase, they will typically take the form of subsidies. That is, they will be in the form of either revenue increases/ revenue stabilisation, or a cost reduction (with both contributing to an increased cash flow performance).
- **Public co-investment as equity or debt.** Rather than provide 'cash' up front, via grants or similar, Government may wish to offer support by taking a stake in the project. Such investment can take the form of equity; subordinated / mezzanine debt; or a debt contribution provided directly to the infrastructure - or indirectly via investment vehicles for infrastructure.
- **State guarantees.** Finally, public guarantees (or back-up liquidity facilities) that are provided to an infrastructure's creditors to overcome structural problems incurred during its development could also be a mechanism to support investment. This support represents a credit enhancement, provided to improve the attractiveness of the project for private investors, where risks would be too high to be borne solely by the private market.

In our view, **the precise form and details of contingent support should be determined on a case-by-case basis, as each project will be unique and carry different challenges**.

Our view that all the options should allow for the possibility of taxpayers bearing some risk is consistent with the UK's broader 'mixed model' approach to the funding and financing of infrastructure. For example, and as shown in Figure 9, in total, public / private funding of infrastructure is reasonably close to 50:50.

[135] *'Private Financing and Government Support to Promote Long-Term Investments in Infrastructure'. OECD (September 2014). We further consider the specific mechanisms, as listed here, could apply under either a 'contingent' or 'direct' approach.*

Figure 9: Funding mix of Total UK National Infrastructure Pipeline



Source: 'National Infrastructure Delivery Plan 2016–2021'. Infrastructure and Projects Authority (March 2016) ; page 18.

This topic frequently arose in our investor interviews. For example, one pension fund investor mentioned that: "*The TTT project was attractive to investors because it was very well designed to help with cost overruns…. If they were very high, Government would put equity in, so you would never lose too much money.*"

ALL OPTIONS SHOULD HAVE A MECHANISM FOR LIMITING OVERALL RISK EXPOSURE (BOTH TO AVOID WINDFALL GAINS TO SHAREHOLDERS, AND UNDUE DOWNSIDE RISK).

5.3.2 Overarching issue 2: mitigating overall risk exposure

As shown earlier in this report, the risk associated with these projects can be very high. This means that billpayers may be exposed to a high degree of bill volatility (and, relatedly, one might be concerned about shareholders earning 'windfall gains'). Similarly, investors face significant downside risk exposure – particularly relating to cost risks. In light of this, we think all options should include a mechanism that can limit overall risk exposure (notwithstanding our views that taxpayer support should also be allowed for). Options for this include the following:

- **The 'fair bet' framework**. This is broadly the Ofcom approach for fibre. Under this method, the regulator would not set an *ex-ante* allowed WACC for the investment (and would not regulate 'at all' in the first instance). Rather, an *ex-post* review would occur (in Ofcom's case, after 10 years), after which price regulation *could* be introduced, if returns were deemed to be outside of a 'fair bet' range.[136]
- **Tramlines for ROCE / equity returns (what we term an 'enhanced fair bet' approach)**. This is a variation on Ofcom's (above) approach. Under this model, we envisage the regulator would estimate a relevant WACC (and / or cost of equity) for large and complex projects *ex-ante*. The regulator would also set out a

[136] *It should be noted that the 'fair bet' gives investors an equal opportunity for gains or losses, which is considered in terms of returns. It does not take a view on what 'fair returns' ought to be, which, on the other hand is that investors are given a fair rate of overall. The current regulatory approach provides for a view of what that 'fair return' is, by way of the appointee WACC.*

view on the 'upper' or 'lower' bounds for returns. This would work differently under 'regulatory' (i.e. price control) and 'competition-led' models.

- **Under 'regulatory' (i.e. price control) models**, this works via an automatic mechanism, whereby prices adjust up or down when returns exceed those boundaries.
- **Under 'competition-led' models**, firms (i.e. the winner of said competition) are free to price / offer services as they wish. However, if returns exceed said firm's proposed upper or lower boundaries (as proposed when bidding in the competition), Ofwat has the option to intervene and require prices be adjusted up or down. Thus, said companies may choose to *voluntarily* adjust prices in these circumstances, taking into account the threat of regulatory intervention. If companies do not adjust prices, but Ofwat exercises its option, it would adjust prices to whichever is lowest out of the company's, or its own, assessment of the relevant bound.

- **Cost pass through**. Here, companies would be automatically allowed to recover certain costs, as they are incurred, unless they are found to be demonstrably inefficient. This recognises that cost variation can be (largely) outside of all parties' control (or at least, that this is hard to establish with certainty). For example, elements of the CAA's approach to R3 at Heathrow are cost pass through.
- **The OFTO approach**. Here, the regulator does not set a relevant project WACC, but rather companies / investors bid for a set revenue stream for 25 – 30 years of the operation of the asset, with some service delivery incentives (albeit with a 'limit' on the extent of revenue at risk – Ofgem limiting it to 10%). This provides some certainty for investors, as well as customers.

We note that the above options are not mutually exclusive and can be used in combination with one another – as we ultimately do for one of our preferred options. For example, cost pass-through can be restricted to defined values to limit customer exposure, but simultaneously there can also be a higher WACC and / or earlier triggers for taxpayer support.

Finally, we consider that generally, an *ex-ante* approach provides greater certainty for investors, given it provides clarity from the outset under which circumstances regulators will intervene. Whereas under Ofcom's 'fair bet' *ex-post* regime, there remains some uncertainty as to whether – and if so by how much – a regulator will intervene after the event. In our view, an *ex-ante* approach has two main advantages: (i) all else equal, it should reduce regulatory risk (which lowers costs for customers); and (ii) it may deter unscrupulous investors, relative to an ex-post approach.[137]

This was another area where **investors we interviewed shared similar opinions**. In particular, they raised the following issues:

- a concern that overall risk exposure was 'too high' to support more innovative projects (either in terms of new operating models and / or technology);

[137] *i.e. under an ex-post approach, an investor may invest absent regulatory interventions. Should those interventions then occur, or be 'threatened', they may decide not to honour certain commitments, believing they can 'force' the regulators hand to soften the intervention.*

- that the current risk-reward balance is asymmetric, with downside risk exposure being higher than upside; and
- that it is hard to 'earn the WACC', once wider incentives are taken into account.

Investors also emphasised that regulatory risk could be mitigated through using simple, stable, and transparent approaches to regulation. There were some concerns that in more recent price controls, there had been 'surprises' in terms of the regulatory method, which made backing large projects more challenging.

5.3.3 Overarching issue 3: the role and form of competition

Here we consider the role and form of competition, addressing in turn: (i) the relative pros and cons of competition and regulation as approaches for delivering large and complex projects; (ii) 'where' in the delivery stage competition might offer most benefits; and (iii) the 'form' of competition – and in particular, what we call 'open competition' – and its relative merits, compared to more restricted forms of competition.

Relative pros and cons of competition and regulation

Whilst there are natural limits to the scope for competition in relation to large infrastructure projects, 'competition *for* the market' (e.g. competitive tendering, procurement and similar) has the potential to deliver benefits to customers, compared to *price* regulation. However, it also carries some risks and potential downsides, relative to *price* regulation. Hence, it is important to consider these with care.

It is well understood that competition provides firms with incentives to innovate and cost minimise, so that resources are allocated to their most productive use. Put simply, opening up the design; build; operation; and financing of assets to competition means *commercial pressure* is brought to bear. In principle, this might improve the chances of the 'right' assets being developed; at the lowest possible cost; whilst enabling the best possible outcomes for customers and the environment. However, the complexity and uncertainty surrounding said projects means competition is not without its downsides and risks. For example, imperfect information may increase the likelihood of the 'winner's curse'. That is, the tendency for the winning bid in an auction to exceed the intrinsic value, or true worth, of an item (in this case, meaning a project might fail to deliver and / or may be significantly more costly than anticipated). Thus, rather than *revealing information* about the true efficient cost of an asset, competition can provide misleading signals about what can be delivered, and at what price (indeed, as discussed in chapter 3, these projects are characterised by very large cost overruns and delays – and historically there have been numerous high-profile public sector tendering failures).

On the other hand, regulation mitigates some of the above disadvantages, since an independent body (Ofwat) seeks to gather all necessary information from all parties – and then reaches its own view on what is required; and its efficient cost. As there is no 'bidding,' there is no risk of anyone 'bidding low' - and that information being erroneously used to inform 'efficient costs.' However, it is difficult for any regulator to robustly identify the 'efficient costs' for these assets (particularly using 'normal'

regulatory tools). Hence, there is a real risk that regulation leads to 'not enough', or 'too much', allowed costs.

'It is inappropriate to conclude that either 'competition' or 'regulatory' models are best. Hence, in developing our own ideas on differential approaches, we have included options which include either competition or regulation.'

The above discussion goes to the challenge at the heart of delivering these projects. On the one hand, most stakeholders would agree that having strong commercial incentives (either through competition or regulation) are 'good', in principle. On the other hand, achieving that is practically difficult – and one must be mindful of the underlying objective of *'getting the asset built and operational'.* For this reason, in our view it is inappropriate to conclude that either 'competition' or 'regulatory' models are best. Hence, in developing our own ideas on differential approaches, we have included options which include either competition or regulation.

Where might competition add most value?

Given some of the key issues discussed in chapter 2 around innovation and driving technological change, we find that competition is likely most valuable in the 'design' and 'operation' phases of these large and complex projects. This is because, currently, competition *for* the market already happens in the construction phase – as companies contract out large civil engineering (or other construction elements) of these projects. If companies were to put out tenders for design or operational ideas, they may receive more innovative ideas than they would otherwise have arrived at, for example. So rather than competition purely being a vehicle to achieve lower costs – it might be that the main upside is around identifying innovative ideas.

Another consideration in determining the scope of competition is that of synergies. That is to say, there are likely to be efficiency gains derived from either: (i) a single competition process; and / or (ii) across the activities of design; build; operate; and finance. For example, under an 'integrated' competition (or the appointment of a firm to undertake all activities) the bidding parties will be incentivised to optimise costs and outcomes across each stage. For example, they will not be incentivised to minimise cost in design or build, at the expense of high operating costs and / or reduced operational performance in future. Thus, we consider models that allow for these synergies to be superior to others. Further to these synergies, integrated approaches also save on tendering costs, given there would be only one tender – as opposed to two, three, or more separate tender rounds. They also reduce the overall time required to complete the project and mitigate the risk of slippage.

Open competition

FOR OPTIONS THAT INCLUDE COMPETITION, WE ADVOCATE AN 'OPEN' MODEL THAT ALLOWS INCUMBENTS TO BID, WHILST ADDRESSING CONFLICT OF INTEREST CONCERNS.

When setting out our options that include some element of competition, we refer to **'open competition'.** This reflects our suggestion that incumbent companies, as well as out of area and non-water industry organisations, should all be able to compete to provide solutions. This is because, whilst we recognise the potential challenges around incumbents bidding (such as conflict of interest concerns) the downsides of excluding them are significant. Specifically, excluding incumbents has the following implications:

- there is, by definition, 'less' competition if one major party, who likely would have the skills and expertise necessary to provide a viable option, is not at the table;
- the quality of end outcomes may be reduced, because (at least in some instances) incumbents may be better placed than most to identify and deliver 'what' customers want; and

- given the high degree of uncertainty around both the 'cost' of delivering and 'outcomes performance' of large and complex projects, the exclusion of incumbents risks omitting valuable information that might help reduce that uncertainty.

All of the above three issues are important. However, in light of experience from other large scale public tendering processes (see chapter 3), we are especially concerned about the latter. That is to say, the risk that projects are awarded to organisations that are, ultimately, unable to deliver them; cannot deliver them for the price promised; and / or deliver them, but with high failure risk (or poor operational performance). As the nature of the projects under consideration here is such that they might be deemed 'essential' for society and the environment, we think a high weight should be attached to this consideration. We further note that Ofwat itself is mindful of the trade-offs in this area and its PR24 consultation stated: *"We will also consider whether conflicts of interest in the tender process could be sufficiently mitigated to allow incumbents to submit competing bids fairly, and whether the benefits of having another bidder outweigh any disadvantages of such arrangements."*[138]

Notwithstanding the above, under an 'open competition' model, we recognise that Ofwat's concern regarding conflict of interests must be addressed. Here, as Ofwat has set out, the issue is that the 'buyer' is also a 'bidder' – and may, relatedly, have an information advantage. Broadly, there would seem to be two approaches to mitigating this concern:

- **Degrees of separation.** The first approach is, as Ofwat has previously discussed, to create a degree of 'separation' between the incumbent itself and the entity that bids on its behalf. This could range from mere organisational separation, whereby a 'closed team' structure is put in place, such that the 'bid team' does not interact with the 'buying team'; through to legal and structural separation (i.e. a separate legal entity / subsidiary is created for bidding purposes).
- **Independently run competition.** The second approach is that an entity other than the incumbent runs the competition process itself. For example, under a SIPR model, Ofwat could oversee a competition 'for' the licence to develop and / or operate the asset in question.

Both approaches have pros and cons. Whilst an independent body (e.g. Ofwat) acting as the 'decider' addresses conflict of interest issues most directly, that body would likely not bear any risk, other than reputational, regarding the delivery of said projects. Nor would it bear asset performance risks subsequently. Thus, it would be hard to align incentives in a way that provides sufficient protection to customers, in our view. On the other hand, the 'separation' option may always leave some perception of a conflict of interest, no matter how it were implemented.

In energy, Ofgem combines the two within its OFTO tender process. That is, incumbent generators are allowed to bid, provided there is sufficient legal separation (i.e. an OFTO SPV).

138 *'PR24 and Beyond: Creating tomorrow, together.' Ofwat (May 2021); page 82.*

5.4 Our shortlisted options

Having set out the key cross-cutting issues, in this section we expand on how we envision our four shortlisted options working. Before doing so, the following figure repeats the overview of said options, for reference purposes.

Figure 10: Re-cap of shortlisted options

Source: Economic Insight.

5.4.1 Option 1: Phased price control

Under our first option (phased price control), the incumbent company remains the *sole* licensed entity responsible for delivering the large and complex project, and there is a phased approach to completing it, through the project lifecycle, whereby the incumbent:

- **identifies the need** for the large and complex project, as they are assumed to be best placed to do so;
- **identifies and appraises the different options and selects the preferred option**, that is, they either develop the solutions fully in-house, or contract out the design of different options to a supplier, using standard procurement processes;
- undertakes the **detailed design**, following from above, once the preferred option has been identified, the final design is then refined;

- is **responsible for construction**, that is, they are responsible for contracting out construction, under the usual procurement and contracting processes; and
- **operates the relevant assets**, that is, they may choose to contract out certain operational aspects, or retain full operational responsibility.

This approach should largely ensure any synergies around the design, build and operation phase are retained, as one entity ultimately remains responsible for the whole process (albeit, said licensee retains the ability to 'outsource' / use 'DPC', allowing for competition – and this may, or may not, somewhat undermine synergies). Under this option, **a separate price control (outside of the 'standard' price control** timescales and processes) **would apply to the asset;** and there would further be the possibility for there to be separate controls for each key phase (most likely separate controls for design / construction and operation). The duration of these price controls would be for the length of construction for the former; and say, 10 years for the latter.

One of the benefits of a phased approach to setting price controls is that information on costs and risks becomes available throughout the different phases; and therefore, uncertainty can be mitigated in this way. For example, parameters for the operational price control can be based on information revealed at the construction phase, rather than everything being set from the outset.

To mitigate overall risk exposure under this option, we consider that Ofwat could set *ex-ante* **tramlines for returns** (which we term **an 'enhanced' version of the 'fair bet' framework**) **for the separate price control in question (i.e. for the asset).** That is, if returns for said asset are above a certain level, they will need to be 'returned' through lower prices. Similarly, if returns were below a certain threshold, prices would be allowed to increase to prevent that. Moreover, given the risks and uncertainties around construction and operation of these assets, we consider that any bounds for returns are set relatively 'wide'.

This approach to risk mitigation is well-suited to an asset-specific (and phased) price control, as the regulator (by definition) has to reach a view on allowed returns ex-ante in any case. This approach also provides transparency and certainty for investors; and is very practical and well understood by the investor community.

Alternatively, there could be an argument for some degree of cost pass-through as the 'risk mitigation' solution for Option 1. This reflects the fact that cost benchmarking remains challenging for unique projects. Here, there would still need to be an upper and lower bound, as ultimately consumers would need to be protected from very high cost overruns; but where those overruns are outside of providers' control, providers / investors also need to be compensated for them. However, given our options all include some form of (optional) contingent Government support, we consider that, under this option, **tramlines for returns** (i.e. **an 'enhanced' version of the 'fair bet' framework**) within the separate price control(s) provides the best risk mitigation strategy.

5.4.2 Option 2: Hybrid price control / open competition

Option 2 is a hybrid that includes price controls (covering design and build) and open competition (covering the operational phase and associated financing costs).

Here, the identification of needs and options, and thus associated design and build, remain the responsibility of the incumbent companies and are delivered / funded through a separate price control (that applies to the asset). In terms of risk mitigation, the separation of the design / construction phase from the operational phase (which, as below, is subject to competition) likely means that more certainty around cost recovery is required (relative to Option 1, for example). As such, a degree of 'cost-pass-through' would seem to be appropriate in any construction phase. This would, nonetheless, be subject to an efficiency review, consistent with the approach applied by the CAA to HAL.

The operational phase would then be subject to 'open competition'. That is to say, incumbents; out-of-area water companies; and other providers would compete for a licence to operate the asset for a period equivalent to the asset's estimated life (e.g. 25 years). To mitigate risk in this phase, Ofcom's 'fair bet' framework would also apply. Thus, at the end of an initial 10-year period, Ofwat would assess whether outturn returns lie within a range it considers is consistent with a 'fair bet'. If they lay outside that range, Ofwat could then either (i) apply a price control for the subsequent 15 years; or (ii) run another competition.

5.4.3 Option 3: Open competition (integrated)

Option 3 encompasses 'integrated' open competition. Here, the incumbent identifies the need for a large and complex project; and then competitive tendering occurs **for the complete solution** (where the incumbent is allowed to bid). Thus, there is a **single provider** for the design; build; and operation phase (and the outcome of the tendering process thus also determines the 'value' of each phase – i.e. there is no price control). Therefore, the commercial incentives associated with bidding are assumed to result in (or are sufficient to deliver) the 'efficient' cost (price) for each phase - as well as incentivising strong outcomes performance.

Synergies in the design, build and operate phases should be retained under this approach. Where the provider is a separate entity from the incumbent, it can obtain a separate licence, which will clearly set out responsibilities and expectations for all relevant stakeholders.

Under this option, our preferred method for mitigating overall risk is to apply **tramlines for returns** (which we term **an 'enhanced' version of the 'fair bet' framework**). Under this approach, at the time of the relevant competition, Ofwat would publish its 'best view' of the WACC (separately for construction and operation), alongside 'upper' and 'lower' bounds on a return on capital[139] range for each WACC that Ofwat considers may be consistent with a 'fair bet' principle for the specific project in question.

Similarly, each bidder will (as part of putting together their submission) set out what WACC (rate of return) they are willing to undertake it for, along with their own

[139] *This could alternatively be considered in terms of RoRE and the cost of equity.*

proposals for an 'upper' and 'lower' bound return. In doing so, they will have visibility of Ofwat's assessment (as above).

Once the competition is concluded, the provider is appointed and is not subject to regulation (i.e. it can price / offer services as it wishes). However, if (in any given year) its returns are above, or below its view[140] of the 'upper' or 'lower' bounds for the 'fair bet' range, Ofwat would have the option (but not an obligation) to require it to amend its prices, such that returns were once again within the tramlines. Ofwat's ability to do this would be made a condition of the company's licence. The decision by Ofwat to intervene would turn on whether it felt the outturn result was mainly 'within' or 'outside' of company control (based on a review of relevant evidence, triggered by the firm's returns being above or below the tramlines). In line with the 'spirit' of the tramlines in the first place, however, the working presumption would likely be that returns beyond those bounds were likely outside of company control.

The critical point is that, in the event of being 'outside' of the tramlines, a company could voluntarily raise / lower prices, in order to ensure returns remained within the 'fair bet' bounds (meaning there would be no review from Ofwat). However, if that company was of the view that it has exceeded the upper bound due to exceptional performance (or vice versa), rather than 'luck', it might choose not to lower its prices. It would do this, knowing that Ofwat had the *option* to review that decision; and subsequently require a price reduction (i.e. the company would be taking that risk). However, as part of that review, the company would have the opportunity to submit evidence to Ofwat, in support of its decision. If Ofwat were to conclude that prices should be adjusted, it would then mandate this; and would apply whichever was lowest out of its and the company's view of the upper and lower bounds. This final step is to ensure the company faces appropriate incentives to:

- adjust prices up or down when returns were outside of the tramlines for reasons outside of management control (noting as above, this would be presumed in most cases); or
- to leave prices unchanged, thus earning returns above (or below) the tramlines, only in cases where it felt there was strong evidence that the performance was for reasons within management control.

5.4.4 Option 4: Open competition (phased)

Our fourth option is a 'phased' open competition, where, as per the other options, the incumbent still identifies the need for the large and complex project, but then each subsequent stage is tendered for, but separately. That is, there is a separate, open competition for:

- designing the options to meet the identified need;
- determining the constructor and 'value' of construction phase; and
- determining the operator and 'value' of operational phase.

Under this scenario, each competition could be 'won' by a separate entity; or they could all be 'won' by the same entity. Were the latter to occur, it would in effect be somewhat similar to Option 3 set out above. An advantage of this approach is that

[140] *The 'company's view' of the upper and lower bound is used at this stage, because the company 'won' the competition on this basis (i.e. competition 'revealed' the efficient WACC and upper / lower risk ranges).*

more information becomes available at each phase, making it more likely that 'efficient' costs are revealed. A disadvantage is the potential loss of synergies, alongside the complexity of running multiple competitions.

In terms of who the licensee would be, it could be the appointee water company, irrespective of the 'winner' at each phase (i.e. the company simply contracts with the winner). Alternatively, there could be a separate licence issued for each tender phase.

To help mitigate overall risk, we consider that under this phased open competition approach, it is beneficial to draw a distinction between the different phases, and thus allocate risk to those best able to control it in those phases.

- We consider that for the **construction phase**, an **equity tramlines** (i.e. enhanced 'fair bet' framework) approach will provide a fair risk mitigation. That is, Ofwat will determine a construction project-WACC and set upper and lower bounds, above (under) which prices need to adjust, so that providers do not earn excessive (or too little) returns. This avoids windfall gains, whilst simultaneously avoiding providers becoming bankrupt, were they to stem all the cost overrun risk.
- For the **operational phase**, we envisage an **OFTO approach** will provide the right risk and reward balance. In particular, by the time the operational phase is tendered for, there should be 'good' information available to all potential bidders. Thus, any bidders would be able to price in the operational risks into their bids appropriately, and obtain a fair revenue stream, whilst ensuring customers are not paying over the odds for the service, too.

Investors particularly liked the OFTO approach, as it provides a lot of certainty and avoids any "surprises" every five (or eight) years.

5.5 Evaluation of options for regulating large and complex projects

The following table sets out our evaluation of the four options across a range of parameters, and we set out our reasoning subsequently. We rate the four options across the following parameters on a scale of **Low** – unlikely to yield benefits over and above the *status quo* in relation to the parameter being evaluated; **Medium** – unclear whether the approach would be better than *status quo* in relation to the parameter being evaluated; and **High** – likely to yield benefits over and above the *status quo* in relation to the parameter being evaluated. The parameters are as follows.

- **Licensed entity / risk accountability**. Where there is an option for another third-party provider that is not the incumbent (who will be the contracting party) to deliver (parts of) the project, then being able to obtain a separate licence is considered an improvement to the *status quo*.
- **Synergies between design, build, finance and operate (DBFO) and long-term incentives.** Where synergies occur due to one provider undertaking all of the design, build, finance and operate phases, this does not only bring efficiencies in the delivery of the project. It could also provide benefits in terms of the solutions taking a longer-term view, as one provider will be responsible for the end-to-end delivery of the asset.
- **Determining efficient cost and / or cost of capital.** Where Ofwat needs to take a view on efficient cost and / or cost of capital – which across all the options the regulator will have to do, to some extent, either explicitly or implicitly – we consider that options that rely *less* on the efficiency / cost of capital having to be determined *ex-ante* are beneficial, compared to those that require it. This is due to various reasons set out previously – in particular, given the uniqueness of these projects, it is particularly challenging to determine what efficient costs (or the relevant cost of capital) are, amongst other considerations.
- **Uncertainty and cost-risk in construction phase managed.** Given the construction phase carries uncertainty and cost-risk, here we assess whether the proposed options balance the need for investment against providing an appropriate incentive power (by allocating risk appropriately). That is, whether the options provide better risk-sharing arrangements compared to the *status quo*.
- **Cost-risk in the operational phase managed.** Given large and complex projects may carry higher operational risk, here, as above, we assess whether the proposed options balance the need for investment against providing an appropriate incentive power (by allocating risk appropriately). That is, whether they provide better risk-sharing arrangements compared to the *status quo*.
- **Information asymmetries.** This is where we evaluate the merits of better cost / risk information, arising from phased approaches, and whether having better information may potentially lead to better risk-allocation amongst those best able to bear the risks..
- **Ability to price in externalities.** This evaluates whether the options provide the *possibility* to price in externalities, mostly by way of the *possibility* for Government support. Given that under the current approach, this is only possible within the SIPR, we consider that any option that provides for this option will be an enhancement compared to the *status quo*.

Table 16: Evaluation of options

Parameters	Option 1 – phased price control	Option 2 – hybrid price control	Option 3 – integrated open competition	Option 4 – phased open competition
Licensed entity / risk accountability	**Medium**: Incumbent only.	**High**: Incumbent and potentially any third-party (operational).	**High**: Incumbent and potentially any third-party (design / construction and operation).	**High**: Incumbent and potentially any third-party (design / construction and operation).
Synergies between DBFO, being consistent with long-term-incentives reflected in offers	**High**: Synergies likely to occur, as incumbent has oversight over all phases and can take a long-term view.	**Medium**: Synergies less likely to occur, as incumbent remains responsible for design / construction and a third party *could* be responsible for operation. This could affect any long-term view.	**High**: Synergies likely to occur, as incumbent appoints one provider to undertake all phases and can take a long-term view.	**Low**: Synergies unlikely to occur, as incumbent appoints various providers for each stage. This could affect any long-term view.
Determining efficient costs and / or cost of capital	**Medium**: As Ofwat will set price controls, it will have to take a view on efficient costs and cost of capital.	**Medium**: As Ofwat will set a price control for construction, it will have to take a view on efficient costs and cost of capital. It will, however, not set any *ex-ante* parameters for the operational phase.	**High**: As Ofwat will set upper and lower return bounds, it will have to take a view on the cost of capital. However, as parameters will ultimately be determined through a competitive process, there is less burden on the regulator.	**High**: As Ofwat will set upper and lower return bounds for a construction phase, it will have to take a view on cost of capital. However, as parameters will ultimately be determined through a competitive process, there is less burden on the regulator.
Uncertainty and cost-risk in construction phase managed	**High**: Given the incumbent has oversight over all phases, there is a separate price control for the asset, and there is an overall limit on maximum / minimum returns, this Option provides appropriate incentives and risk mitigation in the construction phase.	**High**: Given the incumbent has oversight over the construction phase and there is a separate price control with cost-pass through, this Option provides appropriate incentives and risk mitigation in the construction phase.	**High**: Given one provider has oversight over all phases, and they provide the 'value' of each phase, as well as mitigating risk through equity tramlines (enhanced 'fair bet' approach), this Option provides appropriate incentives and risk mitigation in the construction phase.	**Medium**: Given one provider will be awarded the construction phase, and risk will be shared by way of equity tramlines (enhanced 'fair bet' approach), this provides appropriate incentives and risk mitigation for this phase. However, as this phase is dependent on the others, there may be less 'continuity' by having different providers undertake different phases, which may thus mute these benefits compared to the *status quo*.

Parameters	Option 1 – phased price control	Option 2 – hybrid price control	Option 3 – integrated open competition	Option 4 – phased open competition
Cost-risk in the operational phase managed	**High**: Given the incumbent has oversight over all phases, and there is a separate price control for the asset, and there is an overall limit on maximum / minimum returns, this provides appropriate incentives and risk mitigation in the operational phase.	**Medium**: Given one provider has been appointed for the operation via a competitive tender, they carry most cost-risk in this phase. The 'fair bet' approach to risk mitigation is applied, which provides some stability and simplicity in the operational phase. The potential re-tendering or price control after an initial operational phase means project risks can be less easily mitigated and incentives may not be fully aligned.	**High**: Given one provider has oversight over all phases, and they provide the 'value' of each phase, as well as mitigating risk through equity tramlines (enhanced 'fair bet' approach), this provides appropriate incentives and risk mitigation in the operational phase.	**Medium**: Given one provider will be awarded the operational phase and risk will be shared by way of an OFTO approach, this provides appropriate incentives and risk mitigation for this phase. However, as this phase is highly dependent on the others, there may be less 'continuity' by having different providers undertake different phases, which may thus mute these benefits compared to the *status quo*.
Information asymmetries	**High**: Having a phased price control will be based on better information, and therefore may mitigate various risks, that would otherwise have to be stemmed by customers / investors.	**Medium**: Having 'just' a construction price control may give subsequent bidders for the operational phase better information. However, as synergies are lost, this may lead to customers / investors bearing more risks than they would otherwise.	**Medium**: Having no price control will be based on imperfect information and may lead to customers / investors bearing more risks than they would otherwise.	**High**: Having a phased open competition will be based on better information, and therefore may mitigate various risks, that would otherwise have to be incurred by customers / investors.
Ability to price externalities	**High**: As there is a *possibility* for contingent Government support across all options, externalities should be taken into account.	**High**: As there is a *possibility* for contingent Government support across all options, externalities should be taken into account.	**High**: As there is a *possibility* for contingent Government support across all options, externalities should be taken into account.	**High**: As there is a *possibility* for contingent Government support across all options, externalities should be taken into account.
Overall evaluation	**High**: this Option scores **highly** across most areas and would, therefore, be a good alternative in certain circumstances, following a case-by-case assessment.	**Medium**: this Option provides some benefits over the *status quo*. However, Options 1 and 3 score higher across most categories of assessment and are therefore our preferred Options.	**High**: this Option scores **highly** across most areas and would, therefore, be a good alternative in certain circumstances, following a case-by-case assessment.	**Medium** / **Low**: this Option provides little (certain) benefits over and above the *status quo* compared to the other Options considered. Therefore, we assess this is the least likely to deliver significant benefits.

Source: Economic Insight.

As can be seen from Table 16, we consider that Options 1 and 3 would best balance the interests of all parties involved; and ensure large and complex projects are delivered efficiently - and with a fair risk allocation across all parties, as well as accounting for externalities. This is because under either of these two options, we consider the synergies between one provider undertaking the design, construction and operation phase will be maintained.

Moreover, by either having a limit on maximum and minimum returns (Option 1) or by having a maximum and minimum threshold on what a 'fair bet' (enhanced 'fair bet' approach) is (Option 3), we consider that they strike a reasonable balance between 'promoting investment' and 'retaining incentive power' (by allocating risk appropriately, but also reflecting the considerable uncertainty regarding risk controllability).

Under Option 4, only where the same provider 'wins' all tenders would the above synergies occur (and as we discussed previously, there would be additional tendering costs created, which would somewhat offset those synergies, in that eventuality).

Moreover, when comparing Options 2 and 3, we find that to fully reap the benefits of opening the approach to competition, there should not be any construction price controls. This is because ultimately, by 'opening up' the market for competition, the 'efficient' costs of both constructing and operating the assets ought to be revealed. Notwithstanding this, even under these two Options, Ofwat would be considering how far off from a 'fair bet' the providers are, and thus, some view on what an appropriate cost of capital ought to be would be required. Thus, given that under Option 2 there would still be a construction price control (and the 'threat' of an operational one, should the operational provider exceed the 'fair bet' in an initial 10-year operation phase), we consider that Options 1 and 3 are the most fit for purpose, depending on the project. We consider that Options 2 and 4 are less likely to deliver material benefits compared to the current *status quo*.

In summary, we propose Options 1 and 3 could be taken forward for further consideration. These are not mutually exclusive – and could be used in tandem, with projects assigned to one or the other, depending on which is the best fit. What approach – or combination of approaches – is 'right' for any given project will vary on a case-by-case basis. To re-cap, our two preferred options are, therefore:

- **Option 1: Phased price control model.** Here, the incumbent remains responsible for identifying needs and options; design; construction; and operation. However, the 'asset' in question is subject to a separate price control (and, optionally, separate price controls may apply to each 'phase'). Under this option, total risk is mitigated by setting overall 'limits' on the rate of return that can be earned from the asset / within the separate price control (both minimum and maximum thresholds).
- **Option 3: Integrated open competition model.** Here, a single competition is run in relation to the design, build, and operation of the assets (including financing costs). Overall risk is limited through the application of 'equity tramlines' (our enhanced 'fair bet' framework), whereby the 'winner' of the competition initially levies prices in line with their tender – but if returns fall outside of the agreed tramlines, prices are able to be adjusted up or down (but only sufficiently to return within the tramlines). Companies may adjust prices voluntarily where this occurs; or, if not, face the threat that Ofwat may mandate they do so.

6. Recommendations

In this final chapter, we briefly set out our recommendations, drawing on the analyses and evidence we have reviewed. In short, we recommend two differentiated regulatory models for large and complex projects be taken forward for further consideration (phased separate price controls; or integrated open competition). Without a differential approach, there is a concern that certain critical investments will not proceed and / or that the mix or time profile of investments will be sub-optimal, causing customer harm. Under both options proposed here, the possibility of sharing some risk with taxpayers –for example, by way of a contingent Government Support Package – is likely to be important. Similarly, we propose mechanisms for limiting overall risk to billpayers / investors, including in a modified version of Ofcom's 'fair bet' framework for fibre roll-out.

- Firstly, **there is a compelling case for a differential regulatory approach to apply to large and complex projects.** Without this, both the 'in principle' issues, and 'in practice' evidence, suggest that certain critical investments will either not proceed; or will be sub-optimal in terms of either the 'mix' of projects that go forward, or the time periods in which they occur. The latter is a particular concern, in the context of population growth and climate change.
- Secondly, for any differential approaches, we consider they should have the following features:
    - The need for stability and simplicity, particularly in the construction phase.
    - Providing certainty over the allocation of risk across a longer time period than the 'standard' price controls (at least 10 years).
    - Allow for a different risk / reward balance than in the 'standard' price control(s).
    - Ideally allow for an approach that 'prices in' externalities (primarily climate change).
    - Recognise that each large and complex project is 'unique.'
- Thirdly, **the 'option' for sharing risk with taxpayers (on a contingent basis) is likely to be important.** This is because: (i) the risk may be so high that, without it, private investment would not be forthcoming in some cases; (ii) insurance markets may not cover the risks; and (iii) because at the heart of the challenges that need to be addressed (climate change; population growth) are externalities that affect wider society, both now and in the long-term (not just water billpayers today). For example, the Government Support Package (GSP) provided to Thames Tideway Tunnel was essential, in order to ensure investment was forthcoming for this high-risk project. Again, it is important to highlight that each project is unique – and so said support may not *always* be required. However, based on the

project characteristics we have assumed (i.e. which would be consistent with considerable, if not in some cases unlimited, cost risks, and where risk controllability is limited) forms of taxpayer support would be an important consideration. Thus, we recommend that said support should be an *'option'.*

- **Fourthly, overall risk exposure should be limited for billpayers and investors.** This is both to preclude the possibility of 'windfall gains', but also (and consistent with the above) to avoid the possibility of potentially unlimited downsides, which in our judgement (and from market feedback we have received from investors and stakeholders) could also preclude investment. This is particularly important in the context of the delivery of said projects being vital, both to water customers and society.
    - There are various ways of doing this, but under one of our preferred options, we suggest what we term **an 'enhanced' version of Ofcom's 'fair bet' framework**[141] (which applies to fibre broadband). The spirit of our proposal here is to recognise that there can be relatively wide deviation from a 'central' expectation of returns (or performance more broadly) in more complex, innovative projects – and that this can arise for various reasons. Hence, a risk-reward balance and regulatory design that reflects this is needed.
    - Nonetheless, one must also recognise that there should be limits to upside and downside exposure, if the objective is to see essential investments in infrastructure realised (i.e. because if investors observed firms struggling, due to a large project failure, it would undermine their confidence to support similar projects in future. Likewise, if one observed an investor making a very high return, for reasons outside of firm control - and beyond any allowed outperformance incentives from their regulatory settlement - that would undermine trust in regulation).

Taking a pragmatic approach, we are proposing two models that could be taken forward (which are not mutually exclusive). These are described more fully in Chapter 5 of this report.

- **Phased price control model.** Here, the incumbent remains responsible for identifying needs and options; the design; construction; and operation of the relevant asset. However, the 'asset' in question is subject to a separate price control (and, optionally, separate price controls may apply to each 'phase' – i.e. construction; operation etc). Under this option, total risk exposure is mitigated by setting overall 'limits' on the rate of return that can be earned from the asset / within the separate price control (both minimum and maximum thresholds).[142]

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[141] *Ofcom's specific approach is described in detail on page 37. In brief, Ofcom 'holds off' from regulating until: (i) the project is successfully delivered; (ii) it finds Openreach has significant market power; and (iii) it believes Openreach has the ability / incentive to earn significantly > WACC (i.e. where the extent of outperformance is likely not the outcome of a 'fair bet'). Key issues underpinning Ofcom's approach, relevant to our considerations here are: (i) that returns may naturally be > < the WACC for reasons that simply reflect the outcome of a 'fair bet'; (ii) but beyond a certain point, this may not be likely; and (iii) for large and complex projects in the water industry, the envelope for returns is wide – and controllability of risk is limited and unclear. Therefore, whilst one may make best endeavours to correctly identify which risks are most controllable by which party, and allocate them accordingly – this is especially challenging for large and complex projects. Hence, whilst allowing for greater upside and downside potential (relative to the 'average' project) may be appropriate, one may nonetheless need tools to prevent undue variation in returns.*

[142] *The rationale being that without an upper limit, firms may earn returns that are (or are perceived to be) excessive, or 'windfall' in nature (being due to reasons not within management control); and without a lower limit, the extent of downside risk exposure means the (essential) investment would simply not occur. These upper and lower limits could be viewed as a hybrid of RPI-X and 'rate of return' regulation, the latter of which is commonplace in the USA and elsewhere.*

- **Integrated open competition model.** Here, a single competition is run in relation to the design; build; and operation of the assets (including financing costs). Both incumbents and alternative suppliers are free to participate (i.e. making it an 'open' competition). Overall risk is limited through the application of 'equity tramlines' (our enhanced 'fair bet' framework), whereby the 'winner' of the competition initially levies prices in line with their tender – but if returns fall outside of the agreed tramlines, prices are able to be adjusted up or down (but only sufficient to return within the tramlines). Companies may adjust prices voluntarily where this occurs; or, if not, face the threat that Ofwat may mandate they do so.

7. Annex: Investors' perspective

In this Annex, we present the perspective we gained through the interviews with actual and potential investors in the water sector.

7.1 Introduction

It was important, for the purpose of this report, to get a range of investor perspectives. Therefore, in total we interviewed 6 investors, which included a mix of debt investors and equity investors.

Each of these interviews was conducted as a discussion with senior managers at the organisation and, while we present the broad discussion guide below, the interviews did not necessarily follow the discussion guide precisely.

We also note that the ensuing notes are the views of the investors and not our own.

7.2 Our discussion guide

In this section, we set out the discussion guide we shared with interviewees in advance of the interviews to help guide our discussions. Please note that these were for guidance and that not all questions were covered with each interviewee, nor was the order always strictly adhered to.

7.2.1 Introduction

We are working with Thames Water (Thames) to develop evidence and analysis to help Ofwat better understand why a *different* regulatory approach (i.e. separate from the main regulatory framework) might be needed with respect to 'large' and 'complex' projects.

To help achieve this, we need to develop an understanding of (and evidence around) how you think about investment decisions in Thames specifically; and regulated / non-regulated infrastructure, more generally. In particular:

(viii) The extent to which regulation, overall, is seen as a 'positive' or 'negative' for you as an investor.

(ix) The extent to which regulation may be a barrier to certain 'types' of investments / projects (which ones, and why - specifically thinking about 'large' and 'complex' projects).

(x) What specifically it is about the existing regulatory model that makes it poorly suited to certain projects.

(xi) What parts of the regulatory framework could (should) be changed, to encourage investors to invest in 'large' and 'complex' projects (either directly, or via water companies)?

(xii) Whether and how the nature of investment in the water industry might need to change over time, and the implications of this.

Below, we set out a discussion guide to structure our conversation around.

7.2.2 General questions

- Briefly outline the scale and nature of your investment in Thames; and why you are invested in it?
- What are your main objectives from your existing investment in Thames?
- Over what time period do you typically consider investments in infrastructure companies, such as Thames?
- Do you invest in any other UK regulated infrastructure businesses?
- Do you invest in any other UK **non**-regulated infrastructure businesses? If so, to what extent does an industry being regulated affect your assessment of risk and return?

7.2.3 How you see the water regulatory framework affecting investment incentives

- In what ways do you think the existing regulatory model may be **conducive** to promoting investment in the water industry? (i.e. in what ways do you see it as a 'positive'?)
- In what ways do you think the existing regulatory model may act as a **barrier or deterrent** to investment in the water industry? (i.e. in what ways do you see it as a 'negative'?)
- Are there **particular 'types' of investment** / project you think the existing regulatory model is better at **facilitating** than others? If so:
    - How would you characterise these projects?
    - In what specific ways does the regulatory model help facilitate them?
- Are there **particular 'types' of investment** / project you think the existing regulatory model tends to make **particularly hard to proceed with / deters?** If so:
    - How would you characterise these projects?
    - In what specific ways does the regulatory model deter them?
- In terms of 'ways' in which the regulatory model may deter certain types of investment, **do you consider the following reasons to be relevant?** (Please highlight anything important that is missing, and which are most important): rate of return too low; specific benefits project will deliver not quantified; lack of certainty in regulatory approach; wider environmental / social costs not incorporated; and long-term outcomes the project might deliver not quantified.
- In your own experience, can you think of circumstances whereby an investment has not been made / project not proceeded, which you think *would* have delivered better value (relative to what actually occurred) due to some aspect of the regulatory model? If so, can you describe this instance?
- The *existing* regulatory framework is designed to suit the *existing* set of investments / projects / activities in the industry **'on average',** (and the risk-reward balance should reflect this). To what extent do you think **a 'different'**

profile of investment will be needed over, say, the next 20 years? (e.g. 'riskier' investments, in order to deliver greater productivity gains through technology).

- Do you consider that a 'differentiated' regulatory approach (which treated certain, likely 'complex' and 'large' projects separately from the wider framework) would be beneficial? If so: (i) why?; and (ii) what key features do you think this approach should have?
- If the regulatory model were to adapt to include a differentiated approach that, for example, provided a 'higher' rate of return for specific 'higher risk' (and larger) projects, to what extent would that be attractive to you, or do you think new investors with a different risk / reward appetite would need to be brought into the industry?

In the remainder of this Annex, we set out the details of each of the interviews, in turn.

7.3 Investor A

On the one hand, it is helpful that there is a regulatory system in which the goals of the regulator are visible. It is also important to be specific across regions when setting allowances or incentives for companies as there are large differences between various regions in the UK with regards to asset management.

On the other hand, it is very important to have continuity across price controls, which has not been the case in the recent past. That is, the regulator has changed its approach drastically in how it wants to build resilience. For example, it makes sense to create new incentives once the asset base has been renewed. However, the current system with a multiplicity of ODIs shifts the focus on to short-term incentives rather than long-term ones. It has come so far that:

- it is not possible to outperform; and
- as an underperformer, it is not possible to catch-up.

This in turn prohibits taking risk.

The current regulatory model specifically deters the following types of investments:

- **Replacement of current network assets**. Although investors would want to invest in network resilience, the investment is limited by the fact that this does not disturb operations and it is necessary to be allowed the corresponding amount of totex.
- **Projects with high cost variability such as innovation projects**. Due to the nature of innovation projects, the regulator is ill suited to control costs for these. In addition, the cost sharing mechanism that determines how costs of a project are shared between customers and the companies could be improved upon.

This is because the following aspects of the regulatory model seem to deter investment in the sector:

- There is no avenue of getting money, if the cash allowance falls short of the amount required.
- There is a delay between the moment money is spent and when companies get the remuneration for the project allowance.
- The current WACC is insufficient if the risk of a new project is much higher than the 'average' project. The level of the WACC is not a problem in current

investments, but it is for new investments with different risk levels compared to that of the 'average' project.

Projects whose features are different from the 'average' project should be treated differently. Relevant features are:

- size;
- extent of disruption to the existing network;
- whether it is a new asset;
- operability;
- cost variability; and
- the way the project is distributed.

With regards to the way the project is distributed, a separate regulatory structure for large and complex projects is more beneficial to consumers and the industry in the long-term compared to a competitive bidding process. This is because there is a risk that the winning bid is an underestimation of the true cost of the project as bidders try to undercut each other to win the project. For example, new potential investors in the UK water sector might not have enough information and experience to estimate the true cost of the project and thus might bid at a price that is below the true cost. As a result, the lowest cost bidder wins. This also means that the project will lead to cost-overruns. In addition, if different or all phases of a project are tendered for, then this means that investors are invested into the winning bidders rather than Thames, further increasing asset risk. Both these points might lead to potential exit of investors in the long-term.

In order to invest in large and complex projects, the regulatory framework would have to consider the following points:

- **Evaluating these projects over multiple AMPs** depending on how capex heavy they are.
- **Assessing these projects based on additional measures of leverage** than what is currently used. Ofwat uses the debt / RCV ratio as a measure of leverage. However, it does not consider that investors think about leverage as the ratio of debt / enterprise value (EV). In projects such as the TTT, the debt / EV ratio is around 80%, whilst it is a lot less in terms of the RCV. As a result, this would also affect the required return.
- **Measures that decide which party is taking on the operational risk**. There are various parties that could take on the operational risk such as customers, water companies, a combination of both or others. However, this needs to be clearly defined. For example, for shared resources the operational risk is dependent on which company is served first.
- **Mechanism that decides how customers are billed for the costs incurred** from the project.

Overall, cost considerations have overtaken the importance of long-term investment that ensures a resilient network for generations to come. The regulator is stuck on competitive markets as truest source of capital, which is driven by the current low cost of capital environment.

7.4 Investor B

There are certain project features that warrant a differential approach to that used in the current regulatory framework. Specifically, these features are:

- large scale projects;
- higher risk than 'average'; and
- specific 'type' of projects.

For example, they think that transformational projects related to the net zero aim; projects to redesign the network; or building reservoirs should be treated differently.

Ideally, these types of projects should have their own price control that sets different parameters to deliver the project, such as a differential WACC. They should also take into account the capacity and capability of the business to deliver the project.

It is not clear what the benefits to consumers are when using the favoured approach of a DPC (Direct Procurement for Customers) model. Using a competitive framework to allocate projects might not deliver cost savings as it would still be the same contractors to undertake the project. In addition, there is still a risk that participants bid down the WACC of the project that would not be beneficial for the industry. This is because excessive amounts of debt would be needed to deliver a relatively low WACC, which might be above the level Ofwat considers as 'healthy' leverage. In addition, the threshold of £100m totex to qualify a project for the DPC route might not be the right threshold as a £100m totex project means something rather different for different companies – e.g. for Thames and Bristol Water.

When faced with the question on how the WACC would change if investor B were to bid directly for a DPC project, all else equal, they would bid a higher WACC.

On a side note, the real issue to deliver projects are capacity issues in the construction sector which might lead to upwards pressure on construction prices.

They find that the overall regulatory framework to attract investment into large and complex projects is fine, but that improvements are needed around the balance of incentives. Specifically:

- **Decision on who should pay for the investment**. Currently, there is no distinction in the size of the bill between different customer groups related to the types of customers that would benefit the most and the least from a specific project. However, it might be hard to distinguish between different types of bill payers and the tax authority might be better placed to do this.
- **More emphasis on long-term considerations**. There currently seems to be too much emphasis on keeping bills low which will create problems in the future. That is, a low level of investment now destroys the benefits for future generations.
- **Increasing the evaluation cycle to more than 5 years**. The current 5-year cycle is not enough to evaluate investments that have payback periods of around 40 years or more. Often, the return on such projects only comes through over longer periods after the investment has been made. Recalibrating the regulatory framework whilst these projects are being delivered would further increase the risk of return.

- **Differential WACC to account for increased risk in different phases of the project**. For example, investor B would expect a higher WACC for risks that are not covered within the regulatory framework (i.e. construction or development risk).
- **Increases to the amount of investment totex.** The current approach is adversarial as it is heavily focussed on modelling costs. This is shown by the large differences between the bottom-up and top-down assessments. The level of investments is too low resulting in strained networks.

7.5 Investor C

Things that would deter investments include the regulator making unforeseen changes to the established approach. For example:

- **Retrospective adjustments.** When Ofwat moved from RPI to CPIH, it was an unexpected surprise for investors, as they did not know whether Ofwat would play neutral in relation to the indexed RCV value after the transition from RPI to CPIH.
- **Inclusion of elements that can't be quantified**.
- **Business securitisation** which delivered a lower cost of capital.

The current changes to the price control framework at PR19 made it more complex. To deliver these higher risk projects, Ofwat's view is that changes in the level of risk should be priced in, and companies need to adjust the level of risk by taking out large amounts of capex to be able to get a lower cost of capital.

Investors are sceptical about DPC (Direct Procurement for Customers) projects. The motivation of the DPC model is to further reduce the WACC by transferring risk to a third-party. However, it is not proven whether this is actually the case. One would need to run both models concurrently and assess whether one delivers benefits over and above the other. Even if one were able to do this, it would still be hard to quantify what the benefits of competition are in practice. Investors are sceptical because they did not sign up for an arbitrary tendering off of capex that is going through the RCV.

Investor C does not think that introducing competition into the construction or operational phases will result in a race to the bottom. The water companies know the risk and will price it accordingly. Investors would inform themselves before submitting their bid to alleviate some of the information gaps. Even if some new investors under-priced incumbent investors, it is not clear whether the new investor's bid would be subject to misinformation about the value of the investment. Another aspect of introducing competition into the framework is that this introduces more debate and potential litigation.

Given that all the 'easy' (low hanging fruit) efficiency gains have been achieved in the UK water sector, investor C finds that investors would require higher returns to fund larger scale innovation projects – as these are inherently riskier. They require a 30-40 basis points increase in the cost of equity, or otherwise they would look to other sectors. Overall, investors are not investing in the water sector to take big risks, and thus there is a limit on the level of riskiness an investor would want to take on in this sector.

Investments that are higher risk than the 'average' are still attractive for different types of investors. There currently is still enough appetite and money for different risk and return profiles.

7.6 Investor D

They find that the current regime is not very good at encouraging innovation. For example, they are invested in a company abroad and if you come up with a good innovative idea there, you get to keep the benefits for longer (sometimes indefinitely).

If it were in the UK context, even where a water company were to spend £50m to do something at a lower cost, Ofwat would claw it back. Thus, there are no incentives to innovate, as even where you do, benefits are not kept for long. So, if the innovation were to work, companies should be allowed to keep benefits for say 15 years, and were it not to work, they should be able to recoup some of the costs through the RAB. Under the current regime neither applies and hence the incentives to innovate are low.

Therefore, regulation should change to become more accommodating for innovation. Currently companies take all the risks and Ofwat claws back all the benefits.

Moreover, a low WACC is an obvious deterrent for new investment. Institutional investors have the lowest cost of capital as they are diverting money from fixed-income and bonds into infrastructure – but they will only do so whilst the risks remain the same as a debt-level investment. If the sector were to start taking on riskier investments, where the risk profile would be significantly different, it may deter those types of investors.

They did not appear particularly concerned about the DPC model. Their preference would be for water companies to bid for the projects and win them, as water companies would be better at pricing the risk than they (or anyone else) are. They fund water companies as a shareholder, rather than creating a consortium and bidding themselves.

The main questions as they see them are around who shares the operational risk. Again, they invested in a large infrastructure project with a low bid WACC, as there was no operational risk to the project. For example, with more complex projects, e.g. a reservoir or a desalination plant, the question as to who will bear the operational risk arises. If water companies are competing against others who will not be taking on the operational risk, it is not a level-playing field.

They do not think different investors need to be attracted, as the current ones would be willing to invest in innovation, where the framework conditions are right. For example, it is difficult for them as investors to encourage companies to undertake more innovations, as returns are very low. This does not mean that they would not be happy for water companies to do more innovation (where there are the right allowances for it).

For example, they do not consider that the £200m Innovation Fund from Ofwat will foster innovation – as £200m is quite small given the industry size. The main issue, as they see it, is not lack of money (as investors are willing to invest in innovation), but rather that there is not the right framework for keeping the money post-innovation. Therefore, they consider a change in framework to be more helpful than more money.

They think that for innovation to really 'take off', the water company that they are invested in would need to hire more people to be focused on those specific issues.

One of the key issues is that there isn't a very good dialogue with Ofwat, or that Ofwat does not trust the companies / investors. For example, the dialogue with regulators in other countries and even in the UK with Ofcom is a lot better and more mature.

Other ideas on what could foster investment in large and complex projects include allowing different returns for different activities or using a single / dual till approach.

7.7 Investor E

The current regulatory framework is a double-edged sword. On the one hand, it provides stability; but on the other hand, specifically in the most recent 5 years, there have been adverse movements in relation to long-term certainty.

Specific problems with the current approach include:

- **Focus on short-term bill reduction at the expense of long-term investments to build resilience**.
- **Challenge to deliver high service levels at low cost**. The level of penalties has increased, while at the same time returns are decreasing. This increases the risk of returns as you need to deliver high levels of service at decreasing costs.
- **The regulator focuses heavily on leverage.** The water sector went through a lot of crises (i.e. the financial crises and Covid). The water company they are invested in got through these well indicating that there is no issue in the capital structure. However, Ofwat focusses too heavily on the capital structure rather than what is needed for long-term investment.

The current characteristics of the water sector of: (i) low returns; (ii) high capex; and (iii) high service levels appears quite unstable / unachievable and is a struggle from an investor perspective.

In fact, due to the recent changes in the regulatory framework, the sovereign wealth fund turned down investment opportunities, as the long-term stability of the framework was not given. This was the case for an opportunity to invest in an electricity distribution network operator, for example.

They consider that certain types of projects should be regulated under a different approach. For example, the regulator recognised that the risk of an additional runway at Heathrow is different compared to its day-to-day operations. This helped to decide what the correct risk premium was. In particular, greenfield projects are different to a company's day-to-day operations, and this should be recognised by way of a differential approach (or at least a commensurate risk-premium).

In order to invest in large and complex projects, the regulatory framework would have to consider the following points:

- **More dialogue between regulator and investors.** For example, with the investment in the aviation industry, there were lots of discussions between stakeholders as the stable framework did not apply any more, due to new risks arising (i.e. Covid). They think it is necessary to have more dialogue so that new risks are properly reflected. For example, their investment in a foreign utility

asset has resulted in constructive and rational discussions with the foreign regulator in relation to the appropriate level of the WACC, amongst other issues. This is not the case in the UK water sector, as more and more '*surprises*' come from Ofwat. That is, 'surprises' are becoming the norm, which should not be the case in a predictable and stable sector.

- **Sufficient level of return.** Investor D has a fiduciary duty to earn a certain level of return and thus any investments below that would not be considered. Investment in the TTT would not have been considered, for example, as the level of return was below their threshold.
- **More certainty in the longevity of the regulatory framework.** Updating the framework to account for changes in risk is a good and practical way forward. However, what is more important is that the framework stands the test of time and that there is certainty that it will last for a long period of time.

In relation to the DPC model, they would not directly bid for a project if the project value was below a certain threshold. In particular, for them to show an interest, the investment value would need to be at least a couple of £100m.

Overall, they are still committed to core infrastructure investments *if* the returns are high enough. However, they have changed their strategy to increase diversification because of the current trend and the availability of specific types of investments. They are now more focused on investing in the energy and non-regulated sectors.

7.8 Investor F

The current regulatory system is well suited for *average* risk projects. That is, the framework is suitable for projects undertaken in relation to the normal course of business that use tried and tested technology.

However, it is not so well suited to regulate innovation projects. In order to invest in these higher risk projects, the regulatory framework should consider the following factors:

- **The certainty over returns.** If returns are locked in, this would provide certainty for long-term financing at a lower rate. In turn, this would materially lower the WACC. The regulatory framework for OFTOs, for example, includes a provision of a maximum revenue deduction of 10% for certain investments.
- **Additions of investments to the RAB**. Another mechanism that would provide certainty over the revenues is to add investments to the RAB.
- **Caps on cost-overruns**. There should be a rebalancing scheme in place if the 'rules of the game' change. This is in place in other countries, for example, whereby payments get adjusted to be able to achieve the original IRR. Similarly, the largest issue with the TTT was the financing as there initially was no cap on cost-overruns.
- **Allocation of infrastructure ownership**. At the end of the project, it is important to have a clear allocation of the ownership of the asset in order to assure that the capital is paid back.
- **Creation of incentives to invest in innovation projects**. This includes reflecting the increased risk of these projects in higher returns and potentially establishing a separate RAB approach to regulate these kinds of projects.

In relation to the last point, if not all capex is added to the RAB then uncertainty is further increased as the investor might not get remunerated. This makes management question whether they should invest in the water sector. If anything, the debt investor expects that investors would offer more short-term debt (i.e. with maturities of 7 instead of 10-15 years). However, this will affect the funds that water companies will be able to raise.

They are not concerned yet about the implications of using a DPC model to raise funding for large and complex projects. If the model does not add an investment to the RAB that would have otherwise been added to the RAB, then this might increase the risk profile.

They mention that a public private partnership model should not be considered from the outset to fund large and complex projects. Public funding should be considered only if such projects can't be funded in private markets. This might only happen if risks are unknown, or the technology used is too uncertain.

Currently, although the return on equity is quite low in the water sector from an investor perspective, there are still enough investors that are willing to invest. However, if the regime gets even tighter, then the level of risk and return might not attract enough investors anymore.

It is already a lot more difficult to find investors: the average firm nowadays incurs net penalties meaning that there is no return. Adding a risky project on top of this would make the industry even less attractive to invest in. Only very risky investors would get into this.

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