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Approach to overseeing the cost efficiency of new airport capacity

Final Report to the Civil Aviation Authority

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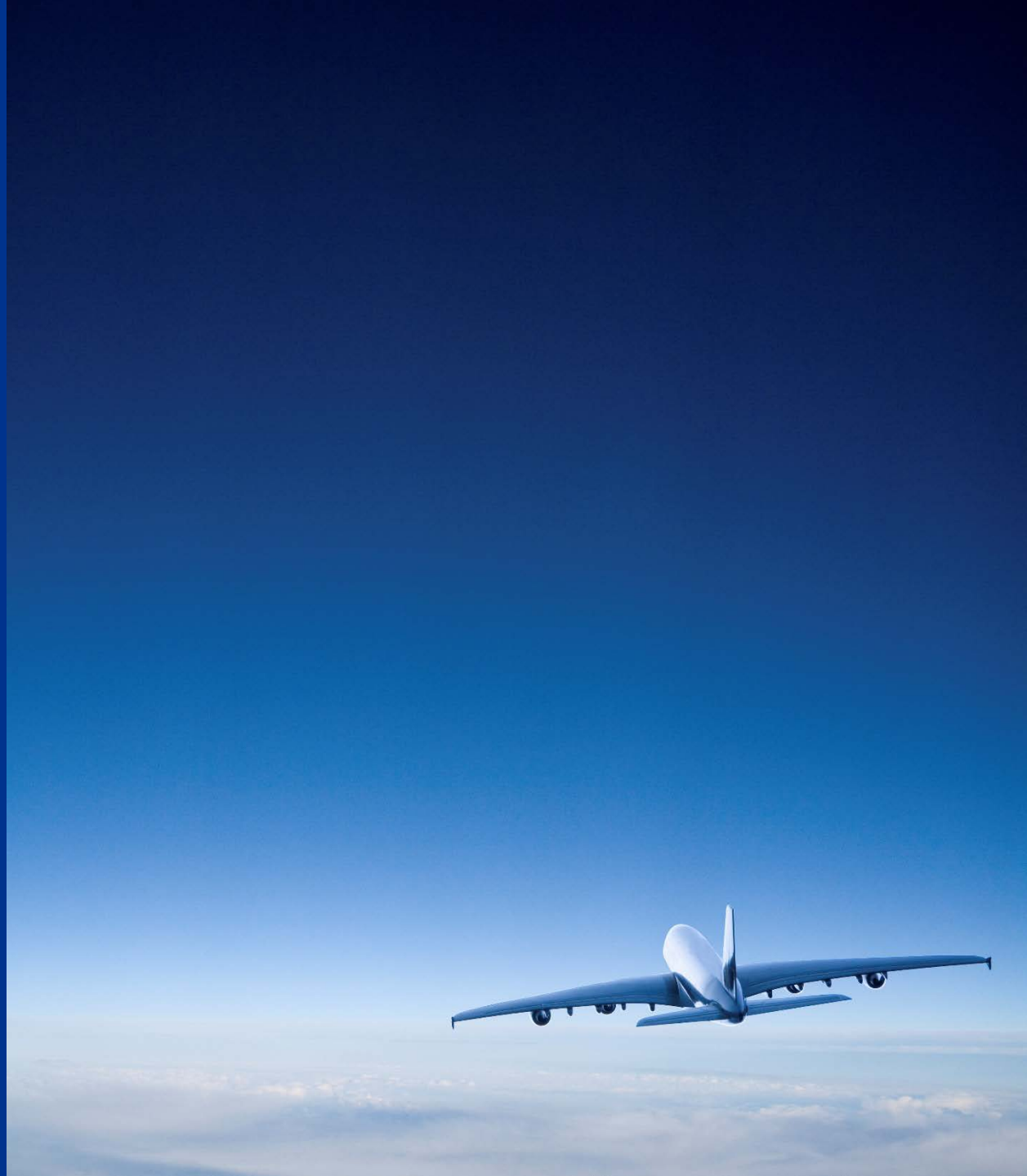
November 2017



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Preface

Preface

This report presents the findings of a study to review alternative approaches to overseeing the cost efficient delivery of new airport capacity. The work was commissioned by the Civil Aviation Authority (CAA) and was independently undertaken by KPMG LLP.

The objectives of the study were to provide:

— An initial sift of possible methods for assessing scheme cost efficiency (both forecast and actual), and mechanisms for incentivising and securing cost efficient delivery (without creating a risk of undue delay).

— The identification of methods and mechanisms that may be suitable for applying in the case of a large airport expansion scheme.

— Recommendations describing one or more regulatory strategy that will help to make sure that airport expansion is delivered efficiently and in users' interests.

— An overall programme covering the stages in the process of designing, constructing and operating new capacity and the points at which the CAA could intervene, how it could intervene and how the approach might vary as the scheme progresses.

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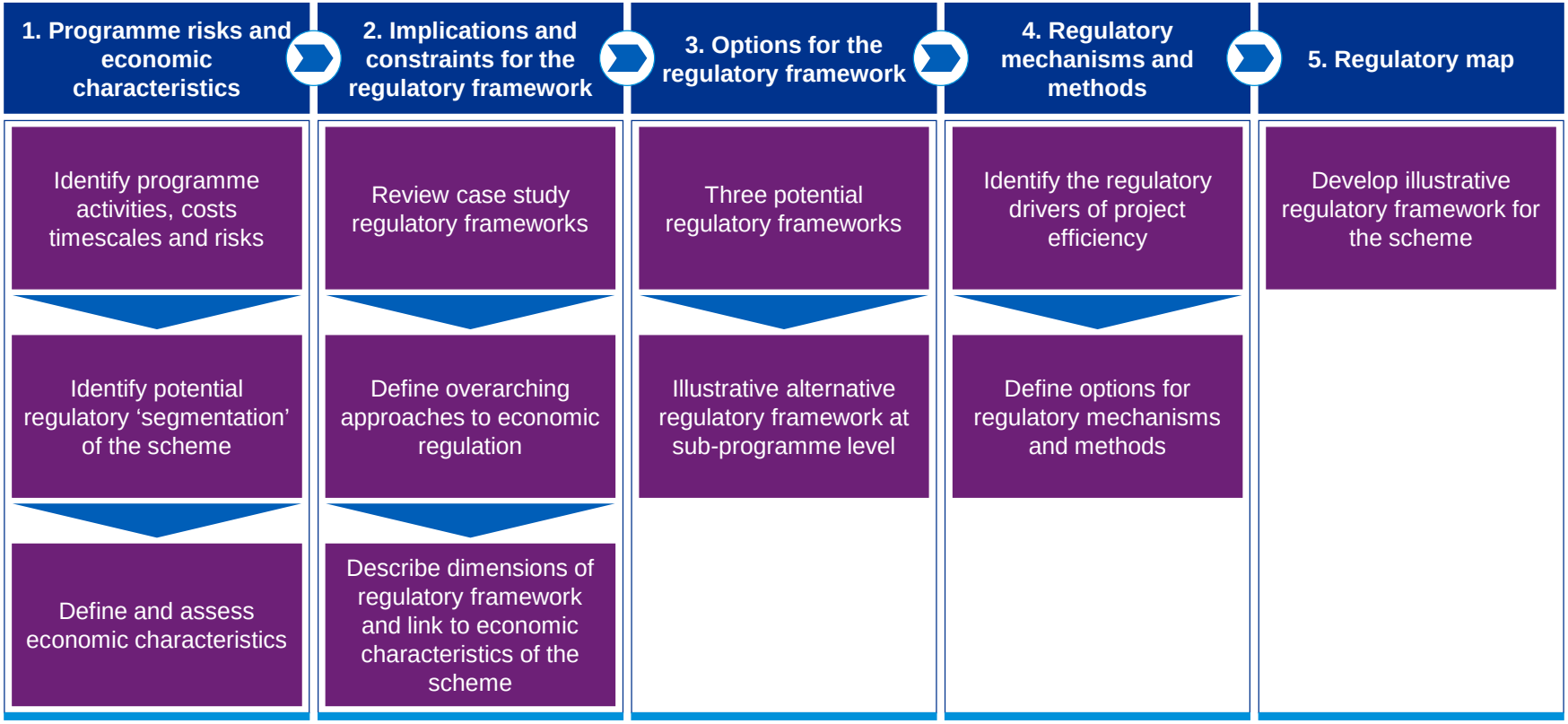
Executive summary

The need for a new regulatory framework

- The CAA's approach to capex efficiency has evolved over several quinquennia to deal with various issues associated with airport projects including: the potential for efficient changes in scope, challenges associated with estimating and assessing efficient costs (due to information asymmetry) and the ability of the airlines to represent customers interests and play a pro-active role in the definition and development of the capital plan.
- At Heathrow these characteristics have led to the development of a regulatory framework which is reliant on discretionary ex-post efficiency incentives, with relatively low risk for the operator and a moderate level of customer engagement and oversight by the regulator. This framework provides a potential option for the new runway scheme – although the economic characteristics of the scheme will differ.
- The CAA's current framework for Heathrow contains ten specific cost efficiency mechanisms and assessment methods as part of its efficiency framework. These include: Constructive Engagement, ex-ante cost assessment using expert review, an adjustment process for core and development capex, capex delivery triggers, ex-post review of expenditure, an inter-temporal adjustment to account for differences between forecast and actual spending and a RAB roll-forward mechanism. Because of the potential for changes in scope in airport business plans, the CAA has tended to rely upon ex-post expert review to create efficiency incentives for the airport operator.
- For Gatwick the CAA has introduced a different framework based on licence-backed commitments developed against a 'shadow' RAB based comparator. This framework gives the operator greater flexibility to set charges and invest, but maintains efficiency incentives through the threat of reintroducing RAB based regulation.
- These mechanisms have been developed to deal with the specific characteristics of airport projects, and as such they may continue to be usefully applied to the new runway scheme. It may be beneficial to consider how each of these mechanisms could be developed or intensified to increase their effectiveness and suitability for the new scheme.
- In particular the intensity and scope of cost assessment mechanisms (ex-post and ex-ante) could be increased to increase the strength of the cost efficiency incentives faced by the promoter by increasing the likelihood of identifying inefficient costs. Similarly it may be beneficial to reform the structure and governance of the core and development capex process and Constructive Engagement to give the CAA greater input where airlines lack capacity or have conflicting interests.
- The scheme is likely to share some of the same economic characteristics as 'business as usual' (BAU) airport projects, but there will also be differences. This means that the CAA's existing framework may provide a useful benchmark to compare with other potential approaches, but may not be optimal. There are a range of other regulatory tools which are not currently applied by the CAA and which may be beneficial to achieving efficient outcomes for passengers.
- This study considers the rationale for developing a new regulatory framework for the airport expansion scheme, starting with a review of the new runway scheme, its main features and components and consideration of alternative regulatory frameworks. We also identify and examine a range of cost efficiency mechanisms and cost assessment methods and conclude with the specification of an illustrative alternative approach to overseeing the cost efficiency of the new airport capacity scheme.

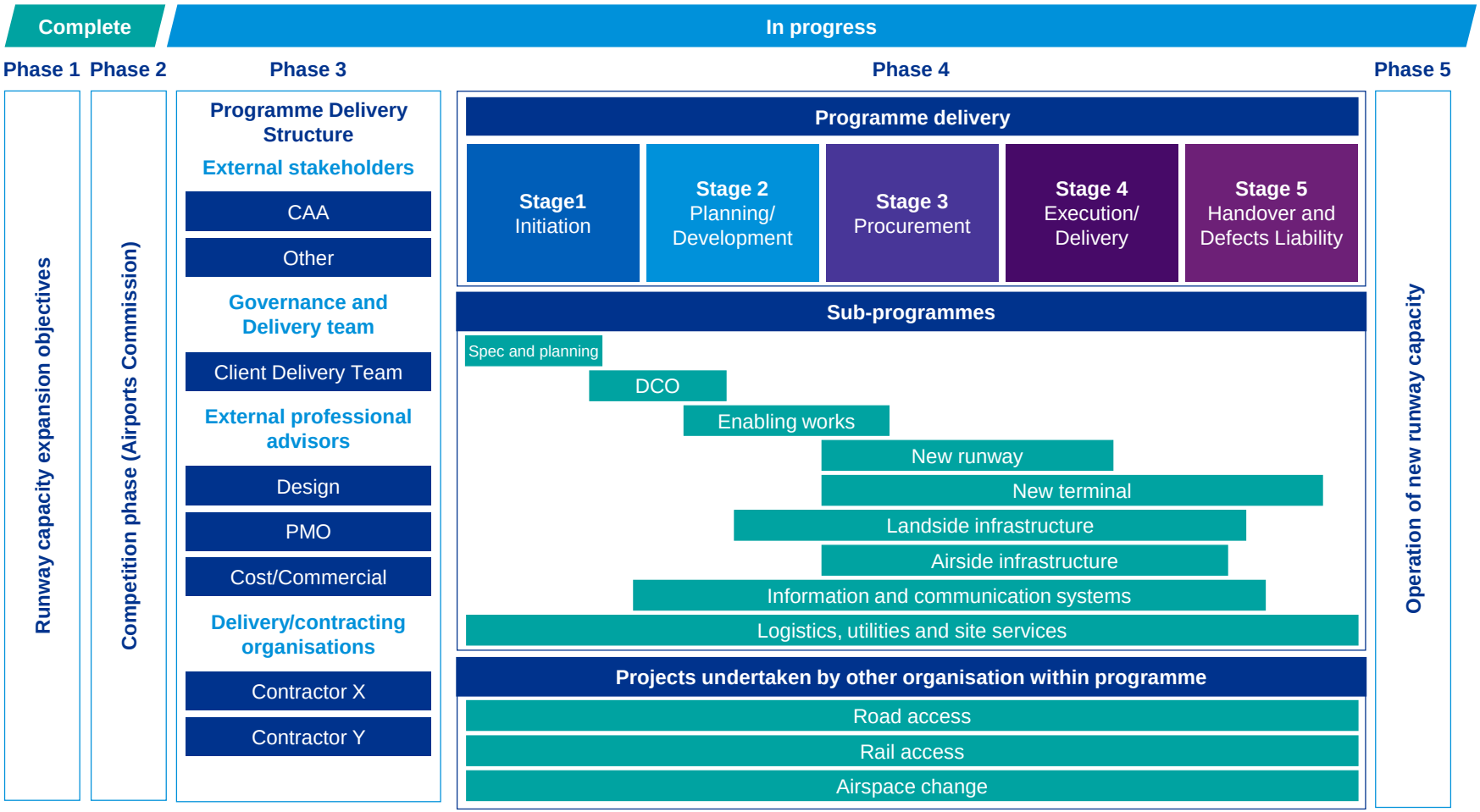
Our approach

Our approach to developing an overall regulatory strategy starts with a review of the costs, timescales and risks of the scheme and identification of its economic characteristics at the level of the programme, sub-programme and individual projects. These **economic characteristics** help to inform the choice of specification or **dimensions** of **the regulatory framework** and the **selection of incentive mechanisms and cost assessment methods.** These are combined in the specification of an illustrative **regulatory map** which describes the implementation of the framework.



Scheme programme map

The scheme will be developed in several phases – some of which have already been completed. The CAA could seek to apply regulatory mechanisms to different parts of this programme. The impact of regulatory intervention on overall efficiency will differ across each phase.



Phases of the programme map

Phase 1. Runway capacity expansion objectives	Phase 2. Competition phase and award	Phase 3. Programme delivery structure	Phase 4. Programme delivery activities	Phase 5. Operation of new runway capacity
— AC objectives for scheme proposals include those related to: - Strategic fit - Economy - Surface access - Environment - People - Cost - Operational viability - Delivery. — Informed by previous expansion plans and the legacy of planning and political decisions. — Competing arguments over the benefits and costs of different schemes. — Highly contentious due to impact on noise, air pollution, costs, surface transport impacts, employment and the potential effects on existing businesses. — CAA provides technical input into the requirements of the project, but does not define objectives.	— AC undertook independent analysis of proposed schemes, which led to the shortlisting of schemes. — Detailed business cases and costs developed by promoters and reviewed by the AC. — Some assessment of costs has been undertaken, but the decision process was not designed as a regulatory cost scrutiny exercise. — Competitive pressure between the scheme promoters relied upon to incentivise cost efficiency. — This may have created incentives for optimism bias. — Not clear what role these cost estimates have as part of the regulatory framework. — CAA's objectives and duties not explicit part of criteria for the project selection.	— Programmes delivered through complex supply chains vulnerable to external risks. — Multiple participants often with different objectives. — Effective management and interaction of delivery partners and stakeholders is important for the programme. — The participants are broadly from four groupings: - External stakeholders including CAA/government/public/ Transport for London/Highways England etc. - The client body/ executing organisation. - Professional advisors, supplement the executing organisations capability. - Delivery/contracting organisations.	— The delivery programme can be considered in five main stages: initiation, planning and scheme development, procurement, delivery, and hand over. — Within a generic airport programme there might be eight major sub-programmes aligned to different parts of the scheme. — Each of these sub-programmes will also contain a variety of 'projects. The breakdown of sub-programmes and projects could differ across the schemes. — Third party organisations will also have to undertake specific projects as part of scheme delivery – such as work related to the M25 and other surface transport upgrades. — These organisations are often outside the direct control of the promotor and CAA and have their own objectives and priorities in relation to the scheme.	— Runway capacity is expected to be operational before 2030. — Transition from construction to operational phase with passenger and aircraft using the new facilities will create specific risks. — Design of project capital costs will have an impact on whole life costs in operational phase. — Once operational, design and construction risk will diminish but transition, commercial and other operational risks (safety etc.) become more significant.

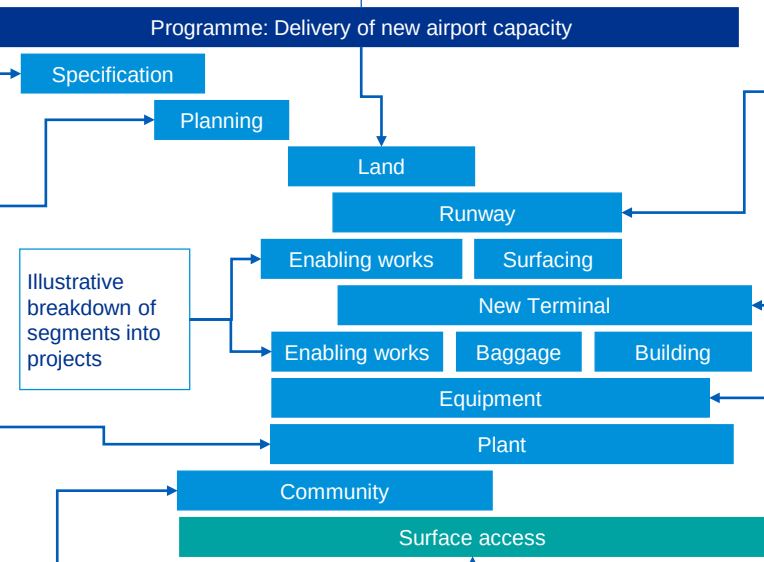
Scheme sub-programmes

Within the overall programme there are a number of sub-programmes and projects which involve different activities, costs, risks and timescales and which also have different economic characteristics. In combination these sub-programmes determine the overall economic characteristics of the scheme and the viability and pros and cons of different forms of economic regulation.

The **specification** stage will directly inform the design and required outcomes of the scheme and structure of the regulatory framework. This will require consultation between the promoter, airlines and the CAA.

Land costs will involve the compulsory purchase of land from third parties around the airport site including commercial businesses and residential properties and the provision of removed facilities. As such these costs will not be incurred as a project, but through the negotiation and legal processes associated with the purchase and compensation. This also includes the provision of serviced plots for third party development.

The **planning** stage will be critical for securing planning permission, setting an overall design for the scheme, and ensuring that impacts on wider stakeholders are identified, minimised and mitigated.
This stage includes developing the planning documentation and engaging with the Planning Inspectorate to secure planning permission through a Development Consent Order (DCO).



The new **runway**, including landing systems and new taxiways and aprons and their associated systems.

The **Terminal** including passenger terminal buildings, piers and satellites, passenger transit systems and car parks.

Plant costs include building plant such as air conditioning, power and utilities generation and distribution equipment.

Equipment costs will include a wide range of different items relating to baggage, transport, de-icing etc. It also includes other facilities such as the control tower, rescue and firefighting, fencing and airside roads.

Community costs include wider community impact compensation and mitigation costs for noise and environmental impacts, including for example work relating to archaeology, ecology, architectural heritage, compensation, blight and Section 106 costs.

Surface access costs include the costs associated with wider surface access projects such as changes to road alignment or supporting rail projects required as a direct part of the scheme.

Regulatory mechanisms and methods

The are a range of regulatory efficiency mechanisms and cost assessment methods which could be applied to the scheme and its sub-programmes to create efficiency incentives. Each of these mechanisms may have a variety permutations and potential differences in calibration and design.

Categories	Types of mechanisms and methods			
1. Financial Incentives	M1.1 Incentive to reveal true costs	M1.2 Ex-ante financial incentives	M1.3 Ex-post financial incentives	M1.4 Outcome incentives
2. Regulatory Approval	M2.1 Ex-ante approval of cost forecast	M2.2 Approval of changes in planned costs	M2.3 Ex-post approval and treatment of costs	
3. Competition	M3.1 Market structure and design	M3.2 Regulatory rules over procurement		
4. Customer Bargaining	M4.1 Requirement for customer consultation	M4.2 Customer involvement in business planning		
5. External Review	M5.1 Upfront information on cost calculations	M5.2 Monitoring and reporting	M5.3 Review of funding, governance and ownership	M5.4 Project representative
6. Control Mechanisms	M6.1 Outcome trigger	M6.2 Discretionary control mechanism		
7. Cost assessment methods	M7.1 Market testing	M7.2 Top-down benchmarking	M7.3 Bottom-up benchmarking	M7.4 Expert review

Types of regulatory framework

Regulatory mechanisms and methods are applied as part of an overall regulatory framework which will tend to reflect several factors including the market structure of the industry, economic characteristics of the scheme or business as well as practical issues such as the resources and objectives of the regulator. There are five broad types of regulatory framework which could be considered by the CAA.

Framework type	Examples	Pros	Cons
Monitoring-based Regulatory intervention applied with discretion	— Regulation of airports in Australia and New Zealand	— Light touch. Low regulatory burden — Appropriate where potential market power or abuse is likely to be limited	— Weak incentives for efficiency where information asymmetry or market power is strong — Reliant on regulatory threat which must be credible
Cost-based Revenues directly linked to costs incurred	— TTT, Heathrow T5, Stansted new runway, Scottish transmission, Lee Tunnel, OFTOs	— Prevents arbitrary over or under reward for company — Enables flexibility for company to deal with risk and uncertainty	— Limited incentives to drive efficiency — Limited incentives for outcomes and innovation — Potential for capex bias as returns linked to RAB
Incentive-based Target cost allowance for company based on forecasts	— Phoenix Gas, Interconnectors, Scottish transmission, Hinkley Point C	— Creates incentives to reduce costs — Most effective where cost or activity is highly predictable and recurring to drive efficiency — Widely used in economic regulation for opex and renewal activities	— Potential for arbitrary over or under reward for company — May be difficult to develop efficient forecasts — May be difficult to account for risk and uncertainty — May be difficult to account for changes in scope — Creates incentives for cost forecast overstatement
Outcome-based Revenues linked to outcome targets set by regulator	— NHS Payments by Results	— Can create incentives to reduce costs and improve outcomes — Helps to drive innovation by focusing company on outcomes rather than costs	— Regulatory challenge to define outcomes and levels of risk and reward — Creates incentives for regulatory gaming and cost/outcome forecast overstatement
Competition for the market Form of competitive process for the market	— Channel Tunnel, TTT, OFTOs. — Rail franchises	— Creates strong incentives for efficiency and innovation amongst competitors during bidding stage — Desired outcomes can be designed into procurement process	— Requires competitive market/supply chain — Difficult to apply to some projects — Tender process can be complex — Difficult to deal with risks and project failure

Dimensions of the regulatory framework

Regulatory frameworks can be further considered through seven regulatory dimensions which can be used to summarise and describe the approach of the regulator and the combined impact of the mechanisms applied. There are interactions and subtleties to each of the dimensions, some are complementary and others may be mutually exclusive for example.

Dimension				
Scheme is considered within the same regulatory framework as the core business operations e.g. linked to existing RAB.	Existing	1	Bespoke for project	Scheme has completely separate regulatory framework from the existing business. For example based on SPV or separate concession.
Prescriptive treatment of costs and uncontrollable factors. Specific identification and treatment of risks.	Prescriptive	2	Discretionary	Discretionary treatment of costs and risks – re-opening of price control and discretion over the treatment of cost risks and implementation of incentives.
Incentives are mainly driven by ex-ante defined treatment of cost, this generally requires prescriptive definition of risk and reward.	Ex-ante incentives	3	Ex-post incentives	Incentives are mainly driven by ex-post treatment of costs, based on prescriptive criteria or regulators discretion.
High level of pass through of costs and risks to other stakeholders.	Low risk and reward	4	High risk and reward	Higher risk on promoter for cost and delivery of scheme.
Customer has greater role and input at key decision points. Must be consulted for changes in costs/scope.	Customer negotiation	5	Regulatory settlement	Limited customer role. Costs and scope changes are treated through regulatory negotiation (could be prescriptive or discretionary).
Short periods between incurring costs and revenue recovery.	Fast recovery of capital	6	Slow recovery of capital	Long periods between incurring costs and revenue recovery.
Low frequency, light touch monitoring or oversight by the regulator.	Non-intensive oversight	7	Intensive oversight	High frequency or in-depth monitoring and oversight by the regulator.

Economic characteristics

The viability and development of different regulatory frameworks and mechanisms is strongly influenced by the economic characteristics of the scheme (C1–C5 below). These should be considered by the CAA to identify the most appropriate regulatory framework, mechanisms and methods.

— **C1: The ability to separate the projects revenues, risks and operations from existing assets** is a pre-requisite for a bespoke framework (e.g. competition or concession type models such as have been applied to the TTT and Channel Tunnel projects). Where it is not possible to separate projects from existing assets, bespoke frameworks will be difficult to implement.

— **C2: The ability of the company to control and predict costs** Limited control over costs (e.g. due to exogenous risks) may motivate a discretionary, low risk, ex-post framework. A prescriptive, high risk, ex-ante framework is not likely to be feasible due to the risks of arbitrary profit or loss for the company.

  On the other hand where costs are more predictable and recurrent, it may be more feasible to introduce more prescriptive, higher risk more ex-ante frameworks which create greater incentives for efficiency and innovation.

— **C3: The ability of the regulator to define and assess efficiency** will influence the degree to which the framework can provide ex-ante or prescriptive incentives to the promoter for cost efficiency. If the regulator cannot define efficient outcomes because the nature of the project is highly complex then a more discretionary, low risk, ex-post framework with stronger customer engagement may be required. In broad terms cost-based regulation may be more appropriate. Even if efficient outcomes can be defined upfront a low ability to assess costs upfront will limit the use of an incentive based framework, which may result in arbitrary over or under reward for the company and encourage regulatory gaming by the promoter.

— **C4: The ability of customers to determine outcomes and efficiency** of the project will directly determine the potential scope for customers to be engaged in the regulatory framework for example in defining the outcomes of the project and or highlighting aspects of the project where regulatory scrutiny should be applied.

  In order for customers to play this role they need to be well informed, have effective representation and their views need to be relatively coherent. In some cases customers may lack the expertise to provide constructive input into the regulatory process or their interests may be directly in conflict with the promoter and other stakeholder such as future customers.

  The ability to involve customers in the regulatory process may provide significant advantages to the regulator by providing an alternative viewpoint and reducing the level of information asymmetry between the regulator and the promoter. There are generally limits to the extent to which the regulator can rely upon customer inputs.

— **C5: The scale of cost and risk exposure for the promoter** has implications for the extent of cost and risk sharing between customers and the promoter. It may be difficult to impose a high risk/reward framework on the promoter for high cost items with a high level of risk. This will also affect the cash requirements of the promoter and the need for fast versus slow recovery of capital through the frequency of RAB adjustments for example. Where a promoter faces a high level of risk exposure it may be difficult to create a high level of financial incentive/risk without increasing the financing costs of the promoter.

Options for the regulatory framework

Based on the economic characteristics of the scheme and its sub-components we have identified three potential frameworks which could most feasibly be applied. The main features and requirements of these frameworks are summarised below.

Framework 1: *Cost-based* – Low risk and reward, ex-post, discretionary framework with high level of customer engagement and regulatory oversight

- Based on CAA's existing regulatory framework, mechanisms and cost assessment methods. Efficiency is driven by customer and regulatory control and monitoring and ex-post financial incentives.
- Greater intensity and scope of existing CAA mechanisms required, in particular the level of scrutiny applied during ex-ante and ex-post review.
- Framework relies upon credible threat of ex-post efficiency assessment and discretionary treatment of RAB. This requires CAA to undertake detailed ex-post cost assessment and develop evidence that costs are not efficient.
- Requirement for more intensive cost assessment processes to reflect scale of costs and risks for passengers, based primarily on intensive expert review. Greater involvement by the CAA in the capex governance process and more explicit consideration of the needs of future passengers and airlines (to balance the interests of current users).
- Intensive customer engagement during specification stage to define efficient scope of the project and targeted on key elements of the scheme.

Framework 2: *Incentive-based* – Medium – high risk and reward, ex-ante, prescriptive, with limited regulatory oversight and extensive risk sharing mechanisms

- Alternative regulatory framework based on setting overall target cost for scheme with range of incentives and risk sharing mechanisms to drive efficiency and manage risk.
- Requires customer engagement with airlines and CAA to define efficient scope/outcomes.
- Intensive ex-ante review of cost forecasts and definition of outcomes. Mixture of expert review, top-down benchmarking and other evidence for cost assessment and target cost estimate.
- Detailed ex-ante risk register for project and development of explicit prescriptive treatment of potential risks, notified items and criteria for potential for re-opener.
- Definition of criteria and principles for material changes in circumstances.
- Additional risk sharing mechanisms, capping the risk borne by the promoter. For instance by setting a cap and collar mechanism with different levels of risk bearing and a boundary above which costs are subject to ex-post review.
- Mechanisms to monitor and ensure the financial viability of the promoter to prevent project failure impacting on existing operations.
- Some scope for monitoring mechanisms to reflect level of passenger risk exposure.

Framework 3: *Sub-programme focussed regulation* – Mixture of cost and incentive based mechanisms linked to different elements of the scheme to reflect variations in economic characteristics

- Mixture of cost and incentive mechanisms applied to different parts of the scheme to reflect specific economic characteristics.
- Requires segmentation of scheme into sub-programmes or projects based on economic characteristics, timing or other operational factors with individual regulatory mechanisms and methods applied to each.
- Level of segmentation could vary to reflect the variation in scheme characteristics.
- Enables project level mechanisms to be aligned to project management gateways to reduce information asymmetry.
- Enables regulatory mechanisms to be more effectively targeted strengthening efficiency incentives, whilst maintaining discretion for risks and changes in scope where appropriate.
- May significantly increase the complexity of the regulatory framework and potentially creates incentives for the promoter to manipulate cost allocation processes to inflate cost forecasts.

Assessment of framework options

Each of these frameworks could provide a viable option for the new runway scheme but have different advantages and disadvantages which influence our assessment of their overall appropriateness.

Framework 1: *Cost-based*

Advantages

- Well understood by stakeholders
- Can be developed based on existing mechanisms
- Enables high level of flexibility to alter scope of project and cope with uncertainty and risk
- Avoids requirement to set treatments for all potential risks in advance
- Reduces incentives for cost overstatement or under delivery of outputs
- Likely to reduce risk of financeability difficulties
- Promoter could be subject to on-going monitoring to create strong efficiency incentives
- Airlines and customers can retain involvement in scheme design

Disadvantages

- Weak incentives for efficiency for promoter
- Passengers implicitly exposed to risks and cost escalation
- High burden of proof for CAA to identify inefficiency ex-post
- Requires oversight of procurement, project management and other processes to drive efficiency
- Revenues linked to costs weakens incentives for innovation and focus on outputs

Framework 2: *Incentive-based*

Advantages

- Potential for stronger efficiency incentives for promoter
- Flexibility to design incentive and risk sharing mechanisms to match profile of the scheme
- Passengers exposure to cost escalation may be limited through risk sharing mechanisms
- Once framework is established, regulatory monitoring can be limited
- Reduces burden of proof for the regulator to identify efficiency

Disadvantages

- Stakeholders likely to be less familiar or comfortable with approach
- Requires CAA to estimate efficient costs and outcomes in advance, which may be challenging
- Need to identify risks and uncertainties and define regulatory treatment
- More difficult to alter scope of project after forecasts set
- Creates incentives for cost overstatement and scope under-delivery in scheme development phase
- Increases potential financeability risks,
- May not be credible for the CAA to allow promoter to fail if risks are significant

Framework 3: *Sub-programme focussed regulation*

Advantages

- Framework can be adapted to the characteristics of individual sub-programmes and projects
- Enables the regulator to focus regulatory scrutiny and oversight on most important elements of the scheme
- Allows the timing of incentive definition and cost assessment to be aligned with the project management timeline
- Could create strong efficiency incentives for the scheme whilst retaining a level of discretion to deal with risk and uncertainty where needed
- **Disadvantages**
- Framework may significantly increase regulatory complexity
- May create incentives for cost allocation manipulation.
- May create incentives for cost over statement
- Approach requires a range of wider implementation work including consultation on the framework design, project segmentation and principles for cost allocation
- Requires the CAA to have confidence in setting ex-ante target costs for a range of complex projects and identifying potential risks and their treatment through notified items

Assessment of framework options (cont.)

- A **cost-based framework** would be similar to the existing framework for Heathrow and is therefore likely to be viable with relatively limited wider implications. This framework incorporates several existing efficiency mechanisms and cost assessment methods and has been specifically developed to account for the differentiated and evolving nature of airport capital projects and the high level of information asymmetry between the CAA and the promoter.
- This framework could be developed further through applying more intensive ex-post cost assessment mechanisms, and an expanded or intensified role for the IFS to increase the likelihood of identifying inefficiency for ex-post treatment. It may also benefit from changes to the customer consultation process to ensure that it is targeted at passenger focussed elements of the scheme and future passengers' views are taken into account in the consultation process.
- An **incentive-based framework** would require an intensive phase of work by the CAA to establish a comprehensive outcome specification for the scheme at the outset. This framework would also require a highly intensive ex-ante cost assessment process to ensure that the target cost is set at an efficient level, taking account of significant risks and uncertainties where they can be identified.
- The natural evolution of the scheme and potential risks and uncertainties, will mean that there would need to be a large number of risk sharing and error correction mechanisms within the incentive-based framework which would result in a high level of complexity. It is also possible that the scheme would experience ongoing changes in scope and target cost to reflect changes in technical requirements (for example to account for new aircraft types and technology). This would need to be accommodated through a scope change mechanism.
- The incentive framework could also be designed to limit the overall risk/reward exposure of the promoter to an appropriate level – given the potential financeability risks of the project – through the use of dead-bands and cap and collar thresholds.
- The **sub-programme framework** poses a variety of challenges including greater complexity and workload relative to the programme-focussed options. This would include novel issues such as the segmentation of the scheme costs for different regulatory treatment. This framework may also tend to create incentives for cost over-statement and the manipulation of the cost allocation processes if the promoter expects financial incentives to be applied
- Despite this the sub-programme framework may offer a number of advantages by enabling greater flexibility and refinement in the application of cost efficiency mechanisms and methods throughout the scheme. The level of segmentation could also be tailored to reflect stakeholders appetite for additional complexity and workload and the variation of the schemes economic characteristics. The application of an overall cost envelope with risk layers for the promoter would also create incentives for the promoter to estimate and manage the overall costs of the scheme.
- Overall, our assessment is that both the cost-based and sub-programme approaches are likely to be viable and effective options for the regulation of the scheme. The sub-programme approach could have superior incentive effects but would have major implications for the complexity of the regulatory framework which would need to be considered carefully by the CAA. A programme focused incentive framework could be difficult to implement due to the challenges involved in defining scheme outcomes and efficient costs.
- The cost-based programme focused approach arguably has limited efficiency incentives but is well understood, relatively straightforward to implement and can deal with the uncertainty and potential changes in scope which could occur. The sub-programme approach could effectively combine the strengths of the cost and incentive frameworks by creating stronger incentives for some parts of the scheme whilst retaining flexibility and discretion where appropriate. These benefits come at the expense of greater complexity and workload for the CAA and stakeholders.

Assessment of framework options (cont.)

- On balance we consider that the sub-programme framework could be the most effective approach for the regulation of the scheme but note that there are a range of wider issues and challenges that the CAA would need to address in order to implement this framework effectively.
- This includes consulting stakeholders on the approach, setting out principles for cost allocation and identifying an appropriate level of segmentation, setting an appropriate overall contingency and cost envelope for the scheme and identifying an appropriate overall level of risk and reward exposure for the promoter. The CAA would also need to consider implications for its internal organisation and workload including requirements for consultancy support, headcount and cost assessment capacity for example. These issues could undermine the benefits of the approach relative to an enhanced cost based framework.
- The ability to assess an efficient ex-ante cost for individual sub-programmes or projects is a key requirement for the sub-programme framework. This may be a challenge for many parts of the scheme – but is likely to be feasible for at least some elements.

Illustration of the sub-programme framework

- To provide an illustration of the sub-programme approach we have developed a high level example programme for the regulation of the scheme describing the types of mechanisms that could be applied. We have used the AC cost forecasts and segmentation to provide an illustration of how the sub-programme approach could be implemented and the range of mechanisms and methods that could be applied by the CAA under this framework. The approach is illustrated on the following slides.
- An alternative segmentation could be considered by the CAA based on the latest scheme information – or to simplify the approach for example.
- We have assessed the economic characteristics of each sub-programme and grouped them into regulatory segments. This has resulted in six segments with different mechanisms and methods for each plus a range of overarching mechanisms and activities which would need to be undertaken to implement the framework.
- The mechanisms and methods applied to each segment are differentiated reflecting the economic characteristics, but generally we suggest that each segment is subject to negotiation with customers (the airlines) at the specification stage to define outcomes and estimate costs.
- The specification stage is a key part of the regulatory framework and is likely to provide opportunities to identify 'win-win' efficiencies through refining the scope of the scheme, whilst also facilitating a discussion over the most appropriate cost-quality trade-off. This stage will also be key to identifying an appropriate regulatory segmentation and the identification of elements of the scheme where financial incentives could be applied.
- For some regulatory segments such as the runway, the CAA may be able to identify a target cost against which the promoter could be incentivised through a cap and collar 'dead band' or thresholds set at different levels to reflect the appropriate strength of incentive as appropriate. Where actual costs fall outside of this 'dead band' the CAA could undertake an ex-post review to determine the reason for under or out-performance and determine an appropriate regulatory treatment of costs.
- For other regulatory segments such as the Terminal – the CAA may decide that it is not appropriate to set financial incentives as the risks, uncertainties and potential changes in scope are likely to be too great. However there may be opportunities for stronger incentives at the project level.
- The risk assessment for each sub-programme could result in a number of 'notified items' which would need to be monitored as the scheme progresses. A change in assumption associated with a notified item would then result in a prescriptive change in the target cost for the element of the scheme.
- In some cases it may also be possible for the CAA to identify appropriate output incentives. These might be linked with the successful delivery of projects or sub-programmes by a given deadline (i.e. Triggers), but wider output metrics could also be identified in some cases supported by consultation with airlines – such as the achievement of operational outcomes for service quality, security flow rates and other factors.
- Some of the sub-programmes and projects are non-customer facing (e.g. plant and land preparation projects). In these cases there may be limited benefits from customer negotiation over the design of the project. In others such as the terminal sub-programme customer consultation in planning and design will continue to be useful for enhancing the outcomes and design of the scheme and should be undertaken at an early stage by the promoter. Ongoing opportunities for customer engagement as the scheme progresses should also be provided.
- Where sub-programmes are not subject to financial incentives there may be a need for more intensive oversight by the CAA to increase the effectiveness of ex-post financial incentives. This could be achieved through several mechanisms including expanding or intensifying the role of the Independent Fund Surveyor (IFS).

Illustration of the sub-programme framework (cont.)

- The role of the IFS could be expanded or intensified to increase the likelihood of identifying inefficient costs. For example the IFS could provide active investigation of specific projects where the promoter's incentives for efficiency are thought to be weak. This could include a review of areas of the promoters project management processes and activities such as the design, option development, procurement, risk management, cost and contract control activities for specific projects.
- The CAA could also set out a set of principles for project procurement to ensure that the promoter achieves value for money. For example the CAA could require the promoter to seek approval, or notification of any project procurement which does not meet a minimum standard (such as securing a minimum of two bidders)/or requiring IFS oversight of procurements over a certain value for example.
- In addition to these sub-programme focused mechanisms, the CAA could also set an overall cost envelope for the scheme which would directly expose the promoter to any cost escalation beyond the envelope.
- This envelope could incorporate a contingency allowance to account for major risks and uncertainties. The CAA could also apply 'risk layers' to optimise the promoters risk exposure at different levels of cost escalation to manage impacts on financeability. The cost envelope could be linked to the promoters original cost estimate for the AC process for example, taking account of cost savings achieved in the specification stage.
- The diversity of projects within some sub-programme may warrant further segmentation at a project level to identify projects which can be targeted with specific efficiency mechanisms and financial incentives. This may also enable the CAA to align the framework to the promoter's project management process and apply mechanisms at appropriate points when greater information on costs and outcome specification is available.
- Potential mechanisms and methods which could be applied to each sub-programme within the scheme are illustrated in the following pages.

Specification sub-programme regulation map

The specification sub-programme will require a variety of mechanisms and cost assessment methods linked to the customer engagement process. The CAA could place requirements on the promoter to provide information, develop and identify options and assess risks for its plans. Airlines will have a key role in this process to represent the interests of their passengers. The CAA will also have a key role in representing wider interests and undertaking research to inform the process.

Early activities

- The promoters submission to the AC will form the starting point for the consultation
- The promoter could also be required to provide an indicative breakdown of the scheme to highlight key sub-programmes and major projects which could form the basis of the sub-programme regulatory framework
- The promoter and airlines will seek to develop these plans to reduce costs and select an appropriate trade-off between cost and quality
- The CAA will also have a key role to represent wider passenger interests, undertake research and provide scrutiny of the cost forecasts

Specification

Promoters initial plan	Consultation	Agree scheme specification
Promoter required to provide overall programme setting key timelines, sub-programmes and projects with reconciliation to AC submission	Promoter required to identify options for cost savings	CAA approval of scheme specification for submission to NPS/DCO process
	Consultation with airlines over scheme design/costs/outcomes	Assessment of appropriate contingency allowance
Promoter required to undertake risk assessment and highlight key risks, processes and contingencies, linked to sub-programmes	CAA appointed expert to provide review of promoters scope and cost estimates	CAA to set initial cost envelope for overall scheme and design layered incentives
CAA develops 'rules of engagement' for Constructive Engagement	Promoter assessment of costs sensitive to NPS and DCO approval	CAA approval of cost envelope supported by expert review to verify cost estimates
Promoter required to develop governance and procurement plan	CAA review of promoters governance and procurement plan	CAA approval of key risks and development of regulatory policy for treatment

CAA/CBB research on customer preferences for scheme design (e.g. Willingness to Pay research)

Development of sub-programme regulatory framework

Late activities

- The design, costs and outcomes of the scheme specification will largely be driven by consultation between the promoter and airlines, but the CAA will need to provide final approval
- This will result in a specification and Target Cost for the scheme
- There will be a need to identify key risks and develop a regulatory policy to account for these issues
- Failure of the promoter to deliver the scheme specification will result in a financial penalty
- Need to consider appropriate level of contingency allowance

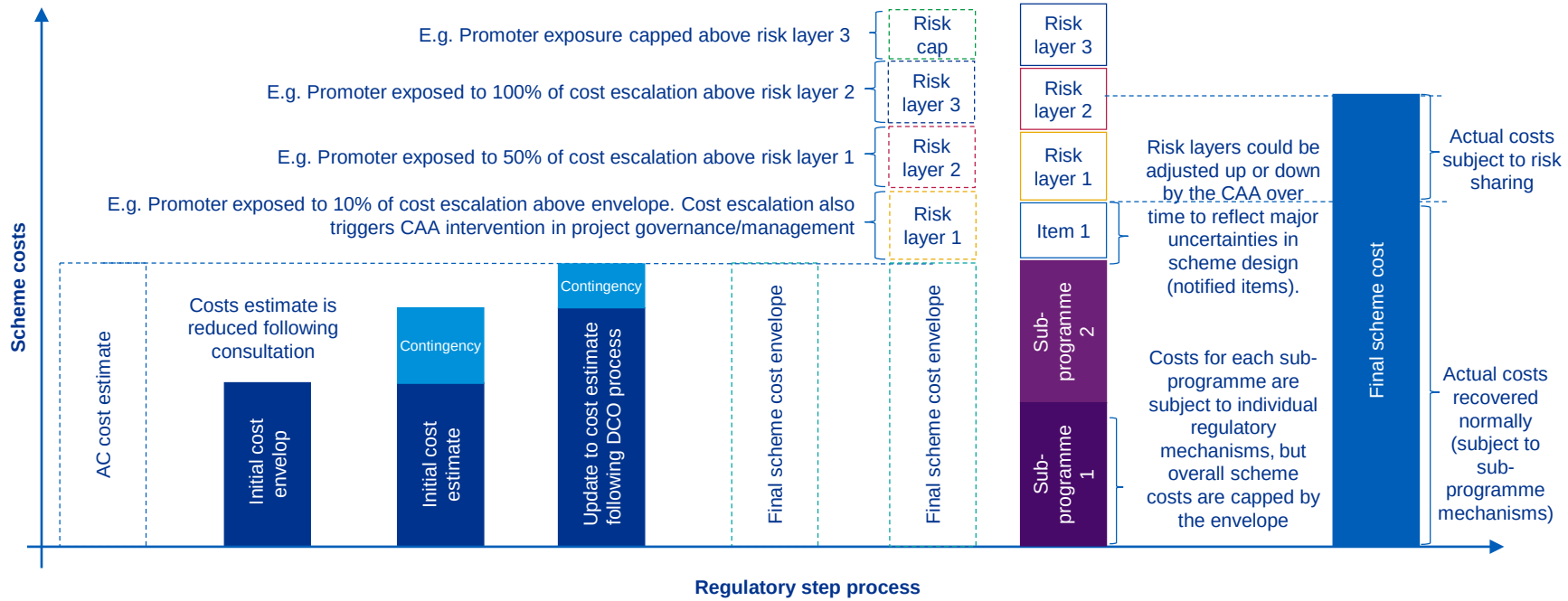
Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

The main objective for this sub-programme is to identify win-win cost savings and to take account of customers views on the cost/quality trade off. Through this process the CAA should also seek to identify an appropriate cost structure for the programme, potential risks and contingencies and regulatory policy to account for these.

Scheme cost envelope and layered incentives

A key objective for the specification stage is to identify a cost envelope for the overall scheme. This could be used to set overarching risk layers to determine the promoters exposure to cost escalation (after accounting for sub-programme risk mechanisms). This would provide the promoter with an overarching budget constraint for the scheme which will help to incentivise the management of overall costs, ensure that forecasts are as accurate as possible and all major risks identified at an early stage. It will be necessary to review the cost envelope at key points when additional information is made available including following the DCO stage. It will also be necessary to reconcile the envelope with sub-programme mechanisms. A illustration of the mechanism is illustrated below. The promoter would be required to provide regular updates on estimated scheme costs and notify the CAA when and if it expects to breach the envelope and risk layers. This could trigger further intervention by the CAA such as intervention in the delivery of the project or intensified IFS oversight.

Specification stage	Update to cost estimate and setting cost envelope	Final cost envelope
The specification stage will result in changes in scheme specification and target cost. There may also be a need for a contingency allowance to account for uncertainty and changes in scope. The CAA could be guided by the AC estimates and research on passengers willingness to pay.	The scheme cost estimates will need to be updated to take account of uncertainties such as the DCO process. The cost envelope can then be set with an allowance for contingency to reflect the potential uncertainty.	The promoter will be strongly incentivised to keep overall costs below the risk thresholds. Breaching the thresholds will impose penalties on the promoter and trigger intervention by the CAA such as intensified IFS oversight or halting the project to identify cost savings for example.



Planning sub-programme regulation map

The specification sub-programme will define the scheme, outcomes and costs which are considered through the planning process. The planning phase of the project will require the promoter to explain the scheme design to the public and ensure that impacts on wider stakeholders are mitigated. The planning stage will impose direct costs on the promoter, but could also have a significant impact on the design and costs of the overall scheme. The CAA should seek to ensure that the promoter has incentives to manage this phase efficiently.

Ex-ante activities

- Target cost and scheme outcomes set in specification stage through consultation with airlines and the CAA
- Promoter required to identify key assumptions about outcomes linked to NPS/DCO decision and the potential impact on target cost as a result of changes in the DCO decision
- Will likely include levels of compensation, environmental compensation and mitigation, extent of compulsory purchase, number of houses, levels of surface access mitigation etc.

Planning

Specification of scheme	NPS/DCO process	Outcomes
Target cost and outcomes developed in specification stage	Fast recovery of planning costs up to £10 million per year	Ex-post cost efficiency assessment of cat B costs over £10m
Key assumptions and risks for DCO process identified by promoter, with estimate of cost impacts/sensitivities to be agreed with CAA.	Slow recovery of capital over £10 million per year subject to efficiency review	Assessment of DCO outcomes – Impact on target costs and key assumptions
	IFS/IPCR monitoring of planning process and costs	Bonus/penalty linked to change in target cost and key assumptions
	Requirement to provide information to CAA and airlines	Addition of category B costs + bonus/penalty to RAB subject to efficiency review

Ex-post activities

- The NPS and DCO process are key risks for the overall costs of the scheme
- The process may result in requirements for mitigation and changes to the scheme which might increase costs. The promoter should anticipate and account for these costs in the original forecast
- The promoters incentives could be linked to the level of cost escalation relative to the original target cost
- The CAA could then reset the target cost-based on the outcomes of the DCO process

Financial Incentives
Regulatory Approval
Competition
Customer Bargaining
External Review
Control Mechanisms
Cost assessment

Cost assessment of the planning sub-programme could be achieved through high level benchmarking based on similar major project planning processes and the identification of key cost drivers such as the number of complaints or submissions and estimated number of days for the planning process. The assessment of efficiency is likely to require expert opinion based on evidence provided by the IFS.

Land and community sub-programme regulation map

The land and community sub-programme will involve the costs associated with compensating residential and commercial property owners affected by airport expansion. Residential properties will be subject to compulsory purchase rules. Retail and commercial properties will be subjected to slightly different processes. These costs will largely be determined by the planning process but there will be some scope for the promoter to achieve efficiency through its approach to commercial negotiation and potential for early purchase of land.

Ex-ante activities

- Specification stage will result in target costs and key assumptions about the outcomes of the DCO process
- Separate estimates of cost and regulatory treatment for residential and commercial properties
- DCO process may result in changes to those assumptions and target costs
- The promoter will need to agree a policy for compensation with the CAA and airlines

Land and community

Policy/strategy	Negotiation and CP	Outcomes
Promoter, airlines and CAA to agree compensation policy for residential and commercial properties (level above statutory minimum if any) and estimate target costs at specification stage	Promoter to develop strategy for minimising costs through early engagement and opportunities to purchase land early	Residential property compulsory purchase costs added to RAB directly as incurred subject to audit
Key assumptions and target cost for residential and commercial property reset following DCO process	CAA sets target costs and incentive mechanisms for commercial property (exposure of ±10%)	Commercial property target costs added to RAB based on target costs and assumed profile, subject to occurrence of identified risks. Promoter exposed to under/out performance.
Expert review of target costs with focus on commercial cost replacement value	Identification of specific risks associated with commercial compensation. Regulatory policy to specify treatment of outturn risks.	

Ex-post activities

- Residential costs will be passed through to the RAB based on actual costs with a light touch review
- Commercial costs will be added to the RAB based on target costs set following the DCO process.
- This will incentivise the promoter to ensure commercial negotiations are effective and provide low level of exposure to cost escalation

Financial Incentives **Regulatory Approval** **Competition** **Customer Bargaining** **External Review** **Control Mechanisms** **Cost assessment**

Cost assessment of land and community costs will differ between residential and commercial properties. Residential property compensation costs are driven by the number of properties, market values and level of compensation. These are largely exogenous outside of the direct control of the promoter. Commercial property compensation costs will require expert judgement and negotiation over appropriate reinstatement values.

Plant, runway and equip. sub-programme map

The plant runway and equipment based sub-programme will include some simple elements with clear outcomes, costs drivers and a wide range of potential benchmarks which may enable the CAA to assess efficient costs with a higher level of confidence than other parts of the scheme. The CAA could seek to apply strong financial efficiency incentives to this aspect of the scheme through setting target costs with financial incentive and risk sharing mechanisms reflecting the level of risk and certainty associated with the cost estimates.

Ex-ante activities

- Outcomes and target costs are defined in the specification sub-programme
- CAA could undertake a more intensive cost assessment of the sub-programme before setting a target cost
- Risks are also identified by the promoter and approved by the CAA with prescriptive regulatory treatment using notified items
- CAA may also consider overall risk/reward profile for the sub-programme

Plant, runway and equipment

Specification	Delivery	Outcomes
Initial target cost and outcomes developed in specification stage	Potential adjustment to target cost-based on notified items and regulatory policy	Target costs added to RAB in line with sub-programme specification and target cost
Sub-programme risk assessment undertaken by the promoter and approved by CAA to identify notified items and regulatory policy		Discretionary treatment of costs outside of risk thresholds
Promoter required to provide evidence of market testing for cost estimates		
CAA appointed expert review of sub-programme specification (for each sub-programme to identify further potential efficiency		
CAA sets final target cost and incentives/risk thresholds for items of cost		

Ex-post activities

- Target costs are added to the RAB and recovered through charges
- Potential for adjustments to target costs based on notified outcomes and regulatory policy
- No ex-post activities required unless actual costs fall above or below risk thresholds set by CAA.
- CAA may undertake ex-post review to inform the discretionary treatment of such costs.

Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

Cost assessment of these sub-programmes could be achieved through the identification of top-down and bottom up benchmarks from various sources. Costs for the runway for example could be compared against similar road type projects, whilst specific equipment costs and prices are likely to be available from various sources. For specialised items expert review of costs may be required.

Surface access sub-programme regulation map

The surface access sub-programme will require involvement and negotiation with third parties including Transport for London, Network Rail and Highways England over the scope, costs and delivery of major surface access projects required to deliver the scheme. The promoter will be expected to make a negotiated financial contribution to many of these projects. It may also be directly responsible for the delivery of some projects. In this case, where the CAA can estimate an efficient cost it may be able to apply financial incentives.

Ex-ante activities

- CAA to develop principles and policy for the estimation of surface access cost contributions
- This should inform the specification stage and initial estimate of costs and outputs associated with each project
- The DCO/NPS process may result in changes to this forecast that will need to be taken into account
- There may also be negotiations with third parties such as TfL and DfT over the level of contributions
- CAA to undertake expert review of cost estimates
- Directly procured projects can be incentivised where the CAA can set a cost estimate

Surface Access

Specification	Delivery	Outcomes
CAA principles and policy statement for the estimation of contributions to third party surface access projects	IFS monitoring of high risk direct procurement projects with no financial incentives	Direct procurement projects added to the RAB based on target costs linked to financial incentives
Initial target cost and outcomes developed in spec. stage	CAA monitoring of promoter/3rd party negotiations and approval of contribution	‘Contribution’ projects added to RAB as costs incurred subject to efficient negotiation
Identification of risks including NPS/DCO process identified by promoter at spec. stage	Expert review of evidence and transport modelling used to estimate contribution	Expert review of non-incentivised projects with RAB adjustment for inefficiency
CAA oversight of contribution estimation/negotiation process, potential appointment of expert to review modelling evidence		
Expert review of costs (for direct projects)		
CAA sets target cost and financial incentives on directly procured projects where appropriate		

Ex-post activities

- Project contributions to third parties will be added to the RAB as they occur
- Directly procured projects may be subject to financial incentives, with only target costs added to the RAB
- Where a direct project is not incentivised, an ex-post review of the costs supported by IFS monitoring should be undertaken to identify any inefficiency

Financial Incentives | Regulatory Approval | Competition | Customer Bargaining | External Review | Control Mechanisms | Cost assessment

Cost assessment of surface access costs will differ for direct and contribution based projects. Contributions will be driven by the relative value or benefits of the project to passengers and the mitigation of negative impacts. This will require scrutiny of modelling and assumptions. Directly procured projects will generally require expert review or benchmarking to set an efficient cost.

Terminal sub-programme regulation map

The terminal sub-programme may be the most complex part of the scheme with a wide range of inter-linkages with the wider airport and impacts on passenger and airline service quality. It may also be subject to a range of changes in project scope. This will make it difficult for the CAA to create strong efficiency incentives and motivates a framework with weaker financial incentives, but high levels of regulatory oversight through the development of the Independent Fund Surveyor role.

Ex-ante activities

- Terminal specification and cost envelope is developed in the specification sub-programme with consultation with passengers, airlines and CAA
- Key risks also identified
- The cost and specification of the sub-programme may need to be altered as the project progresses. This can be managed through the core and development capex process

Terminal

Specification	Delivery	Outcomes
Initial target cost and outcomes developed in specification stage	Engagement with CAA and airlines at key points of programme or risk occurrence	Ex-post cost assessment based on expert review of outcomes and IFS evidence
Sub-programme risk assessment undertaken by the promoter and approved by CAA to identify high risk issues	Changes in scope and target cost controlled through core and development capex process	Target cost added to RAB with discretionary adjustments for efficient changes in scope
Airlines and CAA to identify outcome incentives for the terminal sub-programme (date for completion, service quality etc.)	Triggers for defined project outcomes	Bonuses and penalties applied for outcome incentives
CAA to set financial incentives linked to identified outcomes	Enhanced IFS role – Intensified focus on high risk projects, review of procurement, project management and other issues. More intensive focus on high risk projects (i.e. sole source)	

Ex-post activities

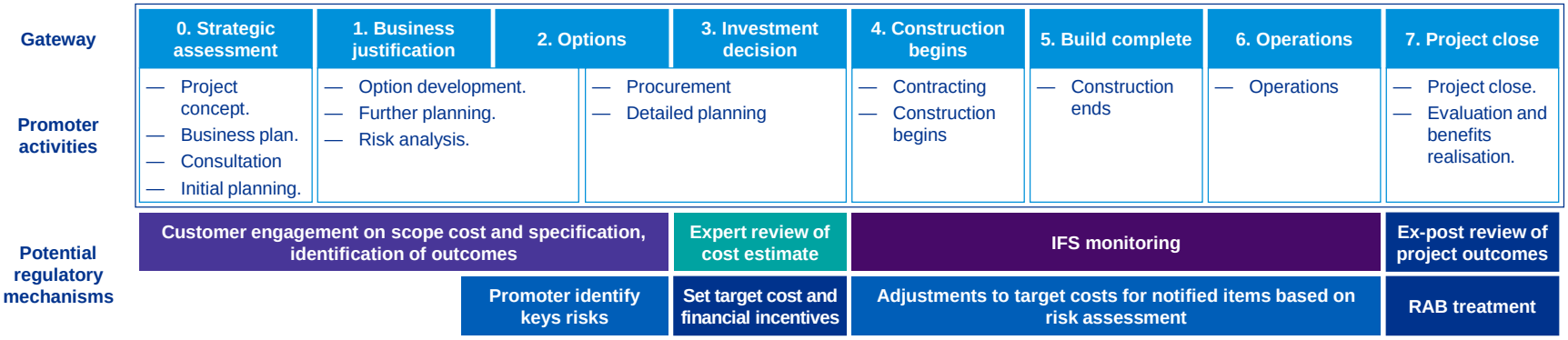
- Effectiveness of ex-post cost assessment will be key to creating incentives for efficient behaviour
- Increasing the likelihood of identifying inefficiency is key. This requires an intensification of the IFS role, with a focus on high risk projects
- The CAA can adjust the RAB to take account of changes in scope and identified inefficiency based on the cost assessment
- Output incentives can also be linked to RAB treatment

Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

Cost assessment for the terminal sub-programme will require a breakdown of the overall cost estimate into key projects with a specification and cost estimate for each. For some projects it may be possible to obtain top-down or bottom up benchmarks. Many projects will be bespoke and difficult to assess requiring expert review of the promoter's business case and estimates.

Project level mechanisms and methods

- As part of the sub-programme focussed regulatory framework, the CAA could seek to identify major projects which could be specifically targeted with incentive mechanisms. This could be achieved based on an assessment of the characteristics previously described at a project level.
- For example the Track Transit System is likely to be complex and subject to a range of uncertainties which will make it difficult to estimate an efficient cost and incentive mechanism.
- In contrast piers, car parks, control posts and some other projects may be more straightforward to assess enabling an incentive-based approach to be applied. These projects could be directly incentivised against a target cost based on benchmarks of similar projects.
- Project level mechanisms and methods would enable greater flexibility in the timing of cost estimates and assessment processes to align with the design progress of each project.
- Generally each project will progress through a set of defined project management decision 'gateways' moving from conceptual design (0-2), to scheme design (2-4) and scheme selection and detailed design (3), procurement and construction (4-5) and operations (6-7).
- The cost estimates, timing and outcomes of each project will evolve along this process as shown in the diagram below. In some cases projects may already have progressed some way through this process.
- At each stage the CAA could seek to apply different regulatory methods and mechanisms to the project as shown below. There will be a key decision point at which a single option is selected, after which cost forecasts can be set with a high degree of confidence based on market testing (usually gateway 3). This stage is a key regulatory decision point at which enough information is generally available to assess the viability of the project, identify key risks and costs, and attach regulatory mechanisms.
- At this stage, in addition to estimating a target cost, the CAA could decide whether or not to apply further efficiency mechanisms such as a cap and collar 'deadband' with prescriptive treatment for notified items.
- To streamline the process and provide the promoter with an understanding of the potential treatment of different projects, the CAA could set out a limited range of options for the regulatory treatment of major projects at the outset and notify the promoter of its selection at Gateway 3.



Implementation of the framework

- The mechanisms and methods described in the sub-programme approach are focused on individual parts of the scheme. In order to implement the programme the CAA may also need to undertake programme-based work streams and develop mechanisms to account for wider issues. In some cases these work streams will also be important for encouraging efficient behaviour.
- Depending on how the sub-programme framework is implemented – we have highlighted some of the key tasks and work streams that may need to be undertaken to implement the regulatory framework as follows:

— **Undertake consultation with stakeholders over the regulatory framework**, including the available options and CAA's preferred approach. This could include an illustration of the sub-programme framework comparing the benefits and drawbacks relative to the CAA's existing framework.

— **Require the promoter to update the business plan and cost forecasts for the scheme** and provide an initial scheme cost segmentation, bottom-up output specification, identification of risks and reconciliation with the AC cost estimate. This will provide a starting point to consider the potential segmentation and regulatory framework for the scheme.

— **Require the promoter to undertake a consultation with passengers and airlines on the scheme outcomes and design options** (the specification stage). This should include assessing the outcome and scope of the scheme and identifying options for major cost reductions, of for example 10% and 20%. This will be a key opportunity to identify cost savings and define the desired outcomes and trade-offs for the scheme.

— **Develop a sub-programme and project-based segmentation of the scheme**-based on an assessment of the promoter's updated business plan, scheme breakdown and the identification and assessment of project characteristics. This report provides an indicative segmentation based on the AC reports. The CAA could consider alternatives with greater or lessor levels of segmentation reflecting the need for stronger efficiency incentives and capacity for additional complexity and workload.

— **Develop mechanisms and methods for each sub-programme** based on the project characteristics and overall consideration of the strength of incentives, risk and regulatory complexity. This could involve a range of different approaches being applied to the scheme including the application of financial incentives where the CAA is confident of setting an efficient target cost, identifying risks and accommodating changes in efficient scope.

— **Develop principles for cost allocation** to be adhered to by the promoter to ensure that the scheme segmentation and separate regulatory treatment is effective, and commit to an ex-post review of the promoters adherence to these principles.

— **Consider how the scheme framework will be reconciled with the framework for the existing assets**, including the timing and frequency of cost assessments and RAB adjustments and linkages between the scheme and existing regulatory processes.

— **Develop a 'shortlist' of options for the regulatory treatment of projects** and sub-programmes to give the promoter clarity on the range of risk and reward it could be exposed to on any particular project.

— **Consider the potential expansion and/or intensification of the role of the IFS** including potential oversight of procurement and project management processes for example and the types of project where oversight is likely to be most beneficial. This could require a review of existing IFS outputs.

— **Estimate an overall cost envelope for the scheme**. This could provide a contingency allowance to account for risks and uncertainties and define risk layers to ensure that the promoter is exposed to cost escalation beyond the envelope. This could be linked to the promoters original cost forecasts and AC estimates for example.

Implementation of the framework

- **Consider the overall level of risk/reward for the scheme** and the proportion of cost which could be subject to financial incentives. There may be practical limits to the level of risk exposure that can be applied to the promoter. There may also be limits to the level of cost escalation that can be recovered from passengers through charges.
- **Place a requirement on the promoter to provide a regular update of scheme related expenditure against budget/target costs**, and forecast cost to completion for the overall scheme. Require the promoter to give notification if/when scheme costs are expected to exceed the cost envelope.
- **Place a requirement on the promoter to undertake a risk assessment as part of the development and update of the business plan and specification stage**. This will identify significant risks within each segment of the scheme. The CAA may provide a prescriptive regulatory treatment for those risks. The promoter could also be required to maintain a risk register and give notification when new risks are identified during delivery.
- **Develop options for intervention in the event that the scheme costs are forecast to exceed the cost envelope**. This could involve a range of contingent mechanisms such as direct intervention in the management of the project through the appointment of a Project Representative, a requirement for the promoter to identify cost savings or a review the promoters activities and the reasons for cost escalation to inform the ex-post treatment of costs.
- **Undertake contingency planning for potential scheme outcomes.** Significant cost escalation above the scheme cost envelope and risk layers could ultimately threaten the viability of the promoter and the delivery of the scheme. In this event the CAA would need to consider a course of action to protect the interests of passengers.
- **Develop a mechanism to enable ongoing changes in project scope** where mutually agreed between the promoter, airlines and the CAA. This mechanism could be based on the existing core and development capex mechanism, but would also need to account for the impact of scope changes on new regulatory mechanisms, target costs and the overall scheme cost envelope. The CAA may also need to ensure that future airlines and passengers interests are represented in this process.
- **Develop an overall regulatory work plan** taking account of the level of segmentation and nature of the mechanisms and methods applied in each sub-programme. Based on this work-programme **consider the overall requirements for the CAA** to deliver the framework effectively. This will involve an assessment of headcount, technical skills and the range and type of consultancy expertise that would be required. Under the sub-programme framework there is likely to be a need for greater expertise and support in cost assessment for example.
- **Consider the need for ongoing consultation** of airlines and passengers by the promoter and the main opportunities for this through the duration of scheme delivery. The main opportunity for consultation will occur in the specification stage. Some parts of the scheme will benefit from ongoing engagement with stakeholders, on the other hand once the outcome specification and target costs/envelope for the scheme is set it may be difficult to facilitate changes.

Implementation mechanisms map

The sub-programme framework will add some complexity to the regulatory framework. In addition to the mechanisms being applied to the individual sub-programmes, it will be necessary to undertake a wider range of activities to ensure that the framework is developed and implemented effectively. This will include consulting stakeholders on the overall framework to be adopted, defining the regulatory segmentation of the scheme, ongoing cost and risk monitoring and developing regulatory options to respond to cost escalation.

- Consultation on the proposed regulatory framework will be key to refining the framework and identifying an appropriate regulatory segmentation
- There may be benefits from enhancing or intensifying the IFS role
- It will be necessary to develop a regulatory segmentation of the scheme. This can be informed by the characteristics of the sub-programmes and projects within the scheme

Framework implementation

Preparation

- Consultation on preferred regulatory framework
- Setting principles for cost allocation (between sub-programmes)
- Enhancement of IFS role
- Development of 'shortlist' of project incentive options
- Regulatory segmentation of the scheme into defined sub-programmes and projects and assessment of overall risk and reward exposure for the promoter

Ongoing mechanisms

- Requirement for the promoter to provide ongoing monitoring and update of cost forecasts
- Requirement for the promoter to provide ongoing monitoring of risks and update of risk register
- Developing regulatory options to respond to cost escalation in the event that cost forecasts exceed the envelope
- Reconciliation of scheme with existing regulatory framework including time periods for review and RAB changes
- Scope variation mechanisms (Core and development capex process)
- Review of CAA organisation and requirements against framework work programme
- Contingency and scenario planning to prepare for potential risks and outcomes (such as cost escalation and promoter failure)
- Ongoing consultation with airlines and passengers

- The promoter may be required to provide regular updates on actual spend and cost forecasts against the scheme cost envelope
- Where the promoters cost forecasts indicate that the scheme will exceed the cost envelope the CAA could decide to apply further mechanisms
- This could involve more intensive monitoring of the promoters activities through the appointment of a project representative

Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

The promoter will have responsibility for undertaking ongoing monitoring of costs (both actual and forecast) and risks and provide regular updates to the CAA. Cost forecasts will be compared against the cost envelope to identify potential cost escalation – potentially triggering regulatory intervention. This will create incentives for the promoter to manage overall costs and provides the CAA with information on the overall progress of the scheme and the outlook for future risks.

KPMG

Section 1 Introduction

Objectives of the study

KPMG has been appointed by the Civil Aviation Authority (CAA) to undertake a study on the approach to overseeing the cost efficient delivery of new runway capacity. The objective of the study is to review potential approaches to regulating capital cost efficiency, including:

— An initial sift of possible methods for assessing cost efficiency, and mechanisms for incentivising efficient delivery, to identify those methods and mechanisms that may be suitable for applying in the case of a large airport expansion scheme.

— A further assessment of these methods and mechanisms to identify those that appear most suitable for ensuring that airport expansion is delivered cost efficiently in the interests of users.

— Recommendations that describe one or more effective regulatory strategy that will help to ensure that airport expansion is delivered cost efficiently and in users' interests.

— An overall programme and strategy that will help to ensure that airport expansion is delivered cost efficiently and in users interests, covering the stages in the process of designing, constructing and operating new capacity at which the CAA could intervene, how it could intervene and how the approach might vary as the scheme progresses.

This document is our Final Report to the CAA. It:

— Describes the stages and risks involved in the development of major infrastructure schemes and major airport enhancements in particular.

— Reviews the options for assessing and incentivising capital cost efficiency across regulated network infrastructure.

— Develops a methodology to describe and assess the suitability of alternative regulatory frameworks.

— Identifies the range of regulatory efficiency mechanisms and cost assessment methods that could be applied by the CAA to the scheme.

— Assesses the pros and cons of applying different regulatory frameworks to the new runway scheme.

As instructed by the CAA, we consider the regulation of capital cost efficiency in relation to a 'generic' airport that reflects aspects of all three runway expansion schemes reviewed by the Airports Commission (AC). Our analysis has been informed by the nature of these schemes in combination. Our analysis is not limited by the existing regulatory framework at each of the airports but it does consider project characteristics which have led to the selection of the existing framework which remain relevant for the new runway scheme. A short description of each scheme is provided in Appendix 1.

Approach to the study

Our approach to this study and the main sections of the report is described below.

Section 2. Understanding airport schemes

Programme 'map'	Programme risks	Project governance

In Section 2 we develop a 'generic' programme map based on the proposals reviewed by the AC and our wider understanding of major scheme delivery. We identify key activities, processes, timescales and types of cost for the runway scheme. We also identify high level major risks based on a review of AC and other evidence.

Section 3. Defining the regulatory framework

Regulatory frameworks	Economic characteristics of major projects	Characteristics of the new runway scheme

In Section 3 we identify major project case studies and define the dimensions of the 'regulatory framework' providing an overarching description of the approach to achieving cost efficiency. We identify the scheme characteristics which are linked with different frameworks and provide a high level assessment of which could be applied to the scheme.

Section 4. Regulatory mechanisms

Cost efficiency mechanisms	CAA's existing mechanisms	Mechanisms for the new runway

In Section 4 we develop a long list of regulatory mechanisms and methods which could be applied under different regulatory frameworks. We identify the mechanisms which are already applied by the CAA and those which could be developed for the new runway scheme.

Section 5. Developing the regulatory programme and strategy

Framework options	Assessment	Overall programme and recommendations

In Section 5 we summarise the findings of the previous sections and develop a set of overarching options for the regulatory framework for the scheme. We assess each of these options and conclude with an overall assessment and recommendation for the design of the framework.

Key terms used in this report

Throughout this report we refer to a number of terms which have a specific meaning. These key terms are described below.

Term	Description
Airport programme	The overall airport project encompassing all work required to deliver the scheme.
Airport sub-programme	Major element of the overall airport programme, consisting of multiple major projects, for example the Terminal or Runway.
Airport projects	A defined project within the airport programme or sub-programme with specified outputs, costs and timescales. For example the baggage handling systems, or car parks.
Regulatory framework	The overarching approach to the regulation of the airport capacity programme including the mechanisms and methods applied to ensure cost efficiency.
Regulatory framework dimensions	Dimensions of the regulatory framework used to describe the economic features of the overall approach.
Cost efficiency mechanisms	Mechanisms which can be applied within a regulatory framework to incentivise efficiency.
Cost assessment methods	Methods which can be applied to estimate the efficient costs of a programme, sub-programme or project.
Project characteristics	Characteristics of the programme, sub-programme or project which influence the specification of the regulatory framework, cost efficiency mechanisms and cost assessment methods used.

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Section 2 Understanding airport expansion programmes

Overview of Section 2

This section provides a description of a 'generic' airport expansion scheme. It also provides an overview of the promoter's potential approach to project governance, project management, procurement and risk explaining the potential approaches to these overarching aspects of the scheme. It is divided into sub-sections: Section 2.1 describes the programme map which provides a structured illustration of the key activities, processes, timescales and types of cost for airport capacity expansion schemes. Section 2.2 considers the risks that are associated with airport capacity expansion and highlights those which are likely to be of greatest significance. Section 2.3 provides an overview of the key issues and approaches to governance, management, procurement and risk and Section 2.4 draws out the implications for the economic regulation of the project.

2.1 Programme map

— Overview of the programme map including:
- Runway capacity expansion objective
- Competition phase and award
- Programme Delivery Structure and stakeholders
- Capital life cycle and delivery
- Operation of new runway capacity

2.2 Programme risks

— Risk assessment framework including:
- Typical programme risks
- AC risk assessment
- Long list of risks
- Top risks; overview and project stage and ability to control

2.3 Programme governance, management, procurement and risk

— Overall governance structure of the programme.
— Promoter's approach to management, procurement and risk.

2.4 Implications for economic regulation

— Implications of the programme map for economic regulation.
— Implications of programme risks for economic regulation.

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Section 2.1 Programme map

Introduction to Section 2.1

In this section we provide a description of airport capacity expansion schemes based on a desk-based review of the AC submissions, our experience and involvement with major infrastructure schemes elsewhere, together with identified best practice principles in project governance, management, procurement and risk. The description of the programme map is structured across five phases as follows:

- Phase 1 – Runway capacity expansion objective. What is the objective of the scheme?
- Phase 2 – Competition phase and award. Which scheme provides the greatest overall benefits?
- Phase 3 – Programme delivery structure. How will the promoter organise the delivery of the scheme?
- Phase 4 – Programme delivery activities. How will the promoter manage the delivery of the scheme?
- Phase 5 – Operation of new runway capacity. How will the promoter manage the transition of the scheme from construction to operation?

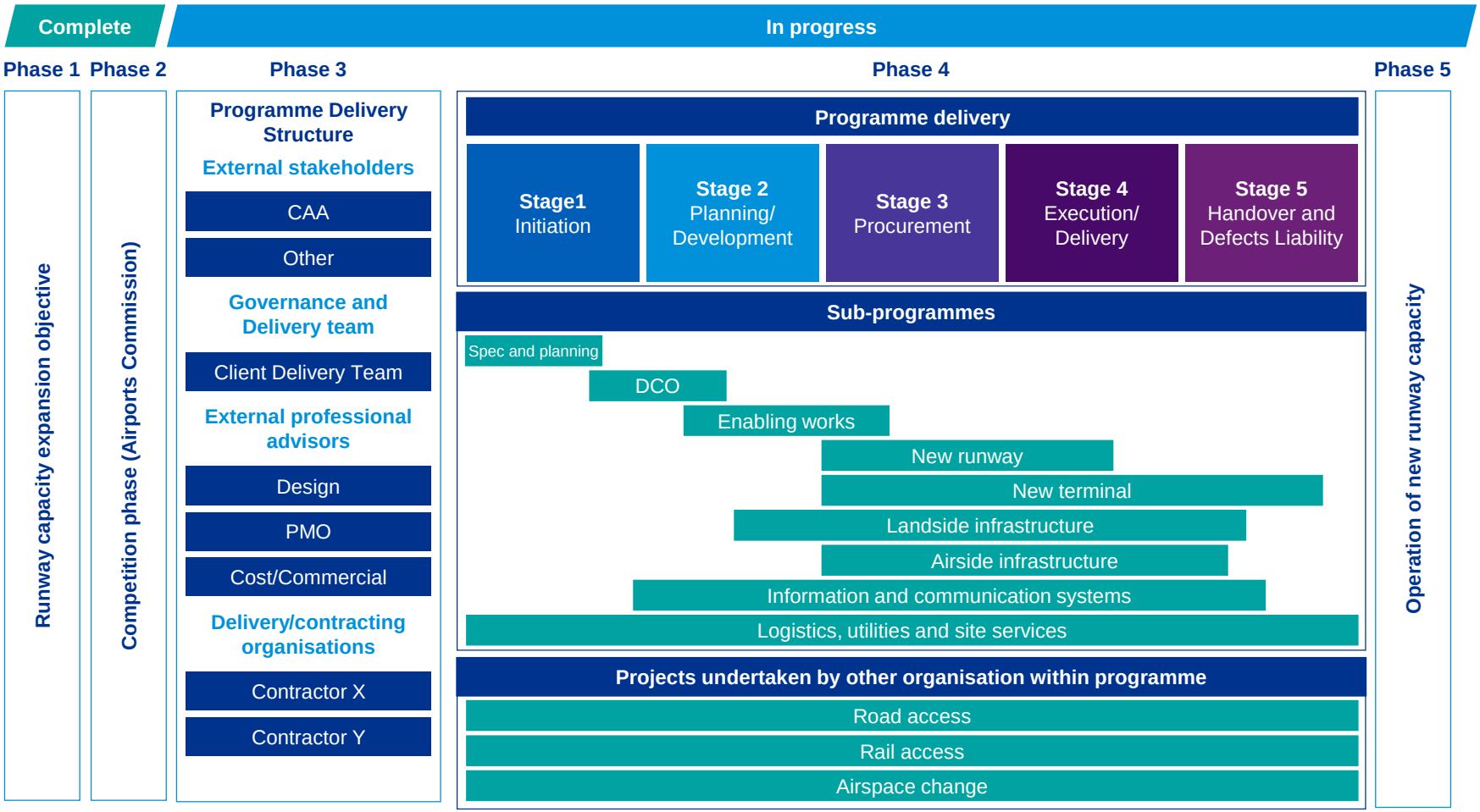
An overview of the programme map and each of the five phases is presented in a diagram on the following page and described in more detail throughout the remainder of this section. The organisation, activity and outcomes of each phase have implications for the costs and efficiency of the scheme and the CAA's approach to economic regulation. In the remainder of this section we highlight the possible implications of each phase to assist the development of a regulatory strategy.

Within each phase a variety of activities will occur. These activities, the way in which they are managed, the incentives faced by the operator and the potential role of the CAA are a key part of the regulatory framework. Where phases have already been completed the CAA will have limited ability to influence outcomes but those outcomes may have implications for the remaining phases which need to be considered.

Phase 1 has been completed through the AC process and the Governments wider acceptance of the need for additional airport capacity. This phase has not explicitly addressed the CAA's objectives and general duties. Phase 2 has also largely been completed with the Government confirming its support for the Heathrow scheme (although the final decision will require a Parliamentary vote in 2017 or 2018). Phases 3, 4 and 5 is where the CAA can therefore have the most influence through its regulatory strategy.

Programme map

The delivery of the scheme will involve several phases – some of which have already been completed. The CAA could seek to apply regulatory methods and mechanisms to different parts of this programme. The impact of regulatory intervention on overall efficiency will differ across each phase.



Phases of the programme map

Phase 1. Runway capacity expansion objectives	Phase 2. Competition phase and award	Phase 3. Programme delivery structure	Phase 4. Programme delivery activities	Phase 5. Operation of new runway capacity
— AC objectives for scheme proposals include those related to: - Strategic fit - Economy - Surface access - Environment - People - Cost - Operational viability - Delivery. — Informed by previous expansion plans and the legacy of planning and political decisions. — Competing arguments over the benefits and costs of different schemes. — Highly contentious due to impact on noise, air pollution, costs, surface transport impacts, employment and the potential effects on existing businesses. — CAA provides technical input into the requirements of the project, but does not define objectives.	— AC undertook independent analysis of proposed schemes, which led to the shortlisting of schemes. — Detailed business cases and costs developed by promoters and reviewed by the AC. — Some assessment of costs has been undertaken, but the decision process was not designed as a regulatory cost scrutiny exercise. — Competitive pressure between the scheme promoters relied upon to incentivise cost efficiency. — This may have created incentives for optimism bias. — Not clear what role these cost estimates have as part of the regulatory framework (i.e. costless bid). — CAA's objectives and duties not explicit part of criteria for the project selection.	— Programmes delivered through complex supply chains vulnerable to external risks. — Multiple participants often with different objectives. — Effective management and interaction of delivery partners and stakeholders is important for the programme. — The participants are broadly from four groupings: - External stakeholders including CAA/government/public/ Transport for London/ Highways England etc. - The client body/ executing organisation. - Professional advisors, supplement the executing organisations capability. - Delivery/contracting organisations.	— The delivery programme can be considered in five main stages: initiation, planning and scheme development, procurement, delivery, and hand over. — Within a generic airport programme there might be eight major sub-programmes aligned to different parts of the scheme. — Each of these sub-programmes will also contain a variety of 'projects. The breakdown of sub-programmes and projects could differ across the schemes. — Third party organisations will also have to undertake specific projects as part of scheme delivery – such as work related to the M25 and other surface transport upgrades. — These organisations are often outside the direct control of the promotor and CAA and have their own objectives and priorities in relation to the scheme.	— Runway capacity is expected to be operational before 2030. — Transition from construction to operational phase with passenger and aircraft using the new facilities will create specific risks. — Design of project capital costs will have an impact on whole life costs in operational phase. — Once operational, design and construction risk will diminish but transition, commercial and other operational risks (safety etc.) become more significant.

Runway capacity expansion objectives

The AC's appraisal of proposed runway expansion schemes was based on a consideration of business cases and the potential contribution of each to the AC's objectives for the project including:

- Strategic fit
- Economy
- Surface access
- Environment
- People
- Cost
- Operational viability
- Delivery

The CAA has not provided a view on each of the schemes but has endorsed the AC's view that there is a strong case for the expansion of runway capacity. The CAA has noted that without additional capacity passengers are likely to suffer from higher prices and congestion, leading to less choice and lower service quality. The CAA has also noted that the expansion scheme is likely to have an impact on airports and airlines' environmental performance.

The objectives and outcomes of the scheme will also have significant implications for the CAA's objectives and general duties which include issues relating to: market structure and competition, market regulation, value and choice for airlines and passengers, environmental performance, cost efficiency, scheme deliverability and financeability. These objectives and general duties may not have been fully considered by the AC.

- The AC has recommended the Heathrow North West schemes on the basis that it provides the greatest overall benefit and performance against wider objectives. This scheme has the highest cost of the shortlisted options. The CAA could consider and identify both the benefits and costs of the scheme when considering how to incentivise its efficiency as part of the regulatory framework.
- Higher scheme costs may be offset by benefits related to airline operations, environmental impacts, consumer choice, resilience and other factors. The delivery of these benefits are an important part of the efficiency of the scheme and could be considered by the CAA.
- In addition to the costs and benefits of the scheme identified by the AC, the CAA will need to consider its own objectives and general duties and the wider impacts of the scheme and how these may influence its regulatory framework to maximise efficiency.

Competition phase and award

The AC has undertaken an appraisal of each of the airport schemes based on its own analysis and evidence presented by scheme promoters. This included some high level scrutiny of the costs forecasts. The cost estimates prepared for this purpose are likely to be subject to some uncertainty and may not yet be appropriately robust for setting regulatory cost forecasts, for example because the scope or design of the scheme may change.

These costs forecasts may provide an important benchmark and evidence base for the regulatory framework as the promoter's incentives at this stage have been to minimise the costs of the scheme to win selection. On one hand this means that the costs forecasts are likely to reflect the promoter's view of the efficient costs of the scheme. On the other hand it is possible that the promoters have been overly optimistic. We note that the appropriate level of optimism bias applied to the scheme costs has been an important issue in the AC process. The AC cost forecasts could also be a useful part of the evidence base for the CAA's framework, although the precise role of the cost forecasts does not appear to have been explicitly described by the AC.

Following scheme selection, the Government will need to produce an Airports National Policy Statement (NPS) setting out the need for a Nationally Significant Infrastructure Project (NSIP), which requires parliament and the public to be consulted. Once achieved, a promoter would then be able to develop proposals on how they would deliver the NSIP and submit to the planning inspectorate (PINS).

The PINS must make a recommendation to the Secretary of State within nine months of receiving the submission, which must take account of views of interested parties. The Secretary of State must then decide whether to grant a Development Consent Order (DCO). This process could result in changes to the original project plan to mitigate certain risks or issues for third party stakeholders.

Alternatively the scheme could be granted planning consent directly by an Act of Parliament, when this is in both public and private interests and may be introduced and debated as a hybrid bill. This approach was used for the Channel Tunnel Rail Link, CrossRail and HS2. This approach would in theory give more control to the government over the timetable for progressing the planning process and the ultimate design of the scheme. Both of these options are subject to significant uncertainty which could lead to changes in the original plan. The award phase of the scheme is therefore subject to risks which could lead to cost increases.

- The AC process has produced detailed business cases and cost estimates that would not normally have been developed in such detail at this stage of a major project. These costs are likely to reflect the promoter's view of the efficient costs of the scheme, but may be subject to optimism bias and uncertainty linked to general uncertainty and risk and the potential for changes in scope.
- The business cases and cost forecasts could be a useful benchmark of efficient costs which could be considered by the CAA.
- The regulatory assumptions or proposals of each of the promoters may also influence the level of confidence each places on their cost forecast.
- Once the award has been made the government will need to develop an NPS or Act of Parliament to ensure the scheme progresses. The planning process may result in changes in the scope of the scheme which could also have cost implications.

Phase 2. Competition phase and award

The Airports Commission process

The capex forecasts for each of the three schemes have already gone through a process of review and scrutiny by the AC. The objective of this process has been to normalise and cross-check the forecasts provided by the promoters for consistency in the appraisal and to identify potential options for reducing costs. There has been some high level scrutiny of costs, but this may not necessarily reflect the level of analysis typically undertaken by the CAA as part of a regulatory review linked to setting charges. The cost forecast developed as part of this process could potentially be useful for the regulatory framework. The boxes below provide a summary of the steps which have been undertaken by the AC.

Promoters develop cost forecasts and supporting material

- Promoters develop cost forecasts and supporting material to support their submission to the AC.
- Material developed using promoter's own approach to cost estimation with some differences in levels of detail, terminology, risk adjustments, optimism bias and other factors.
- Some promoters have submitted additional independent reviews of cost forecasts to support their case.

AC interim review of cost forecasts

- Disaggregation of project costs into 'core', scheme, asset replacements and surface transport elements.
- Normalise promoter submissions into standardised framework with common terminology to enable comparison.
- Determine effective unit rates for key inputs/outputs.
- Adjustments to normalise unit rates.
- Adjustments to normalise risk.
- Adjustments to normalise on-costs.
- Develop new estimates of optimum bias.

Re-submission of cost forecasts

- Promoters respond to and challenge AC assumptions and analysis.
- Promoters provide refinements of cost forecasts to reflect adjustments and normalisation of specific items highlighted by the AC.
- Changes to reflect refined optimism bias assessment.

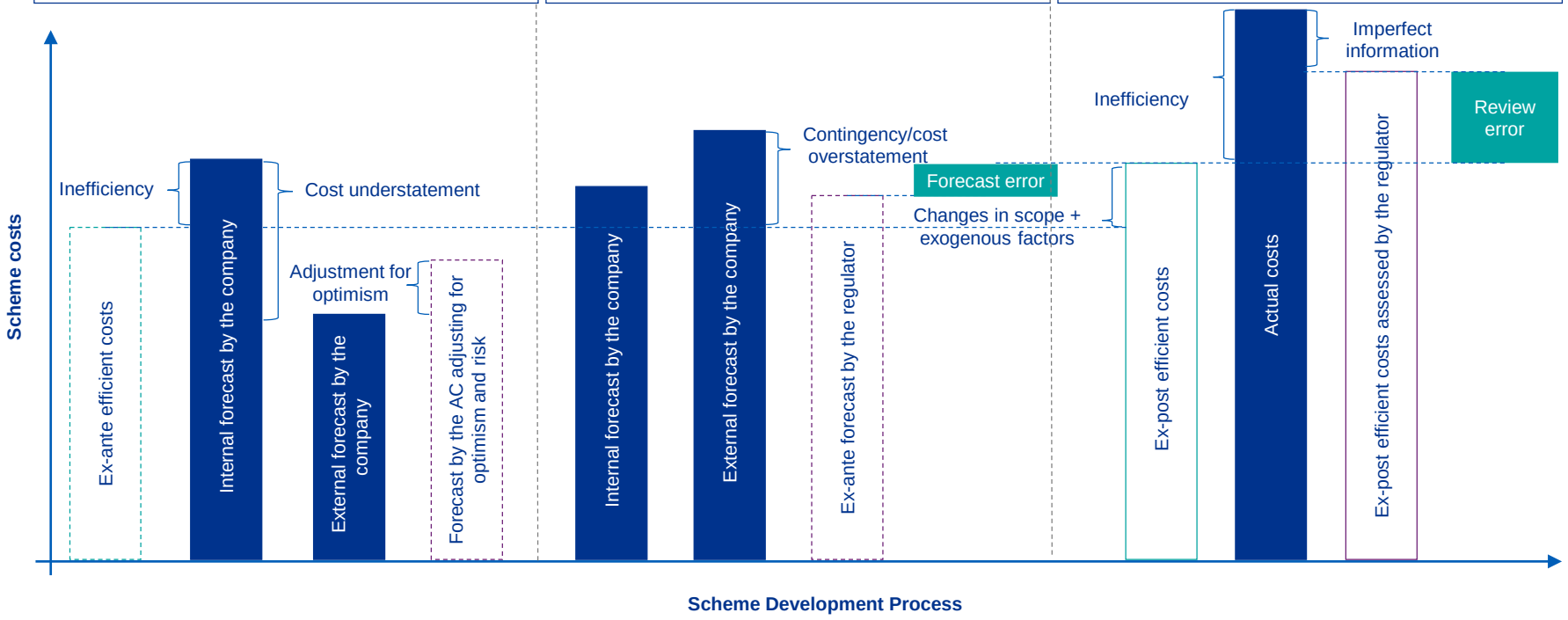
AC final view of costs forecasts and scenarios

- Identification and cost estimation for 'reduced scope' scenarios.
- Intended to illustrate the potential for cost efficiency based on main options for reducing project scope.

The Airports Commission process (cont.)

The AC process has added an additional dimension to the cost forecast process which could potentially provide useful information for the regulatory framework. During the AC process, the promoters have had an incentive to under-declare costs in order strengthen their case and win selection. This may have incentivised an efficient cost estimate, but may also have created incentives for optimism bias. These cost forecasts may provide useful benchmark information for the CAA about efficient costs – but may also underestimate the true costs. The diagram below provide an illustration of the potential incentives and outcomes of the process.

AC process – pre-selection	Regulatory process – post-selection	Treatment of outturn costs
During the AC process, promoters have an incentive to understate costs in order to maximum the apparent benefits of their scheme.	After winning selection the promoters incentives will change depending on the regulatory framework being assumed. Under a RAB based framework – incentives for cost control may be limited.	There may be a difference between the forecasts and actual costs. The regulatory framework will determine how such costs are treated and the exposure of passengers and the promoter to cost escalation.



Risk and optimism bias

The AC's optimism bias adjustment was based on HM Treasury Green Book guidance, with uplifts based on the table below showing adjustments for risk, mitigated optimism bias (MOB) and full optimism bias (FOB) which reflect the maturity of scheme design.

The rationale for the application of an adjustment for optimism bias and risk was that:

— Adjustments for optimism bias and risk are widely applied to the assessment of major infrastructure schemes to reflect systematic tendency for project appraisers to be overly optimistic.

— An appropriate level of contingency is required to ensure the assessment of commercial viability and financeability is robust in the event that costs are materially higher than expected.

Optimism bias adjustment applied by the AC

	Type	Risk	MOB	FOB
Airport	Scheme capex	20%	15%	45%
	Core capex	n/a	10%	15%
	Asset replacement	20%	15%	45%
	Opex	0.5% p.a.	15%	41%
Surface access	Road capex	n/a	44%	
	Rail capex		66%	

HAL and GAL were both concerned by the the AC's approach to the optimism bias adjustment and sought to reduce the level applied.

The promoters made several arguments to support the lowering of the optimism bias adjustment including:

— **Experience:** Promoters have undertaken construction projects of varying sizes before and as such have the knowledge to deliver projects within the expected costs.

— **Risk management procedures:** Experience of project design and management has led to the implementation of rigorous change/risk management procedures.

— **Private sector incentives:** Adjustments for optimism bias are primarily intended to counter the tendency towards underestimating costs in the public sector where commercial incentives are weaker. The promoters felt the adjustment has less relevance in the private sector where there is a duty to lenders and shareholders. Airports also highlighted the importance of their reputation in respect of both forecasting and delivery which means that they have limited incentive to create biased or poorly developed forecasts.

— **HMT Green Book:** Some promoters criticised the specific approach to optimism bias used by the AC stating that the principles of the Green Book Supplementary Guidance, particularly the split of costs between categories, was ineffective.

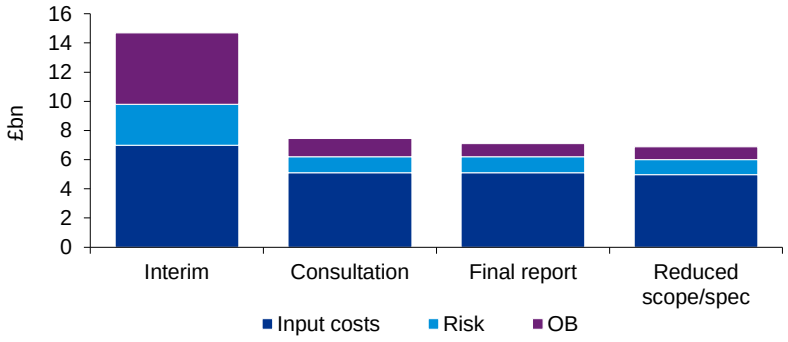
Evolution of costs forecasts

As a result of the optimism bias adjustment, scheme cost forecasts have evolved through several iterations. Estimated costs between the interim report and final reports fell for all schemes primarily because of reductions in the level of optimism bias applied by the AC. The cost estimate for LGW 2R fell from over £14 billion to around £7 billion for example.

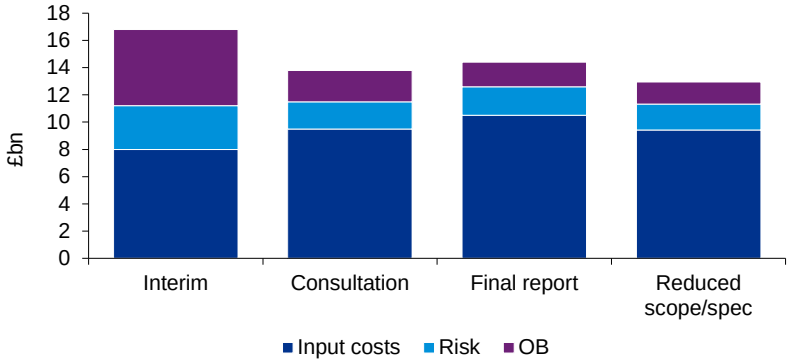
The AC process also resulted in an estimate of 'reduced specification' plans. These costs were based on potential cost savings through reducing the scope of the scheme.

The AC process has therefore provided some detailed analysis of the scheme costs, with multiple iterations reflecting consultation with stakeholders. The accuracy and reliability of these costs is an important issues for the design of the regulatory framework and could be considered by the CAA as a possible benchmark – although the specification of the scheme are likely to evolve.

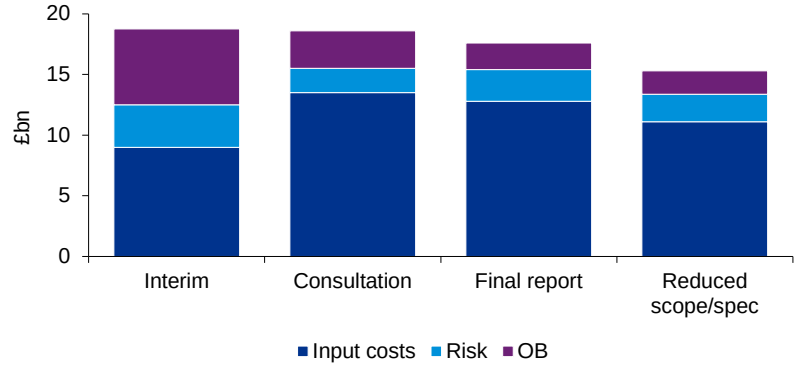
LGW 2R



LHR ENR



LHR NWR



Source: Airports Commission, Final Report, July 2015.

Programme delivery structure

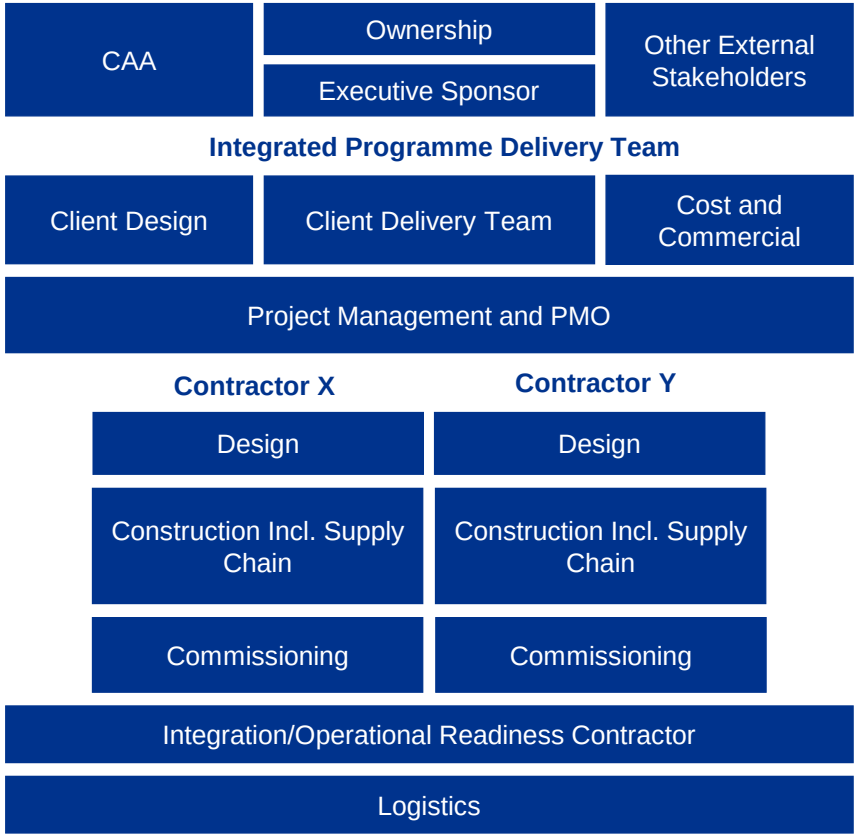
There are four broad groupings of participants involved in the delivery of the new runway scheme:

- External stakeholders including CAA, government and other organisations (such as Highways England, Network Rail and TfL)
- The promoter body/executing organisation
- Professional advisors supporting the promoter
- External delivery/contracting organisations

The design, governance and organisation of the delivery structure is important to the success and efficiency of the scheme and the CAA could seek to scrutinise the proposed structure to ensure that the promoter's approach is robust and in line with best practice.

The promoter is likely to have a well-developed Programme Delivery Team based on its existing processes and experience but the capability and governance of this structure may not be suitable for the delivery of the scheme or designed for the level of external interaction required with other stakeholders for example. There may also be differences in approach between Heathrow and Gatwick. The promoter's approach to this issue is therefore important and could be examined by the CAA.

The number of sub-contractors likely to be required could also have impacts on project interactions, the supply chain and the management of potential risks. There could also be conflicts of interest between stakeholders which need to be managed.



- The programme will require the interaction of multiple stakeholders with different interests and priorities. The CAA may have a role in ensuring stakeholder interactions are managed effectively through scrutinising the planned programme delivery structure.
- The ownership and organisation of the promoter and its delivery team is an important issue for the management of risks and delivery of the scheme. The CAA will need to understand the existing structure and the promoter's proposals for the delivery of the new runway.

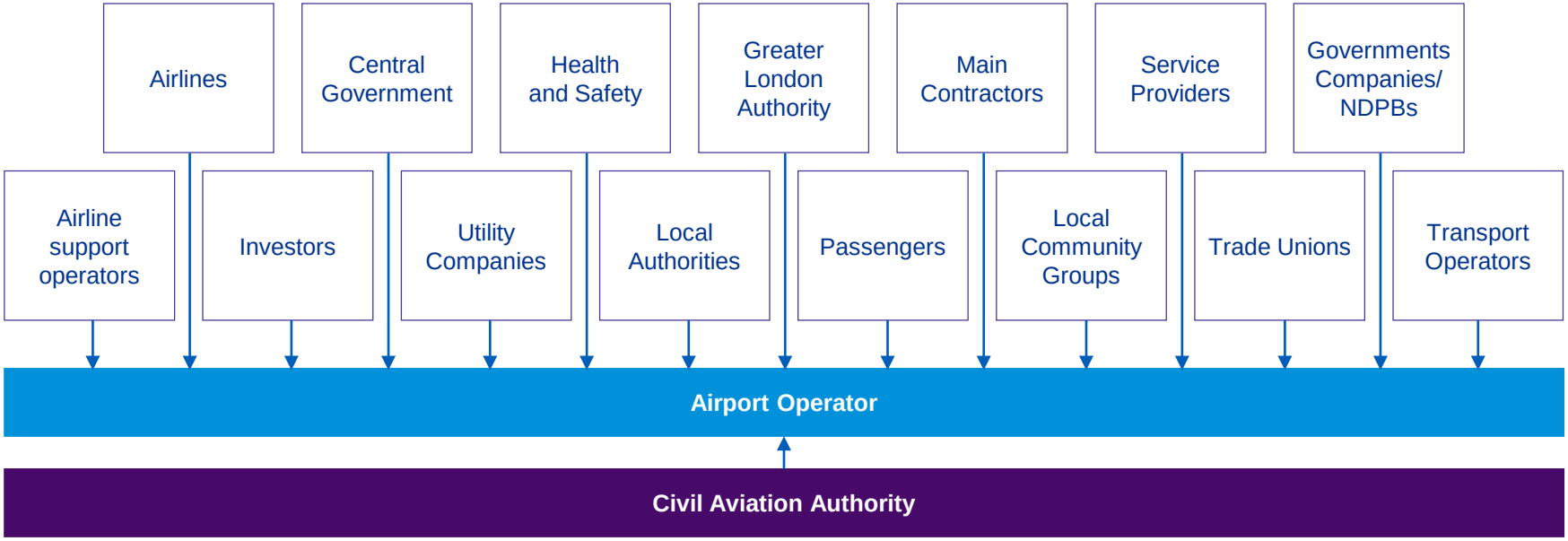
Programme delivery stakeholders

One of the key elements of success for delivering complex major projects is how effectively the key stakeholder groups are identified, their requirements understood and managed and their engagement with the project maintained to identify potential conflicts and ensure positive outcomes.

The expansion scheme will have a large number of external stakeholders. Each of these stakeholders could have an impact on the design, outcomes and costs of the scheme.

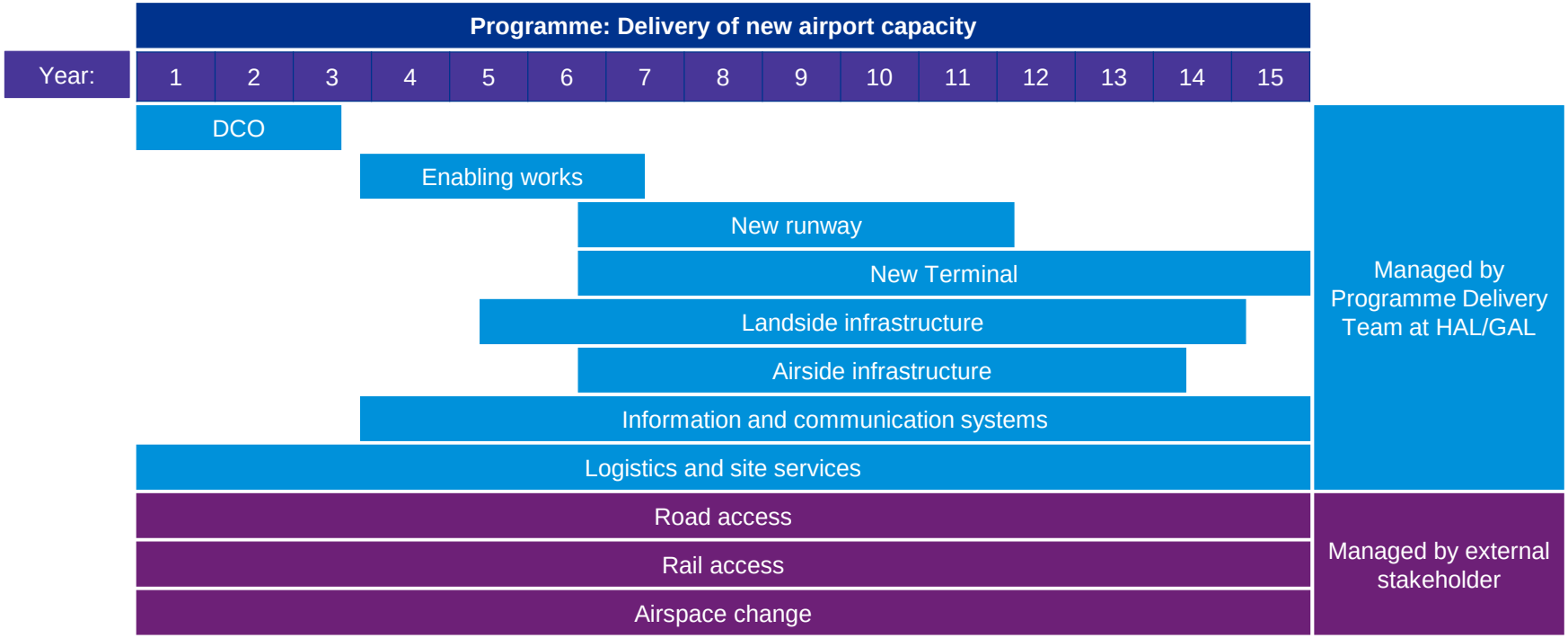
As part of the regulatory process, stakeholders will need to be consulted to identify needs and mitigate risks and potential conflicts.

The promoter's process for stakeholder management will be important for the outcomes of the scheme. The planning and DCO process will provide opportunities for stakeholders to raise concerns with the project which may need to be addressed. The CAA may wish to consider how the promoter will ensure that the stakeholder management process is effective and what facilitating role it can or should play.



Programme and project delivery

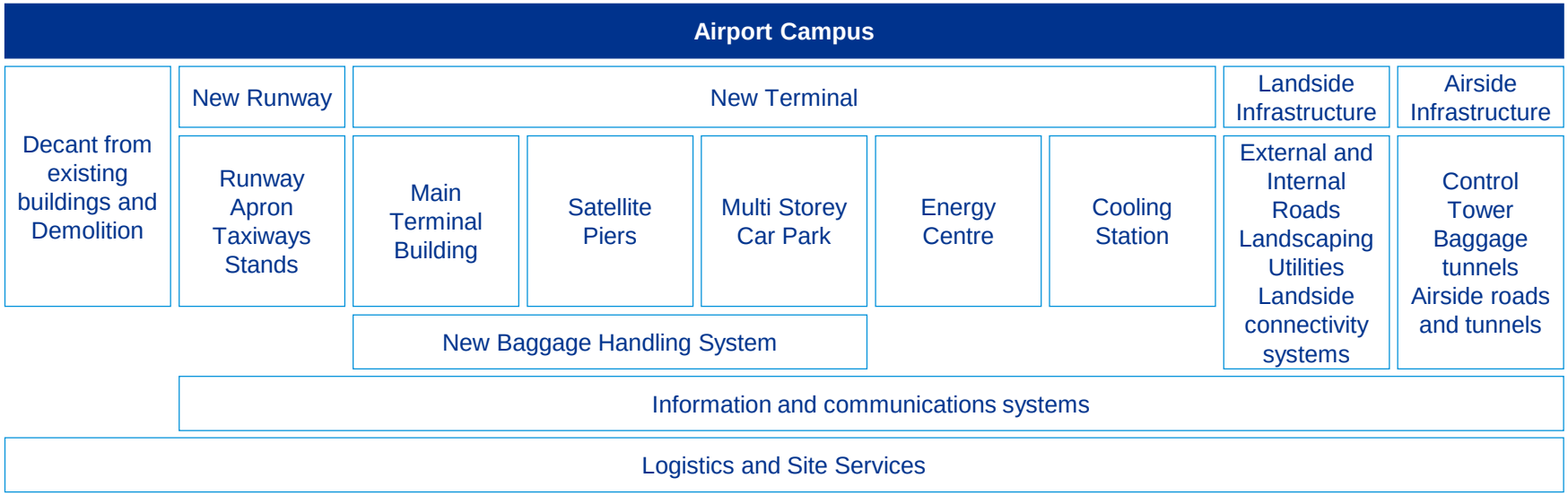
Within the programme there are a number of sub-programmes and projects, some managed by the promoter and some managed by external stakeholders. Each of these sub-programmes and projects may be complex in its own right. Sub-programmes and projects also progress at different speeds through the programme stages. The overall programme could span two or more regulatory control periods. The CAA's regulatory interventions will need to be aligned with this process.



— The programme is made up of multiple sub-programmes and projects, these projects may vary in complexity, timing, cost, procurement model and management approach. Each sub-programme will generally progress through the same corresponding project stages: initiation, planning, procurement, delivery, handover. The CAA could seek to understand the profile of the promoter's overall programme plan. The regulatory framework must be able to account for the natural progression of the programme.

Sub-programmes and projects

The diagram below provides a high-level overview of some of the key sub-programme and projects contained within the programme. For example the new terminal sub-programme is likely to have numerous large interdependent and high risk projects such as the baggage handling systems, main terminal building, car parks, energy centre and cooling stations. The promoter will seek to break the programme down into multiple elements to enable the most effective delivery process.



- The overall programme consists of multiple sub-programmes and projects. Each of these elements has specific characteristics and will progress through the project stages based on different timings. The regulatory framework may need to consider the programme at this level of detail when considering costs, risks, scope and outcomes.
- The CAA will need to understand how the promoter intends to package the sub-programmes and projects and the costs and timing of each.
- The breakdown of the sub-programmes and definition of work packages will have an impact on the competitiveness of the procurement process. The CAA may wish to understand how the promoter intends to approach this task and which sub-programmes and projects are likely to hold the greatest challenges in terms of risks, uncertainties and potential for cost escalation and delay.

Project stages

The overall programme, sub-programmes and projects will all progress through a project life cycle process outlined in the five project stages shown below. These stages will be aligned with the promoter's project management and decision making (or gateway) processes. The activities will differ across each stage influencing CAA's opportunity to intervene and influence outcomes. Different regulatory methods and mechanisms could be applied at different stages.

At the programme level, progress through the stages can only be considered at an aggregate level based on the overall progress of individual projects through each decision gateways. This has implications for the design and timing of regulatory interventions.

Project stage	Stage 1: Initiation	Stage 2: Planning/ Development	Stage 3: Procurement	Stage 4: Execution/ Delivery	Stage 5: Handover and Defects Liability
Outputs/ variables	— Feasibility analysis — Scope options analysis — Financial risk analysis — Business planning — Communications strategy — Risk combination assessment — Contracting options analysis — Overall programme development	— Commercial structuring. — Financial model — Co-ordination of stakeholders, identification of inconsistencies between corporate and project objectives	— Bid evaluation — Fairness assessment — Financial model management — Supply chain management	— Project control assessment — Due diligence — Corporate governance — Risk management — Programme management — Commercial management — Prime contract management — Sub-contract management — Claims and dispute — Design management. — Interface management	— Operational planning — Operational readiness Airline Transfer — Facility cost forecasting — Transition planning — Operation strategy advice — Project close out review — Prime contract close out — Claims and dispute resolution

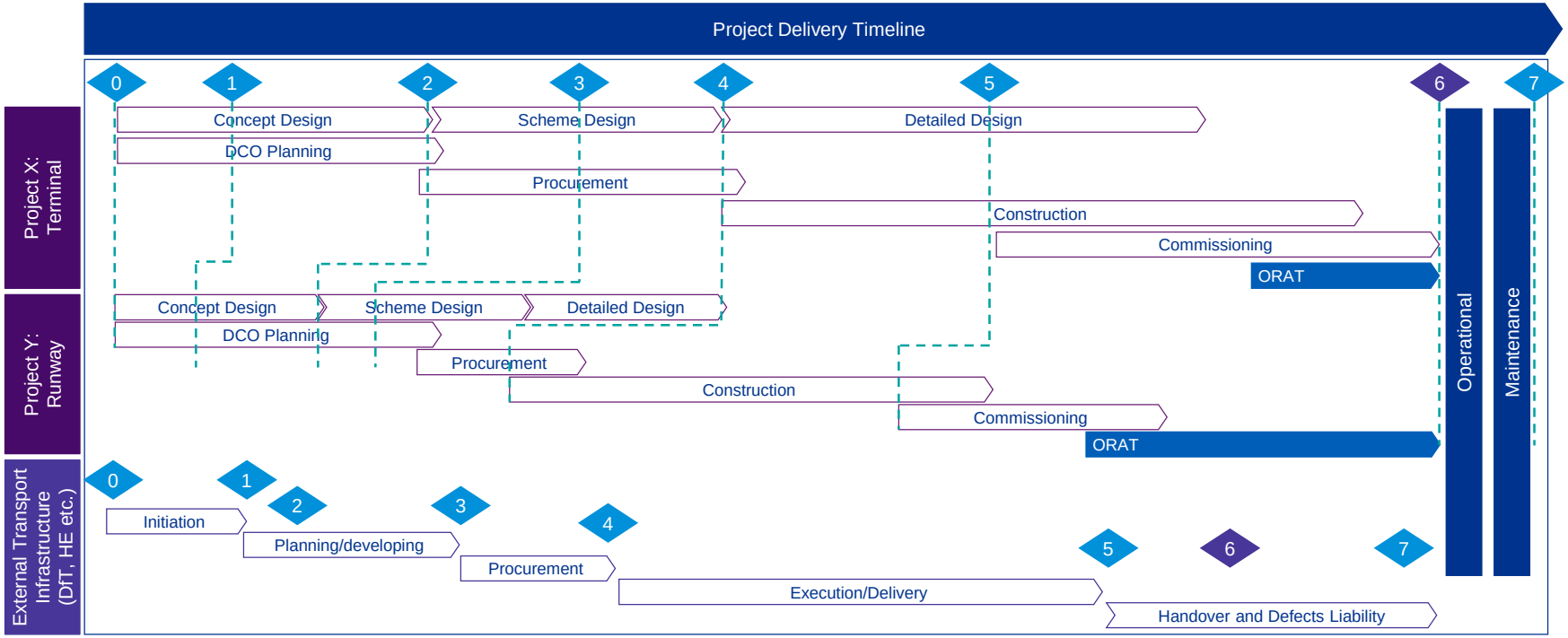
— Each project will progress through five project stages from initiation to delivery. There will be important choices to be made at each stage over for example the project outcomes, phasing, design, procurement model and delivery strategy. Each of these choice will affect project outcomes.

— The activities being undertaken by stakeholders will differ, as will the CAA's ability to influence outcomes. Spending and efficiency outcomes will be greatest during the procurement and delivery stage, but the CAA's ability to influence outcomes may be greatest at the initiation and planning stage.

Phase 4. Delivery activities

Project decision gateways

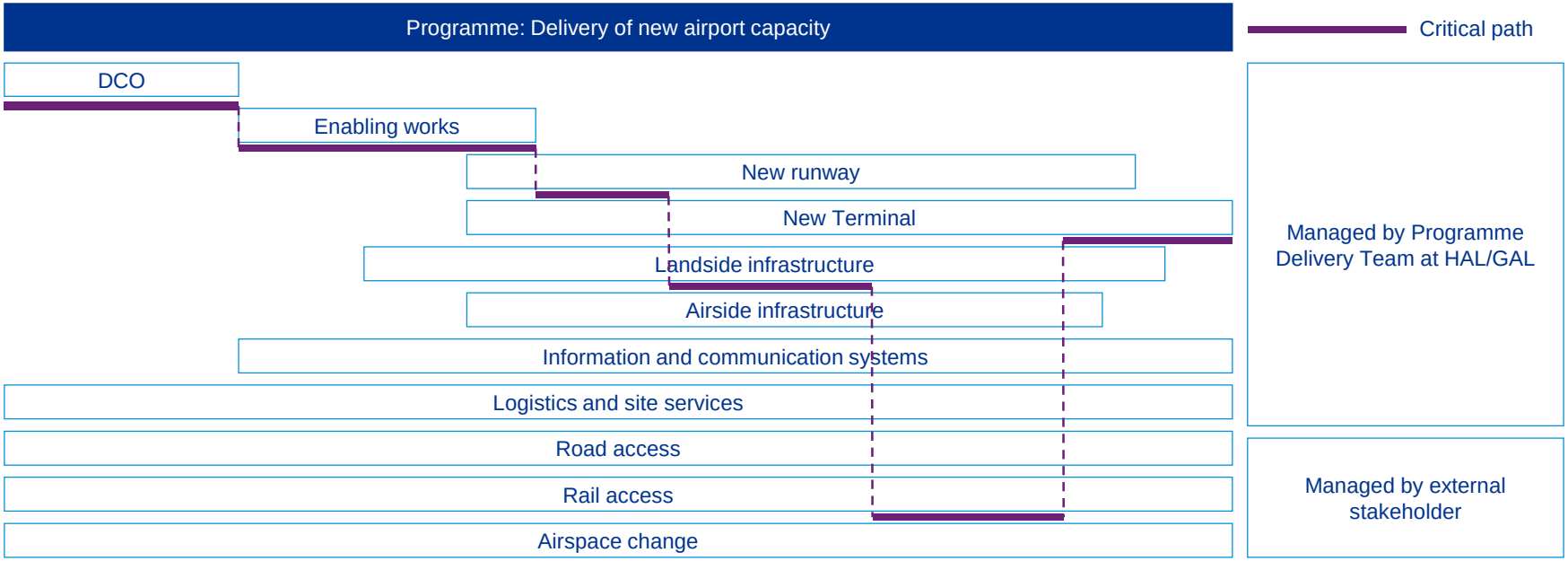
Each project will progress through a set of defined project management decision ‘gateways’, for example moving from conceptual design (0-2), to scheme design (2-3) and scheme selection (3) to detailed design (4-5), procurement and construction (6-7). The cost estimates, timing and outcomes of each project will evolve along this process as shown in the diagram below. The project decision structure may vary depending on the processes used by the promoter for example Association of Project Management (HAL) and Six Sigma (GAL).



There will usually be a key decision point at which a single option is selected for each project, after which cost forecasts can be set with a relative degree of confidence based on market testing (Gateway 3 in APM terminology). This stage is a key regulatory decision point at which enough information is generally available to assess the viability of the project, identify key risks, costs and attach regulatory conditions to its delivery. Prior to this stage there will be a higher level of risk that the estimated scope, design and costs of the project change.

Programme critical path

The programme critical path is determined by the activities which constrain the progression of the overall work programme. Projects and activities on the critical path have the potential to delay other work stages and therefore pose a greater risk to the timing and efficiency of the overall scheme. For instance the M25 works might lie on the critical path for the Heathrow NW scheme as it will not be possible to build the runway until this work is completed. This is important for understanding which elements are dependent on others and where delays could have significant implications for the wider programme. As part of the risk assessment the CAA could require that the promoter identify the critical path and provide a specific plan for the timely delivery of these projects. Projects on the critical path could be subjected to specific regulatory mechanisms such as – for example – time based incentives (triggers) to encourage the efficient delivery of the project.



- The progress of the overall scheme will be constrained by the critical path. Understanding these points in the programme and the promoter's approach to managing them successfully may be beneficial for the CAA to understand the projects and activities where project delays are most likely to impact on progress and where risk analysis and mitigation will be more important.
- Risks associated with projects on the critical path have greater potential to create large delays and cost escalation for the wider scheme. These projects and risks may therefore benefit from greater oversight and regulatory scrutiny.

Operation of new runway capacity

Once the construction phase of the scheme is completed it will transition into the operational phase. The success of this transition is key to achieving the expected benefits. The successful delivery of the scheme benefits and mitigation of risks will only become fully apparent after the beginning of the operational stage. The CAA could monitor and incentivise outcomes after this phase.

Some risks may be more likely to occur at this stage as projects which have been designed and built independently are required to integrate and operate together for the first time. Systems such as IT and baggage handling may require a period of testing to ensure they are working correctly. These risks and their mitigation is an important part of project management and could be actively considered throughout the design and construction phase. Operational risks could be explicitly considered as part of the project design phase for example. The promoter could also be seeking to actively plan for the transitional phase with a suitable period of testing and training for staff, and the development of contingency plans for major risks.

The operational phase of the Terminal five project for example suffered from significant problems related to the operation of the baggage, IT and other systems. These failures resulted in major delays and baggage problems for passengers using the terminal for several days after opening. Similarly Denver airport experienced major problems with its automated baggage handling project – resulting in its abandonment and replacement with simpler mechanisms. Berlin airport also experienced critical problems with its fire safety systems which only become apparent following operational tests. These problems continue to delay the opening of the airport which was originally planned for 2011/12.

- Operational risks and benefits realisation should be a priority throughout the design and construction of the project. The success (and efficiency) of a project can only be fully verified after the operational stage. The CAA should consider how it monitors and assesses these outcomes and ensures that the promoter is able to identify and manage risks and contingencies.
- The operational phase will create different challenges to the construction phase and the CAA may need to consider how the project transitions between these two phases and the promoter's plan for identifying and managing risks associated with operations, resilience and whole life costs.
- The CAA could consider how operational and transitional risks can be managed and mitigated through the regulatory framework. This could be achieved by identifying specific high impact risks for the operational stage and seeking assurance from the promoter for how these risks are being managed.
- There may be lessons to be learnt from recent examples of airport project failure including the Denver airport automated baggage system, new Berlin airport and operational failures experienced during the opening of T5.

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Section 2.2 Project governance, management, procurement and risk

Introduction to Section 2.2

In this section we provide an overview of some of the overarching processes that may affect the efficiency of the scheme. This includes:

— The **programme governance model** for linking the delivery structure of the project to the corporate governance of the promoter and wider stakeholders.

— **Project management** principles and practices. The methods and procedures through which the promoter will deliver and monitor individual parts of the project.

— **Procurement models.** The options for different methods of procurement and their implications for efficiency and risk exposure for the promoter and passengers.

— **Risk management.** The methods and processes used to identify, monitor and mitigate project risks.

Each of these processes could have an impact on the efficiency of the scheme.

We highlight the existing approaches used by Heathrow and Gatwick and some of the pros and cons and trade-offs involved.

The CAA may wish to consider these issues and could seek to apply regulatory mechanisms, such as providing guidance or approval to the promoter's plans for governance, project management, procurement and risk.

Programme governance

Programme governance is the organisation, structures and mechanisms which link the overall corporate governance of the promoter to the activities of the scheme and its delivery body, as well as wider stakeholders such as the CAA and airlines.

The main activities of the programme governance function are to:

— Provide direction for the overall programme, including a central point of monitoring and decision making for the scheme.

— Provide overall ownership of the programme and its elements.

— Ensure project management functions are carried out effectively.

— Provide progress reporting on finance and timescales and disclosure.

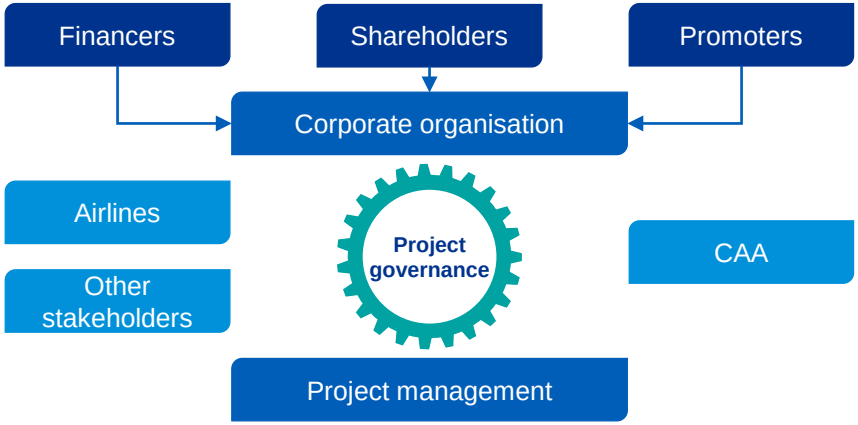
— Provide a central point of contact for project stakeholders.

For the new runway capacity scheme, programme governance will determine the channels, frequency and level of detail over which the airlines and the CAA will engage with the promoter.

The requirements of the programme governance structure may change over time for example at the planning stage the programme governance will need to focus on effective stakeholder engagement, making choices over design and scope and identifying risks.

During the delivery stage procurement and management of project risks will become more important. There may also be linkages between the governance structure and the regulatory framework for example if regulatory approval of scheme design or costs estimates is required.

Effective programme governance requires: transparency of decision making, separation of the sponsor and delivery roles, a system of delegation and processes for timely decision-making, processes for controlling change and managing disputes between stakeholders, good communication, assurance and a collaborative culture.



There are different programme governance models which reflect the nature of the programme, its ownership and stakeholders. There may also be differences between the programme governance of Heathrow and Gatwick for example.

The CAA could seek to understand the governance structure proposed by the promoter, the rationale for the approach versus alternatives, and how it will incorporate the views of stakeholders such as current and future airlines.

The CAA may wish to consider potential lessons from the governance model of other major projects such as Crossrail and Thameslink which included several innovations such as the adoption of a Project Representative and separate delivery and sponsor boards (although these may be considered less applicable for non-public sector projects).

Governance and procurement at Heathrow

The project governance model at Heathrow has evolved over time. This reflects the changes in the company structure and ownership as well as the increasing complexity and size of the schemes it has undertaken over recent years. There have also been developments in best practice for procurement and project management which have altered the company's approach over time.

Heathrow's approach to project governance/procurement

Year	Model	Description
2015	Professional collaboration	— Strategic portfolios linked to objectives — Delivery integrators — Programme design — Second tier supply chain
2013	Intelligent client	— Two stage tendering — Early supply chain involvement
2010	Programme management client	— Launch of capital re-engineering.
2009		— Open competition
2006	Project management client	— Third generation framework
2003	Integrating construction client	— T5 agreement – 'Partnership approach'
2000	Partnering client	— Second generation framework with preferred suppliers
1994		— First generation framework with preferred suppliers

Heathrow's current governance model is aligned to several strategic portfolios which each contain specific programmes and projects. In Q6 the strategic focus for the airport includes hub capacity, resilience, baggage, asset management, passenger experience and T2. The total budget for the Q6 capital programme is £2.3 billion (with an allowance to increase up to £3.3 billion). This is lower than the budget for Q5 and Q4.

Projects are linked with executive sponsors, agents and business case owners who each have specific responsibilities to define the vision and outcomes of the project, test the delivery strategy and deliver the project. The overall governance model is illustrated in the diagram on the next page.

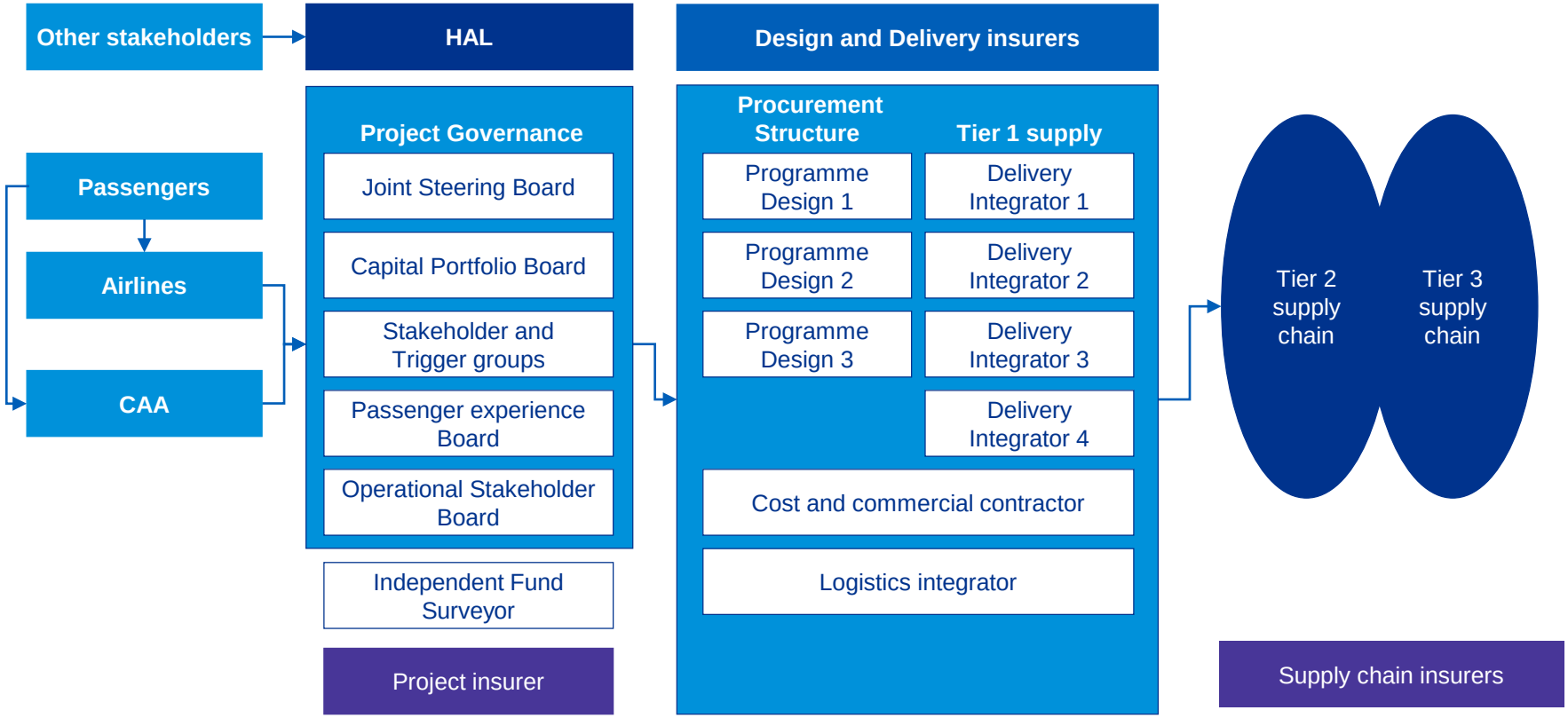
Within each programme there are a range of projects of varying size and complexity. The governance model for each project is dependent on its specific features including its size and potential impacts on airlines, airport financials and airport capacity.

The Independent Fund Surveyor (IFS) provides an on-going assessment of the reasonableness of all key decisions made on key projects and to ensure that capital is being used effectively. The IFS reports at all project gateways and on a monthly basis for the delivery of the project.

This model has evolved over time based on learnings from previous projects and approaches to project governance (and procurement).

Overview of Heathrow capital governance structure

This figure below summarises the overall programme governance structure of Heathrow. The choice of governance model has implications for the interface between different parties, the identification and treatment of risks and the potential for conflicts. Insurance can also be provided individually for each party, or for the project as a whole. This model has evolved following Heathrow's experience of building Terminal 2 and 5.



Terminal 5 - Low risk partnership model

- Prior to T5, Heathrow's governance and procurement model was based on around 50 separate framework contracts with preferred suppliers specialising in different areas of construction and engineering. Successful contractors were required to work in partnership on an ad-hoc basis.
- For the delivery of T5, BAA considered that it required a more flexible procurement process which would enable the development of an overall team with the best contractors, whilst also promoting a collaborative approach to problem solving. This reflected the complexity of the project and potential for contractual arguments between the contractors, hampering the delivery of the project.
- Disputes between contractors are often one of the main major project risks and can lead to significant cost overruns and delays. BAA's approach was directly informed by the 1998 Egan Report which provided recommendations for the reform of the UK construction industry to improve efficiency.
- This led to the development of a 'partnership model' enshrined in the T5 Agreement and T5 Insurance strategy. The main features of this agreement was to create a single overall team approach to the project to avoid conflicts associated with hiring multiple contractors and insurers under different terms (insurers often instigate legal proceeding to limit losses on projects which lead to additional costs and delay).
- In this model BAA held all of the cost, time and quality risk of the project with contractors working to a fixed profit margin. This reflected BAA's belief that transfer of price risk was not feasible for the project without creating disputes and impacting on scheme delivery. It also enabled BAA to play a more active role in managing and mitigating the risks of the project as a whole.
- BAA divided the programme into 18 projects ranging in size from £10 million to £200 million. These were then split into a further 150 sub-projects with around 1,000 work packages.
- Suppliers were engaged as and when required based on a general T5 agreement setting out general terms and conditions supported with specific contractual requirements for each contractor.
- The low risk nature of the contracts (from the suppliers perspective) enabled BAA to demand low margins and a high level of cost transparency from suppliers operating on an open book basis.
- BAA also developed a fund to create incentives for efficient project delivery against key project milestones with penalties limited to loss of profit margin and payment of insurance excesses.
- BAA created a process to manage risk using risk registers. This required the production of documents which set out which party was accountable for each aspect of risk management and the process and measures for delivery. Risk management was central to the governance model, falling under the responsibility of T5's managing director.
- The construction of the project was insured by SwissRE. The insurance covered all primary parties to the project on a joint basis with no necessity to determine a single point of blame. This removed the need for individual contractors to hold their own insurance contracts and reduced the potential for conflict on the project.
- The company's role on the project was important for the identification of risks and mitigation strategies for example drawing on the Tunnelling Code of Practice which promotes best practise for risk management in construction projects.
- The governance arrangements for T5 were successful following the completion of the project construction. The operational issues experienced after the opening of the project as well as wider pressures led to a different approach for T2.

Terminal 2 – Intelligent client model

- The planning of T2 coincided with several issues including: the financial crisis and reduced demand leading to financial losses for BAA, the operational issues following the opening of T5 and the CC market investigation which eventually led to the forced sale of Gatwick, Stansted and Edinburgh airports. These factors led to the perception amongst some stakeholders that the procurement strategy for T5 had increased costs.
- For T2 BAA sought to develop a new approach to governance and project management with greater risk and reward for contractors and enabling greater competition for work packages. This approach has been termed 'the intelligent client' model and represents a departure from the collaborative approach developed under the T5 Agreement. BAA considered that the experience of T5 and other major projects meant that the supply chain capacity for managing risk and complex projects had increased enabling a more competitive approach.
- The T5C satellite building was awarded to a single firm under a Value in Partnership framework for a 'target price' of £230 million. For the first phase of the T2B project BAA decided to shift risk even further to the contractors and awarded the project through a £84 million fixed price contract. This was the largest fixed price contract ever let for an airside project by BAA.
- The intelligent client model required BAA to invest in extensive identification and definition of the scope and risks of a particular project based on a strategic master plan. The approach was applied to any project over £25 million.
- The approach involved a move away from fixed price and cost plus contracts towards 'target price' contracts for most projects.
- These contracts set a target price for the project based on a competitive process with risk sharing between BAA and the contractor and a cap and collar on potential profits and loss.
- The rationale for the approach was to ensure that both BAA and its contractors had incentives to deliver the project and manage risks, whilst ensuring that contractors would not be deterred from bidding for the contract due to the potential for severe losses. This approach also required contractors to operate on an open book basis so that BAA could validate their costs and profit margins.
- The procurement process for projects was also altered to adopt a Most Economically Advantages Tender approach. This involved separate evaluation of commercial and technical bids by a five person panel. This evaluation was supported by evaluation of the risk of company bankruptcy.
- Generally each project was split into two stages: a detailed design phase which develops the scope timing and target cost of the project, and a secondary delivery phase.
- Each contract would have a success fee to provide incentives for efficient/timely delivery. The conditions for this fee could be set by BAA based on project specific and general behavioural criteria.
- Change control on projects was heavily vetted requiring consultation with airlines, and the development of a business case before being considered by decision-makers. This reduced the potential for increases in costs associated with changes in scope but reduced flexibility to respond to changes in scope due to new technology for example.

Governance and procurement at Gatwick

- Gatwick's Construction, Delivery and Transition plan submission to the AC provides an overview of its intended approach to the governance, management and delivery of its new runway scheme.
- The planned approach is based on the development of a dedicated Project Management Organisation (PMO) incorporating technical and project management experts, with a flexible structure to reflect the changing requirements of the work plan. The PMO will be overseen by a Project Management Board reporting directly to the CEO.
- The PMO will be co-located with Gatwick's internal management teams to ensure good communication with the airport and other stakeholders. The structure and performance of the PMO will also be subject to continuous informal review to help improve communication and performance.
- The first step in project implementation planning will be to define all programme elements and partition work into discrete design packages to mirror the contract tendering strategy. These packages will include one or several systems and may be broken down by discipline and facility with a clear demarcation of project design boundaries.
- The project management principles for delivering R2 are intended to be based on Gatwick's existing procedures and processes, updated to suit the requirements of the R2 project. This includes the use of the Design for Six Sigma Tollgate process.
- There would be a Programme Management Board which will consist of a representative of the Programme Sponsor, Finance, Operations, Health, Safety, and Environment, IT and the R2 Programme Director. This management group will report directly to Gatwick's CEO.
- Within the PMO there will be discipline leads who will be responsible for cascading and maintaining compliance with the project management strategy, processes and procedures.
- The PMO will create a project delivery team focused on the management of the project. This will be a matrix organisation drawing staff form Gatwick, the PMO and supply chain partners.
- Gatwick's approach to procurement is based on an Intelligent Client model using delivery partners to scope the design and structure of work packages, with early engagement of the supply chain and the selection of an optimum delivery model based on an assessment of risks, incentivisation and management. The procurement route will be based upon an assessment of the complexity of the project under consideration based on Infrastructure UK guidance.
- Each work package element will have a benchmark cost forecast which will be used to compare the efficiency of bids. The PMO will measure the actual progress and expenditure on projects through an Earned Value Management System. This system will produce periodic reports based on the original budget, actual costs incurred, with estimates and trends for future spending on each project.
- An integrated contracts and procurement team will also be formed to manage the procurement process, ensure effective communication across contractors and monitor and improve supplier quality. This will include the use of KPIs and milestones for procurement.
- The PMO will include a dedicated stakeholder engagement function which will be responsible for creating and managing a stakeholder engagement management plan. This will include the identification of key stakeholder groups and individuals to highlight and manage conflicts.

Project management

Project management is the application of processes, methods, knowledge, skills and experience to achieve specific project objectives. Different organisations have developed different approaches to reflect the nature of their activities and organisations priorities. Nonetheless there are several general principles and processes which are widely considered to be best practice (for example as cited by the Association of Project Management, Infrastructure UK and P3M3 models). These are summarised below.

Key project management processes

Progress monitoring	— Need to ensure the project remains on budget and schedule through ongoing monitoring against milestones; allow for resource planning and ensure the expected benefits are delivered.
Control and mitigation	— Project manager needs to be able to identify and respond to problems as they arise by proactively identifying and managing risks and live issues.
Communication	— Problems can be avoided and mitigated if communication is open and honest with clear escalation routes.
People management	— Project manager needs to ensure that individuals are in a position to deliver work effectively, including motivating and providing constructive feedback to employees and suppliers.

Example best practice processes in project management

Project brief	Risk register	Quality register	Issues register	Lessons log	Daily project log
Summary of project, structure, plan and goals.	Risks which could threaten delivery, including likelihood and magnitude as well as mitigation actions.	Details of planned quality activities. dates and personnel.	List of scope changes, complaints and concerns.	List of any lessons learnt on the project which might be applicable in the future.	Diary recording the key activities and events of each day related to the project.

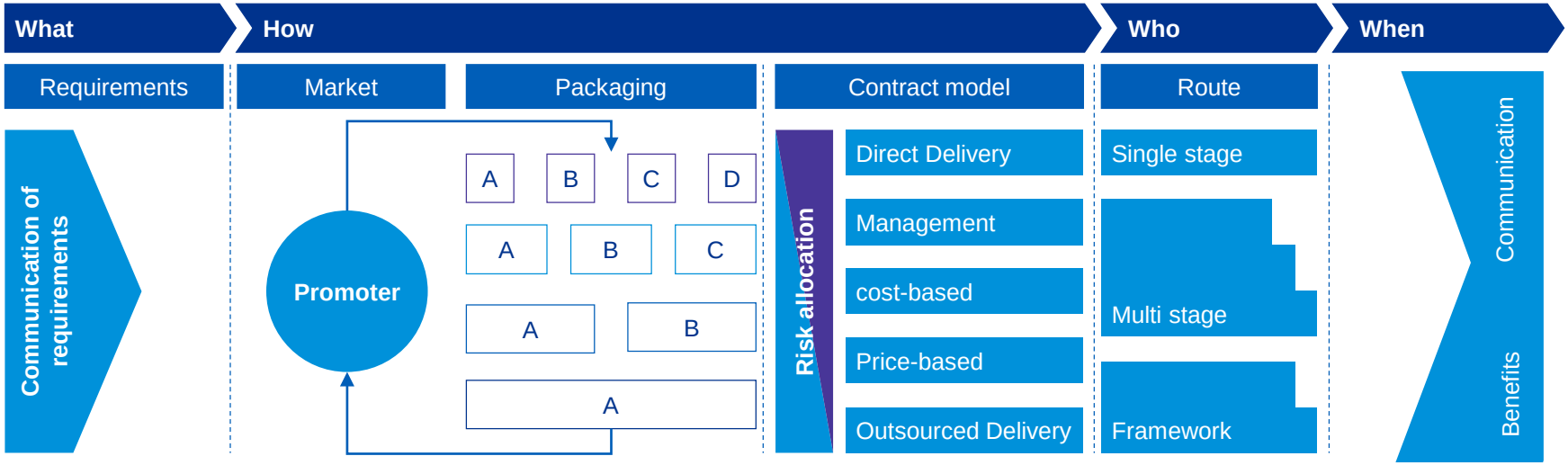
The quality of an organisations project management processes and capabilities is dependent on behavioural factors as well as individuals skills and experience. APM accreditation (or equivalent) for staff and evidence of the above processes could be used to form a partial view of the quality of project management processes. It is also possible to evaluate an organisations performance against best practice criteria using an expert review. The CAA may seek to understand how the promoter will seek to ensure that its PM processes adhere to best practice.

Procurement

Procurement is the process through which a promoter is able to identify, source, access and manage the external resources required to fulfil its objectives. Different approaches can be adopted depending on the nature of the project. In general effective procurement:

- Encourages the market to develop innovative and efficient solutions to the promoter's challenges.
- Effectively allocates delivery risks between the promoter and the supply chain.
- Aligns the incentives of the promoter and the supply chain in order to drive collaboration and successful delivery.
- Allows a transparent and clear process which is open to competition.
- Supports the overall successful execution of the promoter's ambitions.
- Minimises the risk of dispute due to risks, changes in scope and other potential conflicts.

The key stages of a procurement process are shown below, demonstrating the relationships and processes between the promoter and its suppliers.



Source: Infrastructure and Projects Authority, 2016, Improving Infrastructure Delivery: Project Initiation Routemap. Procurement.

Procurement contract models

There are a wide variety of approaches to procurement and some of the main models are summarised below showing general pros and cons. The merits of each approach depend on the complexity of the project, how it has been structured and the competitiveness of the market. The approach can also have implications for the promoter's risk exposure. Different approaches could also be applied to different parts of the scheme. The CAA may wish to understand which models the promoter intends to use for key parts of the expansion programme and the rationale for this approach.

Model	Summary	Pros	Cons
Direct delivery	Works taken in-house by current management and workforce. The promoter may be required to expand its operations and equipment levels.	— Effective if promoter has prior experience and the complexity of the project is limited — Provide budget confidence — Risks are aligned with incentives	— Sufficient resources and expertise are required in-house. — All risks lies with the promoter which can threaten other operations
Management contract	A management contractor is engaged to manage the construction programme. The management contractor has direct contractual links with all works contractors and is responsible for all construction works.	— Can provide best in class expertise and resources to support the promoter for the duration of the scheme — Reduces 'learning curve' risks for promoter	— Contractual relationships may not cover all events — Contractors may exploit interfaces between promoter and manager — Risk transfer may not be complete or optimal — Budgets and programme are not fixed
Cost-based	The project is designed and/or constructed by a main contractor with payment based on allowing cost recovery plus a margin of profit. This could be linked to a target cost for the overall scheme.	— Can support collaborative initiatives if well implemented — May provide visibility of actual costs for promoter to support benchmarking and efficiency challenges' — Enables proactive management of risk if well managed	— Poor understanding of risk transfer may erode incentives of contractor — Incorrect or inflexible performance or commercial measures — Reactive management of risk

Procurement contract models (cont.)

Model	Summary	Pros	Cons
Price-based (Fixed price or target price)	The works are designed and/or constructed by a main contractor that is paid based on tendered prices. The contractor holds the risk in relation to cost overrun. Variations of the model – based on a target price could also be used setting risk and reward sharing mechanisms around a base estimate.	— Costs may be low where suppliers are available and project is simple/low risk — Enables risk transfer to supplier — Can adopt risk and reward sharing mechanisms to tailor contractor incentives and manage risks	— Costs may be high where suppliers are limited or project complex/uncertain — Tender likely to incentive price competition rather than quality of delivery — Uncertainty and need for scope change may increase costs significantly
Outsourced	The promoter transfers ownership of an asset for an extended period of time. An organisation with design, construction, maintenance and operational expertise and financing capability is appointed under a single contract to design, build, operate and maintain the asset in exchange for a stream of payments which could be linked to the underlying performance of the asset.	— Complete transfer of delivery and operational risks — Complete view of project is developed at onset	— Only appropriate where asset can be separated from wider scheme — Potentially complex — High time and costs in preparation/negotiation

Source: Infrastructure and Projects Authority, 2016, Improving Infrastructure Delivery: Project Initiation Routemap. Procurement.

Procurement models and risk exposure

Different procurement models involve trading off cost and risk between the contractor and promoter (and passengers via the regulatory framework). Lower risk for the promoter will tend to imply higher expected profit margins for the contractor and vice versa due to the impact on average tender prices when suppliers are required to bear higher risks.

This trade-off needs to be considered when assessing the promoters approach. A fixed price contact between the promoter and contractor may fully limit the risk exposure of the promoter (and passengers), however this model will also tend to increase average costs through higher profit margins. Conversely, where the promoter has chosen to adopt a cost-based or target price, the promoter (and passengers) are implicitly exposed to efficient cost overruns – but profit margins will be lower. In these situations the CAA may wish to consider if it is appropriate to limit passengers risk exposure through the regulatory framework. It may not be efficient to require contractors to absorb major risks unless they have particular expertise.

Procurement model	Fixed price	Target price	Cost-based
Passenger risk exposure?	— None. Contractor takes all risk of cost overruns above contract price. Contractor sets higher margin to compensate for risk.	— Low to high risk exposure depending on the design of the contract. Contractor risk may be capped or uncapped.	— Full. Contractor is fully reimbursed for costs incurred plus a (limited) margin. Promoter may expect to be reimbursed by passengers.
Efficiency of contract price?	— Requirement for contractor to take full cost risk may deter bidders and will increase average bid cost/profit margin.	— Risk sharing between promoter and contractor may increase bid costs depending on contracts.	— Removal of cost risk may encourage more bids and reduce average bid costs/profit margin.
Regulatory considerations	— Passengers are insured from cost escalations, but base cost is likely to be higher due to greater risks being placed on contractors. — Regulator could ensure that procurement process was effective and costs are efficient based on contractors ability to manage risks (versus promoter)	— Regulator could understand the extent of implicit passenger cost risk exposure and consider if risk sharing mechanisms could be applied through the contractual arrangements.	— Regulator could consider if caps to passenger risk are appropriate. — Procurement is more likely to be competitive due to lower risk for promoter.

Direct procurement models

There have been several examples of regulated companies and government agencies seeking to implement Direct Procurement Models (DPM) for the delivery of major projects.

DPM involves increasing the level of competition for project delivery through tendering for the construction, operation, and financing of an asset. The regulator may require that the company undertakes the tendering process or could seek to run the process itself. For example the CAA could run a separate tender process for the construction of the runway or terminal elements of the project.

Most companies operate some level of narrow tendering for the design or construction of specific assets. This can be achieved using different approaches such as through a pre-qualified framework for example.

Broad tendering for an entire scheme is less common within the regulated industries but is widely used on other projects such as PPPs in the health, education and transport sectors.

Examples of these models include; the Thames Tideway Tunnel project – where contractors competed to build, and investors competed to finance the tunnel; and OFTOs, where the new model 'OFTO build' will allow competition to both build and finance the transmission link.

Broad tendering is more complex as it generally requires the development of a bespoke regulatory framework for the new asset including an operating licence, contracting and the allocation of risks between stakeholders. This also generally requires that the project revenues and costs can be separated from the existing assets.

Infrastructure UK identifies several types of delivery and procurement model which are described in the adjacent table.

Project complexity and client capability: Low → High

Example model	Summary description
— One-off procurement	— Direct tender of single work package
— Prime contracting — Cost led procurement — Two stage open book — Frameworks	— Greater levels of supply chain involvement in project design — Retain options for delivery of work packages — Phased procurement process – design/build
— Delivery partner — Partnering	— Contractor takes a lead role in the definition of work package design. Separation of design/delivery
— Alliancing — Delivery consortia — Joint ventures — PF2	— More complex contractual agreements with suppliers for delivery of project — Pre-defined risk allocation — Assets may be shared with contractor

The choice of procurement model is determined by the complexity of the project and the capability of the promoter and client. Where a project is highly complex an alliancing, delivery consortia or joint venture may be most appropriate.

These models also require a high level of capability in the promoter organisation to design and manage the procurement process.

Risk management

Risk management is the process by which an organisation seeks to minimise and control the probability and impact of known and unknown risks. It is a key part of overall project management and is strongly linked with the project governance and procurement model.

Key risk management activities include:

1. Identification of hazards and associated risks (through a risk register supported by a range of techniques – SWOT, Delphi, Stakeholder consultation for example).
2. Quantifying the risks (based on a risk assessment of probability and impact, probability weighted allowances and contingency).
3. Developing pro-active and live plans aimed at mitigating or eliminating risks (assignment of responsibility for risk and risk tracking).
4. Identifying methods to control risks (contingency plans, risk transfer, insurance, behaviour change).
5. Management through allocating risks to a responsible party through: contracts, insurance and the regulatory framework.

The risk assessment and development of the risk register for the scheme is a critical part of risk management. This process enables the promoter to identify, allocate, control, mitigate and manage risks. Risk management will evolve over the course of the project with different risks occurring at each stage. There are a wide range of guides for best practice in risk management, as with project management, these factors are largely dependent on the culture and behaviour of the individuals in charge of the process. Potential areas of risk are highlighted below.

Project development stage risks

- Site and ground investigation
- Assessment and evaluation of project options
- Project development design studies

Construction contract procurement stage risks

- Preparation of contract
- Selection of qualifications of contractors
- Timing for tender
- Tender risk register

Design stage risks

- Transfer of information between designers
- Design process
- Design checks
- Constructability issues
- Validation of design

Construction stage risks

- Pre-construction activities
- Risk management procedures
- Contractors staff and organisation
- Constructability
- Methods and equipment
- Management systems
- Monitoring
- Management of change

KPMG

Section 2.3
Programme risks

Introduction to Section 2.3

In this section we provide an overview of general and specific risks identified for a generic airport expansion project based on existing sources of evidence including the evidence submitted to the AC by promoters and a general review of major airport project failures.

We provide a long-list of these risks and assess their likely probability and magnitude to identify the most serious risks for the project.

Our analysis is indicative and intended to provide a high level overview of the key risks facing the project, their 'location' within the programme and their potential impact. This analysis is not a comprehensive risk assessment and the CAA could seek to undertake its own more detailed risk assessment in conjunction with the promoter once the scheme has been more fully developed.

The management of the identified risks will be a key issue for the project promoter and the CAA may wish to understand its proposed mitigations for these risks to ensure they are sufficient.

Major projects often experience cost escalation, delay or achieve a lower than expected level of benefits and outcomes. We highlight a range of recent examples of these types of issue across both airports and other major projects. These issues illustrate the high level of uncertainty associated with estimating the costs, timing and delivery of large and complex infrastructure projects, and the tendency at both individual and organisational levels for 'optimism bias'.

Airport project delays and cost overruns

There are many and various examples of major projects experiencing cost escalation, delays and other negative outcomes. There are also many and various reasons for these failures. The table below and on the following page seek to highlight some examples of major project failures. In hindsight, it is often obvious that a scheme was too complex, the contractor lacked sufficient experience or a complete risk register was not developed. Often it is not one specific failure but a collection of interlinking and coordinated failures which lead to overall project failure.

Project	Cost: Planned-Actual	Duration: Planned – Actual	Delay in delivery	Other failures	Main reasons for delays and cost escalation
Doha Airport (Qatar)	Planned $5bn Actual $11bn	Planned 4 years Actual 9 years	5 years late	Termination of a number of contractors for performance failures and disputes	— Access — Re-design to incorporate capacity increases — Contractor performance — Design changes — Regulatory requirements — Labour and material cost escalation
Berlin Brandenburg Airport (Germany)	Planned €1.2bn Actual €7.6bn	Planned 6 Actual 14 years	Exp. 8 years late	Inadequate fire safety equipment design	— Design complexity (e.g. fire system) — Poor governance structure — Change requests — Quality and allocation of contractors
Denver Airport (USA)	Planned $1.7bn Actual $4.5bn	Planned 4-5 Actual 5 years	1.5 years late	Baggage system never fully operational	— Design complexity (e.g. allocation mechanism) — Time management — Procurement non-compliant and contract award to non-bidder

— Other major airport projects have experienced cost overruns and delays related to the realisation of specific risks.
— Complexity of design, late changes to design and failure or conflicts between contractors are amongst the most common issues cited in case studies for cost escalation and timescale delay. Late change requests and overly optimistic forecasts can also result in unrealistic expectations.
— The are a wide range of studies which seek to explain the causes of major project failure.

Other examples of major project delays and overruns

Project	Cost: Planned-Actual	Duration: Planned – Actual	Delay in delivery	Other failures	Main reasons for delays and cost overruns
Medupi Coal Fired Power Station (South Africa)	Planned US$10bn Actual US$15bn	Planned 5 Actual 14 years	9 years late	Late putting into operation	— Labour disputes/Industrial action — Contractor performance and disputes — Design development and approval — Quality and re-work
Dubai Metro (UAE)	Planned US$4.3bn Actual US$8bn	Planned 3.5 Actual 4 years	0.5 years	n/a	— Client initiated scope changes — Design approval process — Material cost escalations — Resource constraints — Regulatory changes
Channel Tunnel (UK/France)	Planned £2.6bn Actual £4.6bn	Planned 5 Actual 6 years	1 year late	Lower than expected traffic	— Design inadequacy (e.g. ventilation design) — Communication breakdown — Untested technology — Optimistic revenue forecasts — Project governance
Jubilee Line Extension (UK)	Planned £2.1bn Actual £3.5bn	Planned 5 Actual 6 years	1 year	Insufficient contingency allowance	— Funders collapsed prior to start — Tunnelling delayed — Industrial action — Management issues — Unrealistic programming

— Delays and cost overruns have occurred on many major projects and there are a range of reasons.
— Major projects outside of aviation can also provide useful insights into generic project failures.
— These major projects also help to highlight the scale of associated risks impact on costs and delay.

Typical project risks

Based on case study evidence we have identified several typical causes of project delays and cost escalation which could be considered as risks for the capacity expansion scheme. These risks are defined for both the project sponsor and contractors.

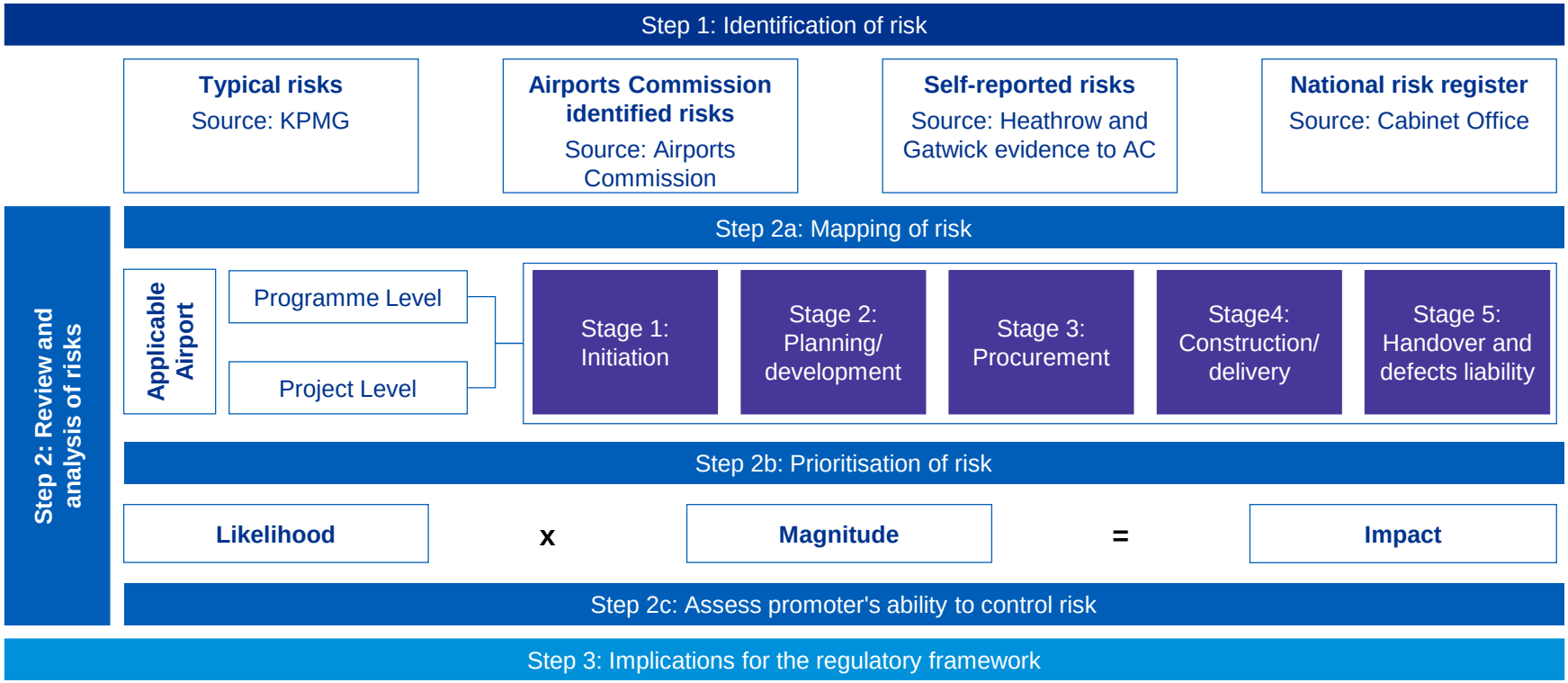
Risks for sponsor
Scoping Issues. Project scope does not fully address organisational business requirements.
Inexperienced or unqualified project team. Project team lacks appropriate skills and expertise to manage the project.
Poor estimating. Project estimates are incomplete or insufficiently detailed.
Lack of integrated budgeting and planning. Business requirements are not aligned with the budget and execution plan.
Incomplete or fluid design. Construction commences based on an incomplete design and project scope is continually in flux.
Lack of proactive risk management. Project risks are not fully understood or reviewed prior to project approval.
Unrealistic schedules. Project delays during planning and approval result in compressed schedule and unrealistic completion targets being set by management.
Insufficient tools and project management infrastructure. Project tools and infrastructure are not set up to effectively plan, deliver, track and report performance.
Disputes between the promoter and contractors and other parties. Change of scope and unanticipated factors can lead to legal disputes which can increase costs and lead to project delay.

Risks for Contractors
Poor estimating. Overly optimistic bids, poor or outdated cost data, missed scope items, flawed assumptions regarding constructability, labour and material price escalation.
Resource shortages and inexperienced project teams. Lack of available craft labour, experienced supervision personnel or qualified project management team members. Supply chain constraints.
Unfavourable contract. Construction contract favours the sponsor in areas such as payment terms, change order pricing, overhead and profit/fee and penalties for non-performance.
Lack of senior management support. The project lacks support from senior management to address project issues and challenges in a timely manner and manage communication with the owner.
Design issues. Project design issues lead to inefficiencies, unrecoverable cost overruns and schedule delay.
Overly aggressive schedule. Aggressive schedule leading to delivery inefficiencies and unrecoverable overtime/premium time.
Lack of risk management. Lack of proactive risk management to identify and address project issues and risks.
Lack of project coordination and integration. Projects are managed in silos with limited integration between project participants/workstreams.

— A number of generic risks exist with regards to any major project and these should be understood and accounted for.
— Some of these risks will be the responsibility of the promoter or contractor, but many will be outside of their direct control.

Identifying programme risks

Airport expansion schemes, like all major projects, face significant risks. These risks can have major impacts on the benefits, cost and time scale of the project. The CAA should be aware of these risks when developing the regulatory framework. To highlight the potential risks for the project, we have undertaken a high level review of potential risks for a generic expansion project based on existing risk assessments. We have also assessed the magnitude and likelihood of each of these risks and considered at what stage in the project map they might occur (or be mitigated) and the ability of the promotor to control or mitigate them. Based on this framework we draw out the key regulatory implications. The diagram below and on the next pages provides an overview of our approach to identifying the key risks.



Risk assessment overview

Step 1: Identification of risks effecting costs

- Long list of risks identified from case studies and several public sources:
  - KPMG review of other major projects
  - Airports Commission
  - Airport capacity expansion submissions
  - National Risk Register
- Each source has identified a range of issues and risks with different perspectives and level of detail helping to provide an overall picture of the risk exposure of the project and specific risks.
- The risks identified in these sources are generic and this is not intended to replace a full risk review of the selected scheme by the promoter or CAA.

Step 2a: Mapping of risks to programme map

- Each generic risk is linked to the programme map based on the stage where it is most likely to occur:
  - At what level does the risk occur, i.e. programme or project specific.
  - Which of the stages within the programme/project might the risk occur.
- By mapping risks to the programme map we can understand the risk profile of the project and the parts and stages of the scheme with the greatest risk exposure.

Step 2b: Prioritisation of risks

- Each risk is assessed based upon its:
  - Likelihood: The probability of the risk occurring.
  - Magnitude: The scale of the impact of the risk on cost/time/ benefits of the project.
- The likelihood and magnitude of the risk determines its overall potential impact and importance for the regulatory framework.
- Risks can be ranked in terms of ‘expected impact’ which is a function of probability and cost.
- High impact risks have a high expected cost probability.
- The CAA could be most concerned with those risks which are most likely to be detrimental to users.

Step2c: Ability to influence risks

- We have assessed the ability of the promoter to influence or mitigate each risk.
- The promoter is deemed to have high control if it is primarily responsible or could in principle take action to mitigate the risk.
- The promoter is deemed to have low control if it cannot actively influence the risk.
- Where a risk is under the direct influence of the promoter it may be more appropriate for the promoter to be exposed to that risk.
- Many risks may appear to be out of a promoter's control but elements of the impact may be determined by a promoter's mitigation strategy and response.

Step 3: Implications for the regulatory framework

- Where a risk has been identified as high expected impact (high cost and high likelihood) the CAA will have an interest in ensuring that the risk is managed and mitigated to the extent possible.
- The potential mechanisms for achieving this largely depend upon whether the risk can be influenced by the promoter versus a third party and the part and stage of the project in which it occurs.
- Exposing the promoter to high impact/likelihood risks that it cannot influence may increase the costs of capital.
- These issues will help to influence the design of the regulatory framework.

Major risks

Based on the long list of risks shown in Appendix 3, we have identified those with the potential for high impact risk based on the magnitude and likelihood of any cost impact. As part of this assessment we have considered the promoter's ability to control or mitigate risks. This results in 10 major risks for the airport expansion scheme shown in the table below. Some of these risks may be largely outside of the control of the promoter. The CAA may wish to specifically discuss these risks with the promoter to understand the potential impact on the project, mitigation plans and how potential costs would be treated under the regulatory framework.

Category	Risk	Mapping of risk		Promoter's current ability to control
		Programme/Project	Stage of Programme/Project	
Planning permission	Levies and 106 agreements cannot be accommodated within the current cost plan. Planning process imposes additional costs.	DCO stage	All	High
General Construction	Airside space may be required on main construction site once a more detailed plan is developed.	Airside Construction Projects	Execution/Delivery	High
Technology	Systems migration. The interface between old technology installations and newly installed technology does not function as required.	All Projects	Handover and defects liability stage	High
Planning permission	The DCO process is delayed, jeopardising runway opening date.	DCO Project	All	Medium
General Construction	Third parties fail to deliver essential works according to schedule.	Construction Projects	Execution/Delivery	Medium
Land	The land assembly and relocation strategy delays commencement of runway construction.	Project	Execution/Delivery	Medium
General Construction	Unidentified below ground services are found on site once construction has commenced.	Construction Projects	Execution/Delivery	Low
Surface Access	Delays in completing surface transport projects (such as M25 tunnels and diversion) may delay the completion of the project.	Surface Access Projects	Execution/Delivery	Low
Utilities	UK Power Network Service projects scope and costs increase.	Utilities Project	Execution/Delivery	Low
Utilities	Complexity of unknown utilities may delay the enabling works and subsequent infrastructure works.	Utilities Project	Execution/Delivery	Low

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Section 2.4 Implications for economic regulation

Summary of Section 2

The programme map, project governance and risks described in this section are likely to play an important part of the regulatory framework for the scheme. We have provided a high level overview of these issues for a generic airport project drawing on evidence from the AC and other sources. As part of its regulatory strategy, the CAA could seek to develop its understanding of these issues for the final scheme.

Programme map

- We have presented a generic programme map which provides a high level example of how the scheme might be structured, organised and delivered by the promoter based on the work of the AC. The promoter will develop more detailed plans, potentially with a greater range of individual projects, with different timescales and processes than described in this report. The planning process may also lead to changes in requirements for the scheme. The CAA should seek to develop its understanding of the proposed structure and delivery of the scheme, including the overall programme plan, delivery structure, and potential risks.
- The achievement of the intended outcomes of the scheme are key to its efficiency. The CAA should identify what outcomes are expected to be achieved by each part of the scheme.
- The various components of the scheme such as the runway, terminal and surface access projects could each be considered as major projects in their own right with different risks and uncertainties and potential approaches to project management and procurement. The phasing of these projects will also differ. The CAA's approach to the regulation of the project will need to take account of this variation.
- The overall management and progression of the scheme can be understood through the programme map which sets out the key phases, stages and processes through which each project and the overall programme will progress. The breakdown and structure of the programme will affect the CAA's approach to regulation.
- Regulatory mechanisms can be applied to the overall programme from the top-down, but at the lowest level regulatory mechanisms may need to align with the project management and decision gateway stages of each project from the bottom-up, for forecasts and financial incentives for example.
- The first two phases of the programme – the objectives, and the competition and award phase – have been largely completed with the AC's recommendation for the Heathrow North West option (and subsequent announcement of Government support).
- The AC process has created a range of evidence, including several iterations of costs forecasts for different design options and discussions over the appropriate level of optimism bias that should be applied.
- The CAA's own duties have not been an explicit part of the AC's assessment process. The CAA has had little ability to influence the design, outcomes, and the overall benefits and costs of the scheme. These outcomes are a key part of the projects 'efficiency' and must be identified for the overall programme and individual projects and considered by the CAA as part of the regulatory framework.
- The CAA may be able to utilise the outcomes of the AC process as part of the regulatory framework. The designs, costs and other evidence collected by the AC could be a key source of evidence for the CAA to understand the outcomes, costs and potential for efficiency of the project.

Summary of Section 2 (cont.)

- The Programme Delivery Structure is important for the overall management and delivery of the scheme. The promoter is likely to have a well developed Programme Delivery Team based on its existing processes and experience but the capability and governance of this structure may not be suitable for the delivery of a programme of this scale or the level of interaction required with other stakeholders for example. The CAA may wish to test the promoter's plans in this area.
- In the delivery phase, each project will progress through a five stage process from inception to design, procurement and execution. This will align with the promoter's project management processes. The time line for each project within the programme will be different. The overall progression of the expansion project can be considered based on the aggregate progress of each project through the project gateway processes.
- Generally, for each project there will be a stage at which design and cost estimates will be accurate enough to allow the CAA to attach regulatory mechanisms. Prior to this stage there are more likely to be changes in scope or costs which will make it difficult to make accurate forecasts.
- The progression of the programme will be constrained by the 'critical path' which is linked to the key pre-requisite activities which need to be completed before further activities can begin. Projects on the critical path are particularly important for the overall success of the scheme.
- The transition and operational phase of the scheme is likely to be subject to particular risks which may not become apparent until after operations begin. Where possible these risks should be identified and mitigated in earlier phases of the project.

Project governance, management, procurement and risk

- Project governance is an important overarching aspect of the delivery of the scheme. The project governance structure will manage and integrate the different strands of the project, provide a central organisation to coordinate stakeholder inputs, change control, project communication, budgeting and other essential management activities.
- The requirements of the governance structure may also change over time reflecting the transition from planning to design, to procurement to construction.
- It may be beneficial for the CAA to develop a greater understanding of the promoter's approach to project governance, project management, procurement and risk and the choices and trade-offs involved in these matters.
- There are complex trade-offs involved in the choice of governance and procurement model and the quality of project and risk management processes is dependent on a wide range of factors. It may be difficult for the CAA to provide prescriptive rules or guidance on these issues. But the CAA could seek explanation and assurance from the promoter on its intended approach to these issues.
- Project management, procurement and risk management are also key overarching activities for the delivery of the scheme and there are a variety of widely recognised best practice principles and processes which should be applied to these activities by the promoter.

Summary of Section 2 (cont.)

- There are a variety of procurement models which could be used on different aspects of the scheme. The pros and cons of these models are largely determined by the complexity of the project, the capability of the promoter and depth of the supply chain. Different approaches could be applied to different parts of the scheme reflecting these factors.
- Good practice across these processes is highly subjective and it may be difficult for the CAA to be prescriptive over the approach adopted by the promoter in many cases.
- Ultimately it is not the responsibility of the CAA to provide prescriptive guidance to the promoter on project delivery issues. It could seek to provide an overview and challenge role supported by experts as required to provide a level of scrutiny and challenge to the promoter on these issues. It may also seek to ensure that the promoter has considered the potential impacts on passengers for example in its selection of procurement models which could implicitly transfer risks onto passengers.
- Some major projects have been delivered through Direct Procurement Models which enable greater separation between the promoter and the programme delivery structure and may encourage efficiency through enabling competition for project delivery. There are a wide range of potential models that could be considered for the airport scheme (and we discuss these options in more detail in Section 3).

Programme risks

- The airport expansion scheme is complex involving a range of different activities over different timescales with multiple stakeholders and delivery partners. The size and complexity of the scheme mean that it is more likely to face risks of cost escalation and delay than BAU airport projects.
- This means that the CAA will need to be aware of the potential project risks and their impact on the delivery of the scheme.
- Major projects are subject to a range of risks which can impact upon time, costs and benefits. The use of untested technology, late changes to scheme design, contractor conflicts and failure have contributed to project failure in a number of case studies.
- A range of high level risks have already been identified by the AC and scheme promoters. These fall into a range of categories associated with planning permission, construction, technology, surface access and utility projects. These risks could affect different parts of the programme.
- The top risks for the scheme include the potential for: higher than expected land and compensation payments, contributions for surface access projects, delays in the planning process, requirements for airside space closure during construction, failures in systems migration and new technology, third party failure or disputes, discovery of below ground obstructions and scope expansion on third party projects. Most of these risks are likely to occur during the construction phase of the project.
- Some of these risks are under the direct influence of the promoter. In this case it may be appropriate to expose the promoter to this risk. In other cases where the risk is under the influence of government or is largely uncontrollable the promoter will have limited ability to influence the risk and risk sharing mechanisms may be appropriate.
- The promoter will need to undertake a more detailed risk assessment for the overall scheme and the individual projects being undertaken. This assessment and the mitigation of risks should be a key part of the management and regulatory framework for the scheme.

Recommendations

Based on the points described above, we make a series of outline recommendations to the CAA to consider as part of its regulatory strategy for ensuring the efficiency of the expansion scheme.

Review the AC process and publications for evidence that can be used as part of the regulatory process

- Review the material produced by and for the AC including the cost estimates, risk assessments and documents associated with the wider project plan and delivery to understand the promoter's 'programme map', delivery structure, procurement model and key risks for the project. Seek to compare and contrast this approach with that developed by the alternative promoter and other case studies such as T5/T2 and examples from other major projects.
- Consider the potential to use the AC cost forecasts and wider outputs as a cost benchmark for the project. The AC cost forecasts may provide a useful benchmark for the 'efficient' costs of the scheme based on the competitive tension created by the AC process – although the potential for optimism bias and cost escalation also needs to be considered.
- It might be possible to treat the cost forecasts as a regulatory threshold for the treatment of costs for example. Testing this idea with the promoter may also help to reveal the promoter's confidence in its cost estimates.
- The CAA could seek to ensure that the promoter reconciles any changes in cost with the cost forecasts submitted to the AC. The CAA could seek to anchor the regulatory process to these forecasts and scrutinise any cost escalation by the promoter.
- Identify the key outputs of the scheme and projects to understand the specific outcomes the promoter will deliver.
- This may include physical factors such as ATM and passenger capacity, terminal floor space, numbers of security lanes, check in desks, concession floor space, features to improve resilience etc. It should also include outcomes such as service quality scores, average ATM delay, passenger queuing times etc. The delivery of these outcomes is a key part of the efficiency of the project and should not be allowed to be undermined by reductions in scope.
- Understand and assess the basis of the optimism bias contingency assumptions in the promoter's submission and the AC's assessment (including promoter's counter arguments). Determine if this level of contingency is appropriate given the nature of the scheme. Seek to understand the level of confidence the promoter has in its cost forecast and its suitability for setting a regulatory forecast.
  The AC and promoters appear to have disagreed over the appropriate level of optimism bias adjustment. It may be useful to define different levels of cost estimate to inform the regulatory framework (base, base + risk, base + risk + optimism bias).

Understand the promoters proposed programme map and its implications for economic regulation

- Seek to understand the promoter's proposed programme map for the scheme including its breakdown of key projects, the critical path, project phasing and proposed work packages. The CAA could seek to understand the proposed timeline for the scheme, key outcomes of each project and the level of certainty over the existing cost forecasts.

Recommendations (cont.)

- Identify key major projects and potential risks which might require special attention from the promoter. The work package structure could also have an impact on the risks of the project and the effectiveness of the procurement process.
- Assess the existing progress of the programme through the promoter's project management stages and identify potential stages for stakeholder consultation to influence project outcomes.

Assess and scrutinise the promoter's proposed project governance model

- Engage with the promoter to understand its overarching approach to project governance, management, procurement and risk management. The CAA could seek assurance over the model which is being proposed, the rationale and how stakeholders and passengers will be engaged as part of this process.
- Consider lessons from other major projects in the UK such as Crossrail, Thameslink and previous Terminal projects at Heathrow to understand best practice and the issues and trade-offs associated with different approaches to project governance, procurement and project management.
- Consider undertaking a review of the promoter's existing project and risk management processes to determine if they are suitable to deliver a project of this scale.
- Seek to understand the potential models for project procurement and the implications for customers risk exposure via the regulatory framework. The CAA could seek assurance from the promoter over its choice of procurement approach and its assumptions about the regulatory treatment of cost escalation or delay. This assurance could be undertaken on a project by project basis reflecting different procurement models.

Require the promoter to provide a detailed risk assessment for the scheme

- Consider the lessons from wider case studies about the factors which have led to major project failure in the past and consider if and where such factors might arise on the scheme. This includes, for example, the potential for late changes in scope, use of new technology and potential for conflicts between contractors.
- Require the promoter to provide an updated/more detailed risk assessment and mitigation plan for the scheme.
- Review and assess the key risks based on their likelihood and potential impact on benefits and costs and the ability of the promoter to control or influence these risks.
- Identify major uncontrollable risks for the programme and potential mitigations by the promoter.
- Engage with the promoter over its expectations or assumptions about the regulatory treatment of controllable and uncontrollable risks. This could include the definition of specific risk sharing mechanisms, or policy statements to allocate the risk of cost escalation to the promoter where appropriate.

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Section 3
Developing the regulatory framework

Overview of Section 3

This section considers the potential specification of the regulatory framework. It starts with an overview of regulatory frameworks used in the UK and provides a discussion of the factors that can influence their specification to identify the key project characteristics which will influence the design of the regulatory framework. We then assess the characteristics of the runway expansion schemes and consider how these characteristics could influence the regulatory framework for the scheme.

3.1 Overview of regulatory frameworks	— Example regulatory frameworks — Five broad types of framework — Seven dimensions of the regulatory framework
3.2 Factors influencing the specification of the regulatory framework	— Factors that affect the choice of regulatory framework and its dimensions — Main project characteristics that influence the choice of regulatory framework and dimensions
3.3 Characteristics of the expansion scheme	— Characteristics of the expansion scheme and its constituent projects — Comparison with the characteristics of BAU capex and key case studies
3.4 Implications for the regulatory framework	— Implications of expansion scheme and project characteristics for the dimensions of the regulatory framework — Comparison with the characteristics of the current frameworks applied at Heathrow and Gatwick and key case studies

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Section 3.1
Overview of regulatory frameworks

Introduction to Section 3.1

The regulatory framework is our term for the overarching approach to the regulation of the business or project including the activities of the regulator, the risk and reward exposure for the company and the nature of the mechanisms and methods applied. Each regulatory framework generally consists of a range of efficiency mechanisms and cost assessment methods which in combination determine the nature of the overall framework.

In this section we review alternative regulatory frameworks using examples from the infrastructure sector including:

- Thames Tideway Tunnel
- Hinkley Point C
- Heathrow T5
- Stansted new terminal/runway
- Channel Tunnel
- Phoenix Gas
- Interconnectors
- NHS Payments by results
- Scottish Transmission, National Grid
- Australian and New Zealand airports
- Lee Tunnel
- OFTOs

The case studies provide an illustration of the variety of regulatory frameworks available to the CAA and from this review we identify **five broad types or framework themes including**:

- Monitoring-based
- Cost-based
- Incentive-based
- Outcome-based
- Competition-based

Within each broad type of regulatory framework there are variations that can be described using **seven framework dimensions** as follows:

- Whether or not the framework is treated separately from existing regulatory assets processes.
- How much discretion the regulator has in applying the framework.
- Whether regulatory incentives are defined in advance or after the event.
- How much risk/reward the regulated company is exposed to.
- How much influence customers have in the regulatory process.
- How quickly the company can recover its costs.
- The intensity of regulatory activities and level of oversight..

Not all of the dimensions are relevant to each broad type of regulatory framework and there are some overlaps between them. The framework dimensions help to provide a structure to the analysis in Section 3.2 of suitable regulatory frameworks for new runway scheme.

Examples of regulatory frameworks

There have been a range of large scale projects in the UK delivered under different regulatory frameworks designed to reflect their unique challenges and characteristics. These examples have been selected to illustrate the wide range of frameworks and framework dimensions that have been developed and applied and to highlight the key characteristics which have influenced this design.

Project	Key issues and business/economic characteristics	Regulatory framework overview
Thames Tideway Tunnel 25 kilometre sewer tunnel under London at a cost of £4.2 billion with construction and acceptance phase of 11 years, and with core construction and acceptance phase of six years.	— Complex construction project, largest ever undertaken in the UK water sector. — Relative of size of project. Additional RAB more than 1/3rd the existing RAB of the promoter Thames Water. — Regulatory risk surrounding treatment of costs (pre and post construction). — Contestability issues. — A steadily declining RAB during operations. — Customers required to pay for the project through increased bills. — Funding risk due to the large investment requirements. — Legal requirement to undertake project and government contingent financial support for project.	**Cost/Competition-based approach** — Construction risk and contestability issues addressed by separation of the new project from Thames Water. — Investors exposure to project cost escalation capped. — Regulatory risk mitigated through fixed bid WACC during construction period. — Regulatory guidance providing certainty during the operations period. — Financeability supported by a bespoke Government Support Package (not IUK guarantee) along with pre-funding and funding of capex liquidity costs. — Extensive customer research and engagement to manage impact of increased bills.
Hinkley Point C New nuclear plant with estimated £16 billion capex under the new EMR Contract for Difference (CfD) support mechanism for low carbon projects	— The Contract for Difference (CfD) and Electricity Market Reform (EMR) regime based support mechanisms for development and financing. — CfDs are complex, incorporating features of PPP/PFIs and Payment Contracts. — The CfD contract needed to give EDF confidence to enable the required investment while demonstrating value for money and State Aid compliance. — The HPC project is to benefit from an IUK debt guarantee, adding another layer of complexity.	**Incentive based approach** — Incentive based as revenues are derived from forecasts of future costs, not actual costs incurred. — Price is set in advance in the long term via a CfD. The power station will sell electricity to the grid at the then wholesale price. The CfD adjusts with payments or receipts depending on the difference between actual and strike price. This mechanism is intended to repay expected capex, opex and returns, but there is no true up for actual capex. — Complex and bespoke commercial structure developed in the context of a novel regulatory landscape and support regime. — Public policy issues and constraints interacting with commercial structuring and risk allocation. — IUK Guarantee supporting financing; State aid issues and resolution.

Examples of regulatory frameworks (cont.)

Project	Key issues and business/economic characteristics	Regulatory framework overview
Heathrow Terminal 5 New terminal building opened in 2008. The Final cost of the project was £4.3 billion.	— Largest stand-alone investment project in the UK airport sector since privatisation. — Regulatory considerations and issues explored at the time; key regulatory precedent in the sector. — Part development of the existing and functioning airport to add and integrate additional capacity. — Capex size large compared to the existing RAB and large scale absolute investment. — Commercial risk. Prices increased materially to finance the new project based on demonstrable capacity on the part of Heathrow to increase prices. — Project not reliant on additional passengers, as the expansion mainly catered to existing demand. — Impact on credit rating and financial position in the context of relatively low initial leverage.	**Cost-based approach** — Framework for delivery included as part of the existing regulatory settlement (no separate RAB). — Additional returns supported through a premium on WACC on the entire asset base. — Pre-funding and revenue profiling to support funding of the project. — Controversial nature of the regulatory commitment and regulatory interpretation ex-post. — Leverage of customer base and market position to secure funding. — Innovative approach to contracting and regulatory treatment of capex spent.
Stansted new terminal/runway Aborted project to build a new terminal and runway.	— Large new capacity project in the airport sector. — High levels of commercial and demand risk. — Some customers opposed to the project. — Abortive costs added to the RAB as a result of project cancellation.	**Cost-based approach** — Wide range of potential approaches considered — Project was not undertaken due to combination of lack of support from the regulator, demand risk, poor customer buy in and legal challenges to the decision process.
Channel Tunnel Rail tunnel connecting the UK and France opening in 1994. Total cost of £4.6 billion.	— Major greenfield transport project planned to be delivered with no public funding support. — Cross border project requiring the involvement of two national governments and regulators creating complex ownership and governance structure. — Project was relatively complex with a high level of risks for both construction, operations and commercial outcomes.	**Competition-based approach** — SPV based on Build, Own, Operate, Transfer (BOOT) concession model with 55 years for operator to recover costs. — Scheme promoter used separate Design-Build-Commission (DBC) model and contract to limit its risk exposure.

Examples of regulatory frameworks (cont.)

Project	Key issues and business/economic characteristics	Regulatory framework overview
Phoenix gas Licenced to construct a gas network in Belfast and to grow and develop the market from a green-field base.	— Green field investment in a new gas network. A rare example of a comprehensive new energy network investment. — Demand uncertainty at the construction stage — Regulatory risk including ex-post review of capex out performance.	**Incentive-based approach** — Regulatory period extended, locking in WACC for an additional period to reduce uncertainty. — Phoenix was able to 'log up' and include any deferred revenues into the RAB due to lower than forecast demand. — Excess compensation in later years to offset initial shortfalls (akin to a project model rather than a regulatory model).
Interconnectors Own and operate the physical, bi-directional gas pipeline between the UK and continental Europe.	— Investment in new, part regulated commercial assets. — EU Directive requires third party access ruling out merchant only models. — UK law prevents interconnectors being added on the onshore RAB. — Regulatory concern about excess returns to investors.	**Incentive and competition-based approach** — Alternative structures designed to remove the risk of excessive equity returns. — Solution was to develop a hybrid model with a cap and floor for returns limiting risk and reward for company within defined windows.
NHS payment by results model Funding system for care trusts provided to NHS patients in England.	— Large number of hospital trusts with different numbers of patients, doctors, resources and wider issues. — Difficult to determine the funding need of different trusts — Originally trust funding is based on fixed rolling bloc payments negotiated by individual trusts based on case work. — Lack of transparency over funding allocation process. Often influenced by the negotiation skills of managers. — Unfair outcomes for different trusts and lack of productivity incentives.	**Outcome-based approach** — Payments to trusts are based on the number of patients seen or treated and tariff associated with different treatments. — Payments are weighted by case mix which reflects the complexity of different patients and treatment provided by trusts. — Creates incentives for trusts to drive performance improvements and improves transparency and equity in funding process. — Enables benchmarking and performance ranking of different trusts.

Examples of regulatory frameworks (cont.)

Project	Key issues and business/economic characteristics	Regulatory framework overview
Scottish Transmission, National Grid £7.6 billion investment in the electricity transmission system in Scotland under the RIIO-T1 regime 2013-2021; significant Capex under T1 for National Grid.	— Size of investment over eight years is more than twice the starting RAB, within a relatively restricted timeframe and geography. — Rate of capex spend is much higher than in previous periods, stretching capacity and management capabilities and raising construction risk. — Cost inflation was a key issue given the concentration and phasing of the required investment spend. — Incentives on accurate prediction of capex put overspend at risk. — The ability of companies to finance the capex is under pressure, both the ability to raise debt and the necessity of equity injections, given the restricted revenue base. — Company had concerns over the recovery of investment. — The length of asset lives has changed affecting the rate of recovery. — The totex regime with fixed capitalisation ratio no long differentiates between capex and opex, again affecting rate of recovery of investments. — The regulatory period is now eight years providing greater regulatory certainty but not covering the full recovery period.	**Cost/incentive-based approach** — Regulatory regime as a key driver of ROI and fundraising (regulatory solutions were developed within the existing regime). — Government support package was critical in obtaining investor support from equity and debt markets. — Phasing of investment over a number of years (but uncertainty over timing of capex spend). — Bespoke incentive mechanisms to deal with project overspends. — Additional equity infusion, as current revenues do not support the investment. — Organisational learning and management capacity required to manage a step-change in investment. — NPV neutral adjustment to cash flows (flexibility capped by demand elasticity).
Australian and New Zealand Airports	— Crisis in airport funding following 9/11 leading to financial distress for many airports and failure of RAB based charging models. — Low level of market power at many airports. — Growth in low cost airlines and foreign carriers. — Increasing importance of non-aero revenues.	**Monitoring approach** — Airports required to report information on pricing, quality and complaints handling information to the regulator on a regular basis. — Explicit threat that cost-based regulation could be re-introduced if airports are found to have abused market power. — Two tier monitoring regime for larger and smaller airports.

Examples of regulatory frameworks (cont.)

Project	Key issues and business/economic characteristics	Regulatory framework overview
Lee Tunnel Four mile sewer tunnel built by Thames Water at a capital cost of £635 million, due to complete in 2014.	— Complex capital project representing a significant percentage of the existing RAB. — Largest recent stand alone project in water until Thames Tunnel. — High political profile. Pollution concerns and construction was near the Olympic site. — As noted above for the TTT, customers paying for the project through increased bills (in monopoly environment). — Model of how much strain a price control framework can bear before regulator considers re-opener.	**Cost-based approach** — Project done on balance sheet and within existing regulatory regime. — Added to RAB as a per normal investment. — Thames carrying many of the risks. — Regulator thought of creating special incentives but changed mind after representations from Thames Water. — Extensive customer research and engagement to manage impact of increased bills.
OFTOs Offshore transmission assets can be built by generators then auctioned by Ofgem to increase competition (the 'generator build' model), or bidders can tender to both build and own and operate the transmission assets (the 'OFTO build' model).	— Innovative forms of funding for new transmission capacity. — Separation of construction and operations risk. — The assets require no further capex so the RAB steadily declines over a fixed period. — Low risk profile means bidders can be pure financials rather than strategic/technical investors.	**Cost/competition-based approach** — The OFTO model is an alternative financing and ownership structure which could be used instead of the incumbent financing and constructing itself. — Assets are purchased once built, meaning development and construction risk doesn't sit with long term asset owners. — Assets are purchased through an auction process, where the participants bid for the revenue stream. — The opex requirement is small and can be outsourced for fixed prices, reducing risk but giving no potential for outperformance. — As risk profile permits lots of investor types, auctions tend to be competitive driving WACC down over time. — In future Tender Rounds, windfarm developers may choose to follow the OFTO build option, whereby OFTOs would become involved in the procurement and construction of the transmission infrastructure rather than just the operation and maintenance.

Five broad types of regulatory framework

The regulatory framework examples described on the preceding pages can be categorised into five broad framework types. These are show in the table below together with a summary of their general pros and cons. The framework types are not always mutually exclusive and it is possible to develop frameworks containing different aspects related to different types of cost (separate treatment of opex and capex for example).

Framework	Examples	Pros	Cons
Monitoring-based Regulatory intervention applied with discretion	— Regulation of airports in Australia and New Zealand	— Light touch. Low regulatory burden — Appropriate where potential market failure or abuse is likely to be limited	— Weak incentives for efficiency where information asymmetry is strong — Reliant on credibility of regulatory threat
Cost-based Revenues directly linked to costs incurred	— TTT, Heathrow T5, Stansted new runway, Scottish transmission, Lee Tunnel, OFTOs	— Prevents arbitrary over or under reward for company — Enables flexibility for company to deal with risk and uncertainty	— Limited incentives to drive efficiency — Limited incentives for outcomes and innovation — Potential for capex bias if returns linked directly to size of RAB
Incentive-based Target cost allowance for company based on forecasts	— Phoenix Gas, Interconnectors, Scottish transmission, Hinkley Point C	— Creates incentives to reduce costs — Most effective where cost or activity is highly predictable and recurring to drive efficiency — Widely used in economic regulation for opex and renewal activities	— Potential for arbitrary over or under reward for company — May be difficult to develop efficient forecasts — May be difficult account for risk and uncertainty — May be difficult to account for changes in scope — Creates incentives for cost overstatement
Outcome-based Revenues linked to outcome targets set by regulator	— NHS Payments by Results	— Can creates incentives to reduce costs and improve outcomes — Helps to drive innovation by focusing company on outcomes rather than costs	— Regulatory challenge to define outcomes and levels of risk and reward — Creates incentives for regulatory gaming
Competition for the market Form of competitive process for the market	— Channel Tunnel, TTT, OFTOs. — Rail franchises	— Creates strong incentives for efficiency and innovation amongst competitors during bidding stage — Desired outcomes can be designed into procurement process	— Requires competitive market/supply chain — Difficult to apply to some projects — Tender process can be complex — Difficult to deal with risks and project failure

Seven regulatory framework dimensions

The examples show that there are a range of regulatory frameworks in use in the UK and elsewhere. The frameworks have been developed to suit the specific circumstances of the companies and objectives of the regulator. Over the following pages we define a set of framework dimensions which capture this variation and which can also be used to further characterise and describe different regulatory frameworks.

Based on our review of regulatory case studies we have defined seven 'dimensions', shown in the adjacent figure. Each dimension is a scale between two opposite points and may vary over time and between different cost categories (such as capex and opex) or project elements.

There are interdependencies between some dimensions, for example slow recovery of costs implies a degree of risk exposure for the company, whereas ex-post incentives tend to result in low risk exposure for the regulated company. Some dimensions may be mutually exclusive, for example it is difficult to apply ex-ante incentives without being prescriptive.

These dimensions provide a taxonomy for summarising the overarching regulatory framework applied in each industry at a high level. They cannot provide a complete description of the characteristics of each regulatory framework.

Dimensions of the regulatory framework

Existing	1	Bespoke for project
Prescriptive	2	Discretionary
Ex-ante incentives	3	Ex-post incentives
Low risk and reward (for promoter)	4	High risk and reward (for promoter)
Customer negotiation	5	Regulatory settlement
Fast recovery of capital	6	Slow recovery of capital
Non-intensive oversight	7	Intensive oversight

- **Based on our review of case studies we have defined seven 'dimensions' that can be used to describe each regulatory framework.**
- **These dimensions can be used to summarise and compare the approaches of different regulators and to characterise options for the CAA.**
- **Within each framework dimensions may vary over time or for different cost categories or project elements such as opex and capex.**
- **There are interactions and subtleties to each of the dimensions. Some are complementary and others may be mutually exclusive.**

Description of the seven dimensions

Dimension			Description of dimension
Existing		Bespoke for project	Framework is developed separately from existing regulatory processes. Bespoke frameworks are often applied to enable greater flexibility and segmentation of risks linked with a specific project.
Prescriptive		Discretionary	Prescriptive treatment of regulatory outcomes enables risk and reward to be assessed by the company in advance. Regulatory discretion gives the regulator flexibility to deal with unexpected events more prudently. It also creates uncertainty and risk from the perspective of the promoter and of financiers. Greater flexibility for the regulator may therefore come at the expense of higher financing costs.
Ex-ante incentives		Ex-post incentives	Ex-ante incentives (and consideration of costs) relies on the ability of the regulator to make accurate judgements about the efficiency of cost forecasts. Ex-post incentives enable greater flexibility but may imply higher risk from a promoter's and financier's perspective due to the uncertainty of regulatory treatment.
Low risk and reward		High risk and reward	The promoter may be exposed to a high or low level of financial risk or reward. Low risk exposure may reduce profits but may also provide weak incentives for the efficient management of the project and control of costs. The ability to share risks is also affected by the availability of funding from wider sources (customers and or government).
Customer negotiation		Regulatory settlement	In principle customer engagement in the regulatory process can be highly beneficial. In practice there may be costs related to the need for consultation and additional time needed to make decisions. Also current customers may not have the same needs as future customers. Where this is the case a regulator led process may be more appropriate.
Fast recovery of capital		Slow recovery of capital	The speed of cost recovery can be used to manage the financial risk of the project, for example by providing revenues during the construction phase. Pre-funding can be controversial and raises the question of inter-temporal equity as current customers are paying for future customers' benefits.
Non-intensive oversight		Intensive oversight	Regulatory intervention can provide benefits – but also imposes costs on stakeholders. 'Better regulation' principles suggest that the intensity of regulatory oversight should be proportionate to the benefits and costs it imposes on stakeholders.

Defining dimensions

Dimension				
Project is considered within the same regulatory framework as the core business operations e.g. linked to existing RAB.	Existing	1	Bespoke for project	Completely separate regulatory framework for the project or business. For example based on SPV or separate concession.
Prescriptive treatment of costs and uncontrollable factors. Specific identification and treatment of risks.	Prescriptive	2	Discretionary	Discretionary treatment of costs and risks – re-opening of price control and discretion over the treatment of cost risks and implementation of incentives.
Incentives are mainly driven by ex-ante defined treatment of cost, this generally requires prescriptive definition of risk and reward.	Ex-ante incentives	3	Ex-post incentives	Incentives are mainly driven by ex-post treatment of costs, based on prescriptive criteria or regulators discretion.
High level of pass through of costs and risks to other stakeholders.	Low risk/reward	4	High risk/reward	Higher risk on promoter for cost and timeframe of delivery. Could include financial incentives for delivering on time.
Customer has greater role and input at key decision points. Must be consulted for changes in costs/scope.	Customer negotiation	5	Regulatory settlement	Limited customer role. Costs and scope changes are treated through regulatory negotiation (could be prescriptive or discretionary).
Higher proportion of revenues accumulated at the same time or before capex is expended.	Fast recovery of capital	6	Slow recovery of capital	Low proportion of revenues accumulated at the same time or before capex is expended.
Low frequency, light touch monitoring or oversight by the regulator.	Non-intensive oversight	7	Intensive oversight	High frequency or in-depth monitoring and oversight by the regulator.

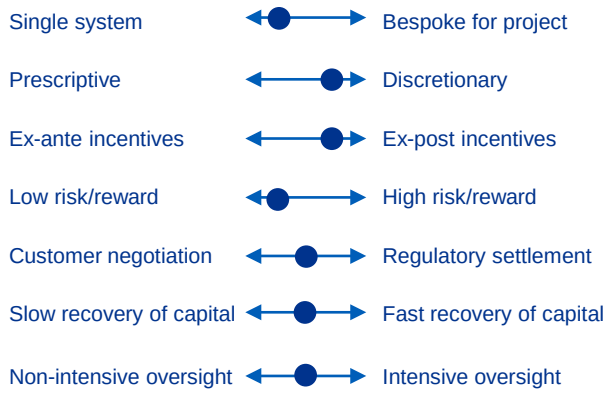
Over the following pages we review the framework dimensions for five case study examples including: Heathrow, Gatwick, water and sewerage companies, the Thames Tideway Tunnel project and the Channel Tunnel.

Regulatory framework dimensions for Heathrow

Heathrow

- Heathrow is regulated through a cost-based RAB times WACC framework with a range of different incentive mechanisms applied to both capex and opex.
- The CAA's approach to capex is largely discretionary and based on creating low risk ex-post incentives i.e. no potential for outperformance on capex. This is achieved by relying on an ex-post review of the airports costs to identify inefficiency and to exclude cost from entering RAB.
- The CAA places stronger ex-ante incentives on operating costs with exposure to risk and reward with the exception of changes to security requirements and rates costs.
- The CAA undertakes an ex-ante review of the airports capex programme, but this is a relatively light touch review. This analysis is used to set an envelope for capex over the period. The CAA also uses a core and development capex mechanism to facilitate changes in scope and cost within the period and flex the overall envelope.
- The CAA relies heavily on airlines as part of the capex governance process. They are involved in developing the airports capital plan and highlighting areas for review by the CAA.
- The CAA also utilises an Independent Fund Surveyor which provides ongoing active scrutiny of the airports activities and project management to provide the CAA with information on performance and inform the ex-post review.

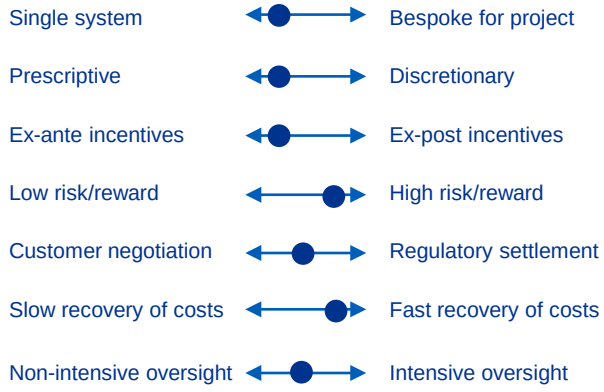
Capex



Rationale for chosen framework

- Lack of comparators, bespoke nature of investment and ongoing changes in project scope make it difficult for the CAA to set an efficient cost forecast for the airport operator.
- Ex-ante incentives may tend to result in overstatement of costs or de-scoping of project outcomes. For these reasons the CAA's framework relies on ex-post efficiency incentives.
- Airlines provide a counterview to the airport over many aspects of airport investments. Airlines participate in Constructive Engagement and capex.

Opex



Rationale for chosen framework

- Operating costs are recurrent and therefore the CAA has a greater ability to assess the airports efficiency and set an efficient cost forecast.
- For this reason the framework for opex has stronger efficiency incentives to encourage outperformance.
- The framework incorporates several risk sharing mechanisms to account for uncontrollable risks such as changes to security requirements.

Regulatory framework dimensions for Gatwick

Gatwick

— Gatwick is regulated through a license backed commitment framework, developed against a RAB based comparator. This is a lighter touch form of regulation than the Heathrow framework which alters the nature of airline engagement to encourage more commercial relationships.

— The commitment framework gives Gatwick the ability to negotiate individual deals directly with airlines (with the backstop of a maximum average charge), Gatwick has also made several commitments on service quality and capex which are similar to the requirements of Heathrow's framework.

— The airport has committed to investing around £100 million of capex per year. Unlike at Heathrow, the CAA has no specific oversight of the outcomes or requirements of this spending. Airlines are consulted, but have no explicit regulatory oversight of the airports activities.

— Because there is no direct link between capex and charges Gatwick is arguably more incentivised to invest in projects which most effectively enhance the airport to increase levels of traffic and commercial revenues.

— There is no explicit formal ex-post review process but the CAA can review the commitments framework and could choose to reinstate RAB based regulation. This potential regulatory threat is likely to create incentives for efficiency.

— It is not known at this stage whether the commitment framework will continue beyond 2021, or be replaced by an alternative form of economic regulation.

Capex

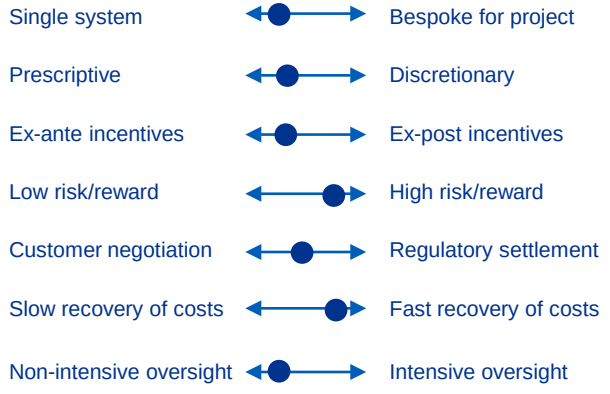
Rationale for chosen framework

— Gatwick has not yet reached capacity and faces competition from other airports including Heathrow, Gatwick, Stansted and Luton.

— Its market power is weaker than Heathrow and it has stronger incentives to invest in capex efficiently to attract airlines and passengers.

— The CAA and airport were in favour of adopting a new approach to economic regulation which would reduce regulatory burdens and create stronger competitive pressures and commercial relationships.

Opex



Rationale for chosen framework

— There is no link between opex and revenues beyond the original analysis undertaken by the CAA as a benchmark comparator of the commitments.

— This means that Gatwick has strong incentives to minimise its operating costs.

— The length of the commitments (from 2014 to 2021) reduce the risk that operating cost savings will be recaptured by the regulatory framework.

Regulatory framework dimensions for water and sewerage

Water and Sewerage

- Water and sewerage companies operate in a regulatory framework with a relatively high degree of risk/reward exposure and with prescriptive mechanisms applied by the regulator.
- Ofwat applies a wide range of regulatory mechanisms including assessment of company business plans with fast-tracking for those of high quality plans and further regulatory scrutiny for those that fail to meet the standard.
- The framework requires companies to develop their own performance metrics and financial incentives which are then calibrated by the regulator (with input form other stakeholders such as the Consumer Challenge Group).
- Ofwat is able to use top-down econometric benchmarking of totex to identify frontier performance. Unlike in aviation there are a wide range of comparable domestic companies which enables greater reliance on this form of analysis. This reduces the need for more intensive bottom-up studies when assessing efficiency and means that forecasts can be set independently of companies own views.
- Ofwat also utilises a range of uncertainty mechanisms or 'notified items' and is prescriptive in defining in advance the factors that might alter the price control for each company.

Capex

Single system	Bespoke for project
Prescriptive	Discretionary
Ex-ante incentives	Ex-post incentives
Low risk/reward	High risk/reward
Customer negotiation	Regulatory settlement
Slow recovery of capital	Fast recovery of capital
Non-intensive oversight	Intensive oversight

Rationale for chosen framework

- There are multiple domestic water and sewerage companies which enable the use of benchmarking to estimate efficient costs.
- Most of the water and sewerage networks are in place so that capex is largely driven by renewal activity which is low risk and predictable.
- The industry does not have a strong customer representative group which means that the regulator needs to provide greater oversight of industry plans and behavior.

Opex

Single system	Bespoke for project
Prescriptive	Discretionary
Ex-ante incentives	Ex-post incentives
Low risk/reward	High risk/reward
Customer negotiation	Regulatory settlement
Slow recovery of costs	Fast recovery of costs
Non-intensive oversight	Intensive oversight

Rationale for chosen framework

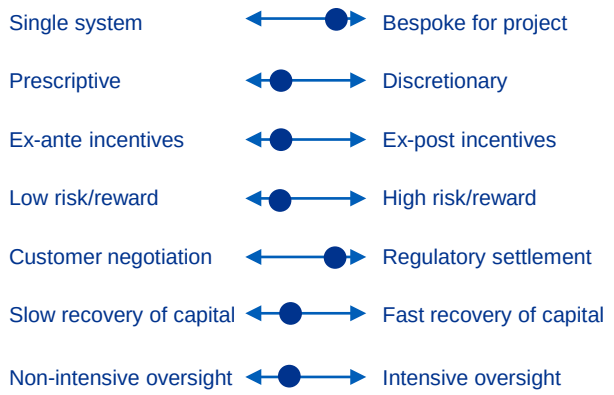
- Ofwat regulates companies on the basis of totex to encourage companies to use whole life costing and deter inefficient cost allocations.
- This approach is more viable in water as most capex is related to renewals which is a relatively recurrent and predictable cost activity.
- This approach means that there is no distinction between the construction and operational phase of the project.
- All costs are subject to the same incentive mechanisms.

Regulatory framework dimensions for TTT

Thames Tideway Tunnel

- Part of the London Tideway Improvements initiative which is made up of upgrades to five sewage treatment works (STW), the Lee Tunnel and the Thames Tideway Tunnel.
- Construction starts in 2016, following 2015 contract and license awards and is planned for completion in 2023.
- Forecast cost of £4.2 billion (2014 prices).
- Procurement option is a hybrid between regulatory procurement and private finance.
- Application of the 'Specified Infrastructure Projects' regulation necessitating that the SIP must be put out to competitive tender and that the incumbent is prohibited from carrying out the project. Thames Water selected the infrastructure provider (IP) via a competition.
- The Thames Tideway Tunnel will be designed, constructed, financed, owned and operated by the Infrastructure Provider. It will have its own bespoke license and its own RAB, each independent of Thames Water.
- The bespoke regulatory framework contains financial incentives to promote cost efficiency, with a cost sharing mechanism set around a fixed cost target.
- The framework also contains a financial incentive to promote delivery on time, with penalties payable for late delivery against defined milestones.

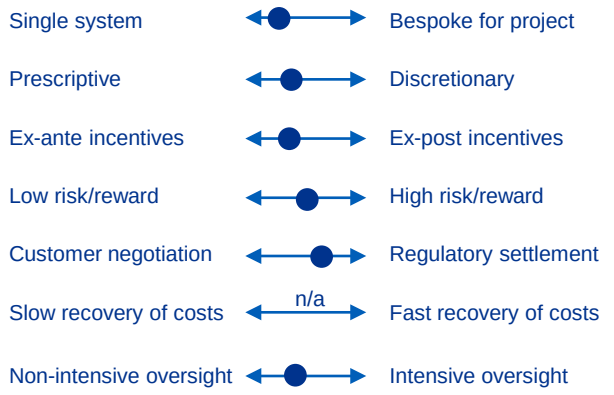
Capex



Rationale for chosen framework

- Large, risky and complex investment. Different risk characteristics to BAU.
- Risk to financeability of Thames Water if carried out on their Balance sheet and RAB.
- Highly separable discrete investment.
- Minimal regulatory discretion and extensive de-risking of IP during construction to deliver low WACC.
- Competition designed to appeal to pure financial investors.
- Penalty and pain/gain sharing mechanisms.

Opex



Rationale for chosen framework

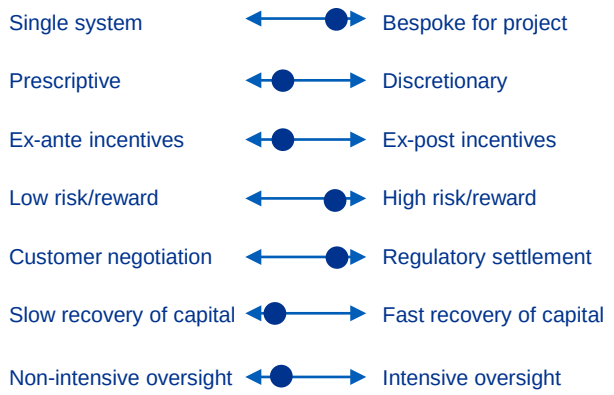
- Incentives implemented once construction is complete. Long lived low risk asset once commissioned.
- Bespoke license and incentives to deliver to time and cost fall away on commissioning. Regulation reverts to the conventional framework.
- Opex targets set ex-ante.
- It is unlikely the Customer Challenge Group process will apply to TTT as Thames Water will continue to pass through costs as approved by Ofwat.

Regulatory framework dimensions for Channel Tunnel

Channel Tunnel

- The Channel Tunnel was planned as a privately financed infrastructure project based on a BOOT concession model funded through revenues from the creation of a shuttle service between England and France.
- The project construction was subcontracted through a Design-Build-Commission (DBC) contract. The design and scope of the project was included as part of this process. This created some uncertainty through the competitive process as the scope of the project was not fully defined.
- The Inter Government Commission in control of the project subsequently changed part of the project scope which increased costs.
- The entire project was to be financed by a private consortium based on the grant of a concession to operate rail and shuttle services through the tunnel for a period of 55 years.
- Due to cost escalation and lower than expected level of traffic the funding for the project was insufficient and the Government had to intervene to guarantee the private debt. The concession was also significantly extended.
- The complexity of the original corporate structure (involving several banks and construction companies from both France and the UK) also made restructuring the project complex.
- The total project cost was around £4.6 billion against a forecast of £2.6 billion (1985 prices) and took six years to complete against a forecast of five years.

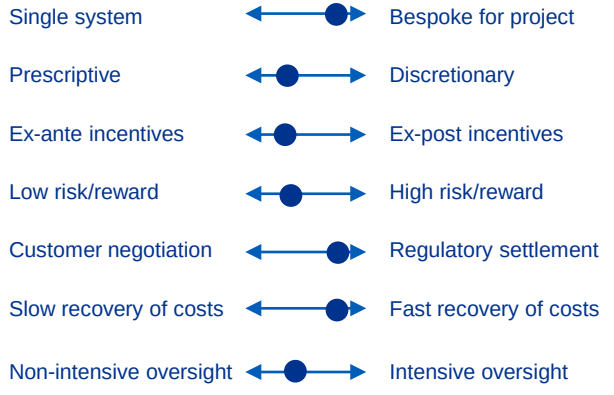
Capex



Rationale for chosen framework

- Need to fund project through private finance led to an SPV concession model with full construction and traffic risk borne by the promoter.
- Promoter attempted to limit risk exposure through contracts, but hindered by changes in scope and late decision making by the IGC.
- Eventual project costs and traffic forecasts resulted in financial challenges. Government support was eventually required through changing the terms of the concession.

Opex



Rationale for chosen framework

- The BOOT model implies that the operator would be exposed to full risk and reward associated with the operation of the concession.
- The intervention of the government in the original terms of the concession and the ownership of the tunnel shows that in practice the government has had to apply discretion over the treatment of the project.
- In effect this altered the regulatory framework of the project to reduce risks and extend the duration of the concession.

Summary of Section 3.1

Overview of different regulatory frameworks

A key issue for the CAA is what approach it should take to the economic regulation of the new runway scheme. This is a complex issue and will be influenced by the nature of the project, stakeholders views and the existing regulatory framework in place for the promoter. Different frameworks could also be appropriate for the Heathrow and Gatwick schemes.

— There is not necessarily an optimal framework and the CAA's choice will be influenced by its objectives and consideration of relative risks and benefits.

— The dimensions of a regulatory framework may vary by specific project elements and cost types. This could mean that different frameworks could be applied to different types of costs (for example opex and capex) or for different periods of the project (design and construction).

— The regulatory framework provides the context to consider the specific mechanisms and methods that can be applied to the scheme or its constituent projects.

— The regulatory framework may also change over time or have different mechanisms applied for different elements e.g. surface access costs or terminal buildings. The CAA could consider the potential benefits of a differentiated approach to the treatment of different costs.

— The CAA has already consulted upon different treatments of costs associated with developing material for the AC process, planning and post planning costs of the new runway (category A, B and C). Similar distinctions could be made across different parts of the scheme.

A definition of regulatory frameworks based on seven dimensions

— Each regulatory framework can be described through seven dimensions which capture the trade-offs between different regulatory methods and mechanisms. This includes the level of regulatory discretion or prescription, level of risk, intensity of oversight and level of customer involvement.

— There is some overlap and interaction between some of these dimensions (for example ex-ante incentives generally requires a higher level of prescription over the treatment of costs) and there can also be complex subtleties within each – customer engagement can take a wide range of forms for example.

The current regulatory frameworks

— The CAA's existing framework for the regulation of Heathrow capex is cost-based with a low risk approach based on an ex-post review of costs and a RAB model. The framework is largely discretionary with a high level of customer input to define the outcomes of investment, and moderate levels of regulatory oversight.

— For Gatwick the framework is based on monitoring with a looser pricing cap, supported by investment and service quality commitments from the operator. The framework has a higher level of risk/reward exposure and lower levels of customer input and regulatory oversight than the Heathrow framework.

— These regulatory frameworks reflect the characteristics of the two airports: their market power, incentives and, level of risk and predictability of costs.

— Both frameworks could be maintained or adapted for the regulation of the new runway scheme.

KPMG

Section 3.2
Factors influencing the specification of the regulatory framework

Introduction to Section 3.2

In this section we explore the rationale for the choice of alternative regulatory frameworks, drawing on the review of regulatory case studies described in the previous section.

We identify five project economic characteristics that influence the development and design of the regulatory framework and its dimensions.

These characteristics are then discussed in abstract in this section before being applied to the context of the airport expansion scheme in Section 3.3.

Important caveat on the development of regulatory frameworks and use of case study evidence

It is important to acknowledge that each of the regulatory frameworks considered as part of our study have been developed in response to the specific issues and challenges associated with the nature of the project. This includes factors such as the market structure, size of the project, level of risk and uncertainty over the cost forecasts, ability of the promoter to control costs and the linkages with existing regulatory frameworks.

Some of the regulatory frameworks have evolved over time to incorporate an increasing range of regulatory methods and mechanisms. These have often been developed in order to counteract or re-balance adverse incentives created by the original regulatory framework.

For example the CAA has applied a requirement for Heathrow to consult customers over the definition of a project business plan, project triggers and the core and development capex process to ensure that the scope of airport investment is efficient. This is because under the RAB based framework the airport arguably has limited incentives to ensure efficient investment outcomes in terms of the scope of capex investment.

There have also been changes to market structures and the wholesale approach to the regulation of major projects in some sectors with an increasing application of: customer engagement, the introduction of competition within segments of the market and the separation of projects into discrete assets to facilitate competition for the market and better allocations of risk (e.g. TTT and OFTOs).

In each case the regulatory framework is guided by the characteristics of the project but is also based on professional judgment by the regulator based on the relative pros and cons of different approaches.

Factors affecting the dimensions of the framework

The design of the regulatory framework is influenced by a range of factors related to the nature of the project, the level of uncertainty and the capacity of the regulator and other stakeholders. These are set out in the table below.

			More important factors					Less important factors
Dimensions of regulatory framework			**Factors affecting choice of dimension**					
1 Existing	↔	Bespoke for project	Ability to segment project revenues, costs and risks from existing assets	Ability of promoter to control cost and outcomes	Scale of costs and customer risk exposure	Ability of regulator to assess efficient outcomes and costs	Potential for third party impacts	Similarity of risks to BAU
2 Prescriptive	↔	Discretionary	Ability of promoter to control cost and outcomes	Ability of regulator to assess efficient outcomes and costs	Potential for impacts on financing costs	Scale of costs and customer risk exposure	Need for efficiency incentives versus controlling profits	Potential for efficient scope changes and risks
3 Ex-ante	↔	Ex-post	Ability of regulator to assess efficient outcomes and costs	Ability of promoter to control cost and outcomes	Need for efficiency incentives versus controlling profits	Scale of costs and customer risk exposure	Potential for impacts on financing costs	Degree of uncertainty over material cost components
4 Low risk bearing	↔	High incentives	Ability of regulator to assess efficient outcomes and costs	Ability of promoter to control cost and outcomes	Potential for impacts on financing costs	Need for efficiency incentives versus controlling profits	Potential for third party impacts	Uncertainty and potential for catastrophic/ uninsurable risk
5 Customer negotiation	↔	Regulatory settlement	Customers ability to define and assess efficiency	Ability of regulator to assess efficient outcomes and costs	Quality and accuracy of business plans at time of decision	Divergence of customers views (between groups)	Divergence of customers views (across time)	Negotiating power and information asymmetry between promoter and customer
6 Early recovery of costs	↔	Late recovery of costs	Potential for impacts on financing costs	Scale of costs and customer risk exposure	Divergence of customers views (across time)	Scale of costs	Financeability of project in absence of pre-funding	Inter-generational equity
7 Non-intensive oversight	↔	Intensive oversight	Ability of regulator to assess efficient outcomes and costs	Scale of costs and customer risk exposure	Quality and accuracy of business plans at time of decision	Scope for customer harm without redress	Maturity of regulatory framework	Exposure of promoter to reputational and financial risks

Implications for the regulatory framework

Based on the previous analysis we have identified five main project economic characteristics (C1- C5) which influence the design of the regulatory framework and choice of specific efficiency methods and mechanisms. The table below provides a summary of some of the main implications of each for the project characteristics for the design of the regulatory framework.

Implication for dimensions of framework	Project economic characteristic	Implication for dimensions of framework
Project revenues, costs and risks cannot be separated from existing assets. *Project may need to be integrated into existing framework.*	C1. Ability to separate project from existing assets	Project revenues, costs and risks can be separated from existing asset and is attractive to bidders as a standalone asset. *Bespoke framework – potential for competition-based approach.*
Promoter has limited ability to control costs and regulator faces high risks of creating arbitrary over – or under reward when imposing financial incentives. *Requires discretionary, low risk, ex-post framework. Cost-based approach may be more appropriate.*	C2. Ability of business to control costs	Promoter has greater ability to control costs and regulator can create stronger dynamic efficiency incentives with less risk of arbitrary risk and reward. *Enables prescriptive, high risk, ex-ante framework. Incentive or outcome-based approach may be more appropriate.*
Regulator unable to forecast or assess costs accurately reduces viability of setting binding forecast. *Requires discretionary, low risk, ex-post framework with stronger customer engagement, cost-based approach may be more appropriate.*	C3. Regulator's ability to define and assess efficiency	Regulator can define and assess efficiency accurately to create strong efficiency incentives. *Enables prescriptive, high risk, ex-ante framework based on regulatory settlement, incentive or outcome-based approach may be more appropriate.*
Customers have limited ability to assist the regulator in defining efficient scope of the assessment and forecasting of costs. *Regulator must define project outcomes and assess efficiency, i.e. a framework based on regulatory settlement.*	C4. Customers' ability to define and assess efficiency	Customers have greater ability to assist the regulator in defining efficient scope of the assessment and forecasting of costs. *Scope to engage customers over regulatory outcomes and efficiency i.e. a framework based on customer negotiation.*
Small low risk projects have limited risks for financeability, supply chain and the overall delivery of the project. *Enable greater risks to be placed on the promoter with less oversight from regulator.*	C5. Scale of cost and risk exposure	Large high risk projects create greater potential risks for financeability, supply chain and the overall delivery of the project. *Limits promoter risk exposure and requires regulatory to provide more intensive oversight of the project.*

C1. Ability to separate project costs, revenues and risks

The ability to separate project costs, revenues and risks from existing assets has a direct influence on the ability of the regulator to implement a bespoke regulatory framework i.e. distinct from the framework for existing assets. This could include PPP/SPVs or direct procurement approaches such as those adopted for the TTT, Channel Tunnel, HPC and other projects.

- The ability to separate the project from existing assets is determined by several factors including:
  - Whether the project is green or brownfield.
  - Whether the project has a defined and independent revenue source (such as public funding or user charges separated from existing assets).
  - Whether the project has operational linkages with existing assets which could mean that revenues, costs and risks cannot be separated.
  - The size of the project and its attractiveness as a standalone PPP/SPV project to the supply chain.
  - The availability of suppliers with the capacity to bid for the project in a competitive market.
- In combination these factors determine whether the project can be effectively separated from existing assets so that project failure would not threaten the operations, finances and funding of existing assets.
- Where this is possible and the asset is of sufficient size to be attractive to a competitive market of potential suppliers it may be feasible to adopt a more bespoke framework with a wider range of efficiency mechanisms.
- The ability to separate the project into a bespoke regulatory framework has several potential advantages including the ability to protect existing customers from project failure whilst also creating stronger incentives for cost efficiency for the scheme promoter through enabling direct competition.
- Bespoke frameworks can also enable a competitive process for the project for example as a Design – Build – Operate (DBO) contract, which could enable the regulator to arrive at an efficient cost estimate through market testing. A consequence of this approach is that the operations of the asset must be separated, which may have consequences for overall operations.
- Bespoke regulatory frameworks have been developed for several major projects including the TTT, Hinkley Point C, Channel Tunnel, Interconnectors and offshore transmission operators.
- These projects are or were all greenfield assets, with defined revenue streams based on government support or potential concession income. There has also been a relatively competitive market for most of the projects which may have helped to achieve efficient costs.
- Operational linkages between these projects and existing assets is also relatively limited which enables separation from existing assets. The new runway project may not have these characteristics.

Where a project's revenues, costs and risks can be separated from existing assets, and competitive tendering for the project is feasible a more bespoke regulatory framework could be adopted including the use of PPP, SPV and other procurement models. Such frameworks can provide benefits by isolating the costs and risks of the project from existing users and introducing direct competition for the project.

C2. Ability of business to control costs

The ability to control costs is important for the viability of different regulatory frameworks. Costs which cannot be controlled or forecast by the company can be difficult to incentivise. Uncertainty over the potential outturn costs of a project can increase the need for adjustments and risk sharing mechanisms to pool risk and avoid arbitrary under or over reward for the promoter.

— The overall costs of the scheme are the responsibility of the promoter but some elements of costs may be difficult to predict and control. This is because they could be influenced by:
  - Government decisions and changes in policy.
  - Third party activities.
  - Input price fluctuations.
  - Efficient changes in scope and design.
  - Unanticipated factors such as bad weather, supplier failure, natural disasters etc.

— For example decisions on airspace design, business rates, security requirements, noise, residential compensation and other factors could all affect the costs of the runway scheme and are at least partially outside of the direct control of the promoter.

— Third party organisations such as Highways England, utility providers, Local Authorities and other organisations may underestimate the costs of their own scheme elements or create impacts for wider parts of the scheme.

— Input price fluctuations are a large risk for the project due to its scale and the wider range of infrastructure projects which are likely to occur at the same time. This will place pressure on the supply chain and prices.

— Aviation is also a dynamic industry and the needs of airlines and passengers are likely to evolve over the course of the project so that the scope of the scheme may need to be changed to accommodate new technology or security risks for example.

— Unanticipated factors of any kind such as extreme weather, or supplier bankruptcy for example may occur and increase the costs of the scheme in an uncontrollable way.

— Each of these factors could result in the costs of a scheme element being higher (or lower) than assumed by the promoter. To at least some extent these factors are not directly under the control of the promoter, although it does have a responsibility to ensure that the risks and potential impacts are captured within its forecasts and mitigated where possible.

— Where an element of cost is not fully controllable, the application of incentive or outcome-based mechanisms would be more challenging and risky as uncontrollable factors will tend to increase the need for a discretionary treatment of costs.

— This will increase the risks faced by the promoter and if efficiency mechanisms are applied there may need to be an ability to adjust the mechanism in response to an uncontrollable factor, this can be complex and requires detailed consideration of the range of potential outcomes, the impact on scheme costs and the regulatory treatment of those costs.

— **The promoter has overall responsibility for the costs of the scheme, but there might be factors outside of it's direct control which impact on costs. Where this is the case, it will be difficult for the regulator to apply incentive mechanisms without creating risks of under or over reward.**

— **The source of these risks include government or judicial decisions, third party costs, the need for efficient changes in scope, input price fluctuations and unanticipated factors.**

C3. Regulator's ability to define and assess efficiency

— There are differences in the level of accuracy that can be achieved in the definition, assessment and estimation of efficient outcomes and costs across regulated industries. Where a regulator has limited ability to define outcomes and assess costs it is difficult to create financial incentives for cost or outcome performance for example.

— More fundamentally it may also be difficult for the regulator to define what outcomes the business should be aiming to achieve through its investment in which case it must rely on the regulated company or its stakeholders to define those outcomes. This creates a risk that the company sets targets which reflect its own priorities rather than those of its customers.

— If the regulator cannot define efficient scope it must rely on the judgment of the business supported by customer engagement and expert guidance. This may tend to force the regulator to rely on cost-based regulation to avoid creating adverse incentives for investment.

— The ability to assess efficiency reflects several factors including:

- The availability of suitable comparators.
- Whether the project type is a network or a single asset.
- The regulators understanding of the business and key cost drivers
- The complexity of the project being considered.
- The potential for costs to be affected by exogenous factors.
- The potential for market testing within the regulatory framework.

— It is generally possible for a regulator to assess costs and outcomes ex-post based on the outturn performance of the company and detailed reviews of its planning and implementation processes.

Regulator's ability to define/assess/estimate costs based on

Ability to asses efficiency: High → Low

Project type	Number of comparators	Standardised product	Network or single asset
Water distribution	High	Yes	Network
Gas distribution	High	Yes	Network
Electricity distribution	High	Yes	Network
Road	Low	No	Network
Railways	Low	No	Network
Airports	Low	No	Single

— Incentive or outcome-based mechanisms require that the regulator is able to assess costs and outcomes in advance. This can be challenging and the regulated company will often have a significant informational advantage over the regulator.

— The complex and diverse characteristics of airport projects means that the CAA's ability to define efficient project scope may often be quite limited and it has relied upon Constructive Engagement between airlines and the airports to help define the efficient scope of projects.

— Airport projects also tend to be relatively unique so that few truly direct comparators exist for benchmarking. This means the CAA's efficiency review is typically limited to the identification of ex-post inefficiency rather than identifying a true efficient cost 'frontier'.

— The ability of the regulator to assess cost efficiency both ex-ante and ex-post is a key project characteristic which influences the design of the regulatory framework and the choice of efficiency mechanisms.

— It may be difficult to define and assess the efficiency of the airport scheme as there are limited direct comparators and airports are non-standardised 'products' with multiple outcome objectives (service quality, commercial revenues, operational requirements etc.).

C4. Customers' ability to assess value and efficiency

Customers' ability to contribute to the definition and assessment of value and efficiency of a project is important for the design of the regulatory framework. Customers can assist the regulator by bringing a different perspective to the regulatory process informed by their own needs, helping to reduce information asymmetry and the need for the regulator to define outcomes.

- Where customers have the ability to define and assess efficiency they may provide a useful input into the regulatory process. Customers' views are likely to be useful for helping to define outcomes and scoping options to achieve those outcomes. This is particularly valuable where the regulator does not have a good understanding of the optimal scope or outcomes of a project.
- Customers can also help to overcome information asymmetry by, for example, highlighting specific projects or areas of the business where they consider greater efficiency could be achieved, or where the intended outcomes are not in line with their interests.
- Customers views are not always aligned and some groups may have specific interests which do not reflect the needs of customers as a whole or the needs of future customers.
- Divergent views between customers, either between groups or over time, reduces the effectiveness of engagement and increases the need for regulatory intervention, oversight and judgment.
- Where this is the case the regulator must manage customer input, address conflicts of interest and represent the interests of vulnerable groups. This is particularly relevant to the runway scheme where the main beneficiaries will be future passengers and airlines not currently serving the airport due to a lack of capacity.
- For example, the competitive interests of existing airlines may conflict with these groups on some issues due to the potential impact of new competitors and increased charges.
- In the price control process the CAA has relied on airlines to represent the interests of passengers to define project outcomes and the efficient scope of projects, manage the change control process and highlight areas for efficiency review.
- For the new runway project the interests and capacity of existing airlines to play this role on behalf of all passengers may be weakened. This could mean that the CAA may need to play a greater role than under the existing price control process to represent the interest of future users, for example to prevent the interests of individual airlines being used to block investments which are costly to current airlines but in the interests of passengers overall.
- In general airlines are likely to have a good ability to engage with the regulatory process but their interests and capacity for providing oversight on a project of this scale needs to be considered.

- **Customers' ability to define and assess value and efficiency is important for the design of the regulatory framework, specifically they can help to define efficient scope and assist the regulator overcome information asymmetry.**
- **Regulators may not always be able to rely on customers where their interests do not reflect wider needs or where customers lack an understanding of the issues facing a specific project. In this case the regulator must seek to represent the needs of these groups.**

C5. Scale of cost and risk exposure

The scale of cost and risk exposure will influence the design of the regulatory framework and the viability of specific efficiency mechanisms. Large and risky project elements may create greater risks for the financeability of the project, which may also reduce the viability of high risk incentive mechanisms. There may be a limit to the level of risk and cost escalation to which the promoter can be exposed without threatening the viability of the project.

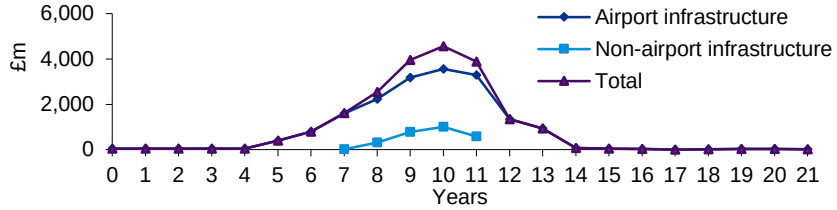
- The new runway scheme will be a large and costly project, though not unprecedented. The costs of the project could be potentially in line with Crossrail (£14 billion) or Hinkley Point C (£18 billion) with the total costs of the schemes at Gatwick and Heathrow expected to be between £6 and £21 billion.
- Within this total there are several particularly large projects including the terminal buildings, transit systems, equipment, land and road projects which each account for a high proportion of the project costs and represent a large amount of spending in their own right.
- These projects may be subject to particular uncertainties or risks which could limit the viability of efficiency mechanisms. Cost overruns or delays on these elements of the project could create financial distress for the promoter. The terminal, transit systems and road projects for example are high cost and high risk. These parts of the scheme may require particular regulatory focus. Lower cost and risk elements such as taxiways and aprons, runways, and car parks could be treated in different ways.
- The CAA's cost efficiency framework should be most focused on the projects associated with the largest level of cost. Where these projects are subject to a high level of risk or uncertainty, the need to ensure financeability may reduce the scope of financial incentive mechanisms and increase the need for risk sharing and cost adjustment mechanisms.

Proportion of costs	HENR	HNW	G2R	Level of cost risk
Total costs (£billion)	**£20.6**	**£17.4**	**£6.1**	
Planning	1%	1%	4%	Low
Terminal buildings	17%	20%	14%	High
Plant	4%	3%	4%	Medium
Tunnels and bridges	0%	0%	0%	High
Transit systems	6%	6%	3%	High
Runways	1%	2%	2%	Low
Taxiways and aprons	3%	4%	7%	Low
Equipment	6%	6%	2%	Medium
Land	14%	7%	18%	Low
Airfield ancillary	4%	3%	4%	Medium
Car parks	3%	3%	1%	Low
Third party land users	0%	0%	0%	Medium
Environment	3%	3%	6%	Medium
Community	2%	2%	2%	Medium
Roads	11%	13%	8%	High
Rail	2%	3%	0%	High
Optimism bias	11%	11%	11%	-
Risk	12%	12%	13%	-

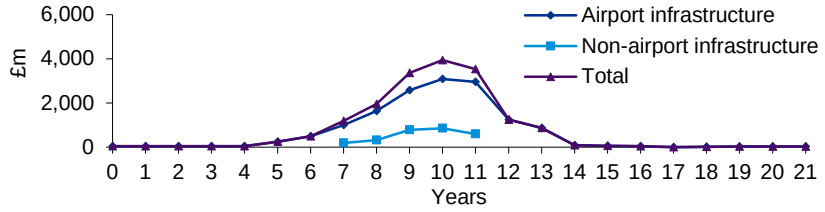
C5. Scale of cost and risk exposure (cont.)

Each of the schemes has different characteristics which might affect the optimal design of the framework. The scale, profile and potential risk exposure of the Heathrow and Gatwick schemes are likely to be different and need to be assessed individually. These differences may enable a different form of regulatory framework.

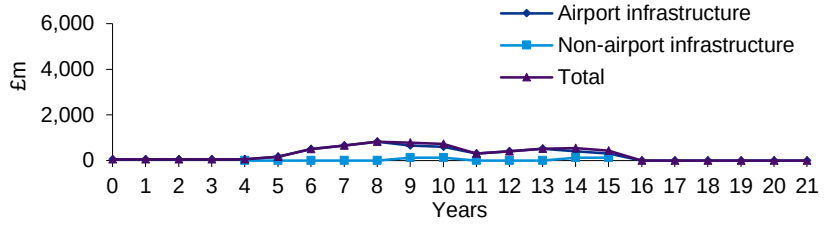
Capex profile – Heathrow Extended Northern Runway



Capex profile – Heathrow North West



Capex profile – Gatwick Second Runway



- The level of risk associated with each project element and the potential for the promoter to experience financial distress as a result of cost escalation and other issues is linked with the overall spending profile of the project, relative to the revenues generated by the airport.
- Where there is a peak in the cash requirements of the promoter, additional risks associated with incentive mechanisms are more likely to result in financial distress.
- In this respect the Heathrow schemes appear to have a much greater level of overall expenditure and peak case requirement than the Gatwick scheme. At its peak the Heathrow schemes will require around £4.5 billion of capex annually, versus £0.7 billion for the Gatwick scheme. This could have implications for several aspects of the project, including the critical path, financeability and supply chain pressures.

- **The airport expansion project will be a major undertaking, being one of the largest projects undertaken in the UK. The scale of the cost will create financial challenges for the promoter which may limit its ability to bear risks associated with regulatory mechanisms.**
- **Differences in the scale of costs and profile exist between Heathrow and Gatwick scheme options which may effect the viability of different frameworks.**
- **Each of the airport projects contains costs associated with or under the direct control of third parties.**

Summary of section 3.2

Factors influencing the choice of regulatory framework

— The approach to economic regulation and the specific design and dimensions of the regulatory framework are influenced by numerous factors which affect the viability and effectiveness of different regulatory mechanisms. The design of the regulatory framework is ultimately based on the judgment of the regulator over these issues.

— Ultimately the specification of the regulatory framework, its dimensions and mechanisms and methods is based on the choices and decisions of the economic regulator and different regulators have made different choices in this regard reflecting the economic characteristics of their industries and projects. There is a clear trade-off between creating efficiency incentives for the company/promoter and preventing arbitrary over or under reward i.e. cost or incentive-based regulation. There are also a range of decisions which need to be made about the level of risk/reward exposure for the company and the involvement of customers in the regulatory process for example.

— We have identified **five main project economic characteristics** which may influence the choice of the regulatory framework for the runway scheme. These are:

- Ability to separate the costs, risks and operations of the project from the existing asset (C1).
- Ability of the company to control and predict the costs of the project (C2).
- Ability of the regulator to define, estimate and assess efficient outcomes and costs (C3).
- Ability of customers to determine efficient outcomes and efficiency (C4).
- Scale of cost and risk exposure for the promoter (C5).

Summary of section 3.2 (cont.)

The regulatory implications of the five main project economic characteristics

— **C1: The ability to separate the projects revenues, risks and operations from existing assets** is a pre-requisite for a bespoke framework (e.g. based on competition or concession type models such as have been applied to the TTT and Channel Tunnel projects).

Where it is not possible to separate projects from existing assets, bespoke frameworks will be difficult to implement.

— **C2: The ability of the company to control and predict costs** Limited control over costs (e.g. due to exogenous risks) may motivate a discretionary, low risk/reward, ex-post framework. A prescriptive, high risk/reward, ex-ante framework is not likely to be feasible due to the risks of arbitrary profit or loss for the company in this situation.

On the other hand where costs are more predictable and recurrent, it may be more feasible to introduce a more prescriptive, higher risk/reward, ex-ante based framework which creates greater incentives for efficiency and innovation.

— **C3: The ability of the regulator to define and assess efficiency** will strongly influence the degree to which the framework can provide ex-ante or prescriptive incentives to the promoter for cost efficiency. If the regulator cannot define efficient outcomes because the nature of the project is highly complex then a more discretionary, low risk, ex-post framework with stronger customer engagement may be required. In broad terms cost-based regulation may be more appropriate. Even if efficient outcomes can be defined upfront a low ability to assess costs upfront will limit the use of more incentive-based frameworks, which may result in arbitrary over or under reward for the company and encourage regulatory gaming and cost overstatement.

— **C4: The ability of customers to assess the values and efficiency** of the project will directly determine the potential scope for customers to be engaged in the regulatory framework for example in defining the outcomes of the project and or highlighting aspects of the project where regulatory scrutiny should be applied.

In order for customers to play this role they need to be well informed, have effective representation and their views need to be relatively unified. In some cases customers may lack the expertise to provide constructive input into the regulatory process or their interests may be directly in conflict with the promoter and other stakeholder such as future customers and third parties.

The ability to involve customers in the regulatory process may provide significant advantages to the regulator by providing an alternative viewpoint and reducing the level of information asymmetry between the regulator and the promoter. There may be limits to the extent to which the regulator can rely upon customer inputs where issues are more complex.

— **C5: The scale of cost and risk exposure for the promoter** has implications for the extent of cost and risk sharing between customers and the promoter. It may be difficult to impose a high risk reward framework on the promoter for high cost items with a high level of risk without creating financeability risks. This will also affect the cash requirements of the promoter and the need for fast versus slow recovery of capital through the frequency of RAB adjustments for example.

Where a promoter faces a high level of risk exposure it may be difficult to create a high level of financial incentive/risk without increasing the financing costs of the promoter.

KPMG

Section 3.3 Characteristics of the airport expansion scheme

Introduction to Section 3.3

In the previous section we identified five main project economic characteristics that influence the design of the regulatory framework. We now consider the specific economic characteristics of the airport expansion programme and its constituent sub-programmes. This enables an evaluation of potential regulatory frameworks in Section 3.4.

We first set out the economic characteristics of the expansion schemes compared to BAU investment undertaken at each airport. Building on the analysis of airport expansion programmes set out in Section 2.1 we also consider the economic characteristics of nine illustrative sub-elements of the airport expansion scheme. These include sub-programmes associated with major projects, but also regulatory and planning processes where different regulatory mechanisms could be applied:

— Specification stage

— Planning

— Terminal

— Plant

— Runway

— Equipment

— Land purchase

— Community compensation

— Surface access

These elements of the programme have been identified based on the Airports Commission cost breakdown and the key activities which will need to be undertaken by the CAA. **Alternative definitions of the scheme could also be considered by the CAA**. Our assessment of the economic characteristics of each is based on our professional judgment, benchmarked against wider regulatory precedents.

Each of the five economic characteristics are discussed, comparing the characteristics of:

— Heathrow and Gatwick expansion schemes (with the two Heathrow schemes being sufficiently similar for this to be denoted as one).

— Sub elements and projects within the airport expansion scheme.

— BAU investment undertaken at each airport.

— A number of key case studies.

New scheme versus 'Business As Usual'

The new runway scheme will have several features relative to business as usual (BAU) airport projects including: less cost certainty, more difficulty for the CAA to define and assess efficiency, less ability for customers to define and assess scope and efficiency and significantly greater potential for cost and risk exposure for the promoter. These differences are summarised in the table below.

Characteristic	Expansion scheme	BAU	Summary
C1. Ability to separate project costs, revenues and risks from existing asset	Low – Medium	N/A	The ability to separate the expansion scheme from existing assets will be limited because there are strong operational and geographic linkages between them. The project is on a brownfield site and is reliant on the same source of revenue as the wider asset.
C2. Ability of company to control costs	Low	Low – Medium	The promoter's ability to control costs will be more limited in many areas. There are several large third party sub-programmes and many uncontrollable contingencies which might increase costs including surface transport projects, and government and legal decisions. Other factors such as - the scale of the scheme, its impact on areas outside of the immediate airport boundaries, the number of stakeholders and processes associated with achieving planning permission, the potential for cost inflation in the wider supply chain and uncertain compulsory purchase costs – may also reduce cost controllability.
C3. Regulators ability to define and assess efficiency	Low	Low	The large scale, complexity and one-off nature of the project means that the ability of the regulator to define the required outcomes and assess efficiency is likely to be even more limited than for BAU projects. The CAA will probably not have the capacity to take a view on the design of many of the elements of the scheme. There will also be few appropriate benchmarks to illustrate the potential for efficient outcomes.
C4. Customers ability to define and assess efficiency	Medium – High	High	The expansion scheme is primarily for the benefit of future passengers and airlines. Existing airlines may not have the same interests and incentives as these groups. Airlines may also lack the capacity to engage in regulatory processes for this much larger project. For these reasons the ability of customers to define and assess efficiency could be more limited than under the business as usual case.
C5. Scale of cost and risk exposure	High	Low – Medium	The project costs are large (particularly for the Heathrow schemes) relative to business as usual and may create financeability risks for the promoter which need to be considered by the CAA.

C1. Ability to separate project costs, revenues and risks

Defining the ability to separate project costs, revenue and risks

The ability to separate the project costs, revenues and risks from existing assets is an important factor for the design of the regulatory framework – and the potential to develop a bespoke framework. For this characteristic to be considered high several factors are important:

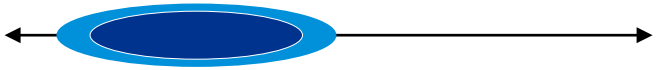
- New greenfield project.
- Limited geographic or operational linkages with existing assets (so that project failure would not impact existing customers).
- Independent revenue stream (such as user charges or public funding).
- Project is attractive as a standalone PPP/SPV project and likely to have competitive market for bidders.

In combination these factors help to determine whether or not a project needs to be regulated as part of the existing asset. Or whether a separate treatment is possible such as direct procurement through competition.

Application to the expansion scheme, comparison with BAU capex and case studies

The figure provides a comparison of the dimension for Heathrow and Gatwick expansion schemes, the scheme projects and a number of case studies.

— The airport expansion scheme (or elements of it) is likely to be attractive as a standalone project to many bidders, however the first three factors described above probably do not apply. The project is brownfield, has strong linkages with the existing airport assets and will not have an independent revenue stream that can be fully separated from landing charges.

Low	Medium	High
Case studies		
		HS1
Terminal 5	Thames Tideway Tunnel	Hinkley Point C
Terminal 2		Channel Tunnel
Airport-level		
		
Business as usual capax comparison is not relevant for this characteristic		Gatwick scheme Heathrow scheme
Expansion scheme projects		
Terminal	Plant	Planning
	Runway	S.Access
	Equipment	
	Land	
	Community	

— For these reasons the ‘ability to separate’ the project from existing assets is probably quite limited and could create operational challenges. The failure of the scheme would have impacts for existing users and could threaten the operation of the wider airport. This will make it difficult to insulate passengers from risks and would limit the feasibility of any separation. Separate ownership of the asset would also probably create operational complexities which would have implications for the general operation of the airport. This implies that a fully bespoke economic framework may not be appropriate as it would be difficult to separate the costs, revenues and risks from the existing airport asset.

C2. Ability of company to control costs

Defining the ability of company to control costs

— The ability to control costs is related to the level of risk, uncertainty and predictability of the scheme costs. This is partially determined by the uniqueness of the items and services being purchased and the scope for changes which may make it difficult to control costs.

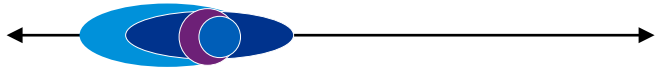
Application to the expansion scheme, comparison with BAU capex and case studies

— The ability of the airport to control costs might generally be considered to be low for the main reason that there is significant variation in the design of airport projects and the scope and outcomes are often quite intangible and subject to scope change.

— This can occur for example as a result of changing preferences over terminal design, changes in technology, changes in aircraft equipment and design, changes in airlines and competition from other airports or short term shocks such as bad weather or security risks which alter the optimum design or timing of a particular project, or create a need for new equipment and services.

— In contrast for most other major projects the required outcomes can be defined more easily. The nature of the market means that infrastructure design in power and water networks for example is more stable so that ongoing changes in requirements are less likely and significant. The Channel Tunnel, or TTT are equally complex projects for example but the desired outcomes of those projects are relatively easy to define.

— As with all major projects, airports are also subject to risks and uncertainties which can result in uncontrollable cost increases, some of these are notable and largely out of the control of the promoter, e.g. surface access costs and compensation payments.

Low	Medium	High
Case studies		
	Thames Tideway Tunnel	
Hinkley Point C	Channel Tunnel	HS1
Terminal 5	Terminal 2	
Airport-level		
		
Business as usual capex – Gatwick		Gatwick scheme
Business as usual capex – Heathrow		Heathrow scheme
Expansion scheme projects		
Terminal	Plant	Planning
Land	Equipment	Runway
Community		
S.Access		

— The new runway scheme will face a range of risks and uncertainties which could also reduce the ability of the promoter to control costs. Some of these risks have been highlighted in Section 2.1. for example changes in government policy or the actions of third parties such as Highways England and TfL could also result in uncontrollable cost increases for the promoter.

— Many of these issues also occur on other mega projects, but the location and wide range of policy, technical and political risks for the airport scheme do suggest that the promoter may have a more limited ability to control costs for some parts of the project and in some situations.

— For these reasons – the overall ability of the promoter to control costs will be more limited than at present and is generally lower than the other case studies examined in our study.

C3. Regulator's ability to define and assess efficiency

Defining the regulators ability to define and assess efficiency

— The ability of the regulator to define and assess efficiency is determined by several factors including the availability of benchmarks and general level of information asymmetry.

— Where the regulator can determine efficient scope and outcomes, it may be able to forecast and assess costs with differing degrees of accuracy. This is largely determined by the predictability of item costs, e.g. based on historic examples and external benchmarks.

Application to the expansion scheme, comparison with BAU capex and case studies

— Airports are unlike many other infrastructure projects (such as in energy and water) because they directly interface with customers i.e. airlines and passengers. The design and quality of the airport therefore has a major impact on customer outcomes. This means that the efficient outcomes of investment projects are often quite intangible and difficult to define in advance particularly by the regulator. It would be difficult for the CAA to determine an efficient terminal design or stand layout for example considering the wide range of objectives for such projects.

— Competitive and technology cycles in aviation are also relatively fast meaning that projects can quickly become obsolete. For example the development of new aircraft, security process equipment or changes in airline requirements can change the need or scope of an investment project.

— Assuming that the scope and design of a project is optimal and in the interests of passengers the CAA's ability to forecast and assess those costs is also generally quite limited because airport projects are bespoke and there are generally few appropriate benchmarks to enable an assessment of efficient costs.

Low	Medium	High
Case studies		
Terminal 2	Thames Tideway Tunnel	HS1
Terminal 5	Hinkley Point C	Channel Tunnel
Airport-level		
		
Business as usual capex – Gatwick		Gatwick scheme
Business as usual capex – Heathrow		Heathrow scheme
Expansion scheme projects		
Terminal	Planning	
Community	Plant	
S.Access	Runway	
	Equipment	
	Land	

— Terminal projects for example can be highly complex containing a wide range of technical equipment with different designs and supporting equipment which also mean that external benchmarks are not perfectly comparable, though it is generally possible to benchmark some elements of the project from the bottom-up.

— For these reasons it is generally quite difficult for the CAA to forecast efficient capex costs in advance and the CAA has tended to rely upon ex-post review to generate efficiency incentives as part of the price control process.

— In comparison for most of the other regulatory case studies, the required outcomes can be defined by the regulator. Because of this, as well as the greater availability of benchmarks, and the potential to introduce competition into the process, the regulators ability to define efficiency within the project has been generally higher.

C4. Customers' ability to assess value and efficiency

Defining customers' ability to define and assess efficiency

— The ability of customers to assess value and efficiency is important for defining their role in the regulatory framework. Where customers can define efficient outcomes and scope, and/or provide information on the efficiency of the regulated company they can provide a useful input into the regulatory process.

Application to the expansion schemes, comparison with BAU capex and case studies

— Within the airport sector customers' ability to assess and value efficiency is high. This is primarily because of the presence of the airlines, which – as large well resourced competitive businesses often operating from a variety of airports – are well placed to represent the interests of customers and understand the operations and efficiency of the airport.

— For this reason the CAA has developed several processes which draw on the expertise and understanding of the airlines to inform the airports business planning including Constructive Engagement and the capex governance processes at Heathrow.

— In comparison in most of the other regulated sectors there is no agent equivalent to the airlines which can represent the view of passengers. Customers of water, gas and rail companies for example are small and diffuse and do not generally have the expertise or resources to contribute to technical issues dealt with by the regulator.

— For the new airport project, airlines will continue to have useful views on the design and efficiency of the project which means that they may continue to play a role in the regulatory framework. However, the scale of the project and its wider requirement for surface access, utilities and other types of project could mean that airlines may be less effective at providing input into these processes due to its greater demands.

Low	Medium	High
Case studies		
Thames Tideway Tunnel		
HS1		Terminal 2
Channel Tunnel		Terminal 5
Hinkley Point C		
Airport-level		
		
Business as usual capex – Gatwick		Gatwick scheme
Business as usual capex – Heathrow		Heathrow scheme
Expansion scheme projects		
Planning	Plant	Terminal
Runway	Equipment	
Land		
Community		
S.Access		

— There could also be some conflict of interest over the design of the project given that its primary objective is to expand the capacity of the airport and therefore potentially result in additional competition for incumbents.

— On balance therefore airlines (as representatives of customers) will continue to provide useful evidence and views on the scheme design and efficiency as part of the regulatory process but the size and complexity of the project and greater potential for conflicts of interest mean that the CAA may not be able to rely as strongly upon them as it does in the current price control process.

C5. Scale of cost and customer risk exposure

Defining the scale of cost and customer risk exposure

— The scale of cost may be broadly assessed upfront and in general cost estimates become more accurate throughout the development, design and planning processes. The scale of customer risk exposure will be determined by the scale of the project, the magnitude and likelihood of cost risks and the degree to which the risks are mitigated or managed by the promoter e.g. within the supply chain or through insurance.

Application to the expansion scheme, comparison with BAU capex and case studies

— The new runway project will face inherent risks associated with its size and complexity. With a total cost of between £6 billion-£22 billion the project could represent up to 20% of the total UK transport infrastructure pipeline. Whilst the project is large, there are a range of other infrastructure projects of similar or larger scale. The size and cost of the project is not unprecedented and several projects such as HS2, Crossrail, Hinkley Point C and Moorside power stations have (or are expected to have) comparable costs.

— The scope and complexity of the project will mean that it may face greater risks, for example related to third party activities and cost inflation, which may make some costs less predictable and controllable than in a BAU situation.

— Both Heathrow and Gatwick schemes also face a range of specific risks (described in Section 2) which could result in cost escalation and which may be outside of the direct control of the promoter.

— Similarly supply chain pressures due to wider infrastructure projects such as Crossrail, HS2, TTT etc. could result in higher than expected costs for some elements of the project. Whilst the scale and magnitude of the risks are high they are arguably comparable to the risks faced by other large projects. In some ways risk may arguably be lower as the scheme does not involve the introduction of wholesale new technology and is focused on a small geographic area which may make some risks easier to identify and manage.

Low	Medium	High
Case studies		
	HS1	Hinkley Point C
	Terminal 2 & 5	
	Thames Tideway Tunnel	
	Channel Tunnel	
Airport-level		
		
Business as usual capex – Gatwick		Gatwick scheme
Business as usual capex – Heathrow		Heathrow scheme
Expansion scheme projects		
Planning	Equipment	Terminal
Plant	Land	S.Access
Runway		
Community		

— One area where the project will differ significantly from other major projects is the exposure of customers to risk. Unlike HS2, Crossrail, Hinkley Point C and ultimately the Channel Tunnel there will be no explicit government funding support for the project. This means that all funding must come from passenger charges and therefore – depending on the regulatory framework – passengers potentially face a high level of risk exposure to cost escalation.

— In addition as the scheme promoter will likely be the airport operator, any unexpected cost escalation that threaten the financial viability of the project could also have implications for passengers. It may therefore be difficult to fully apportion cost risks to the promoter.

Summary of Section 3.3

There are a range of factors that will influence the design and choice of the regulatory framework for the expansion scheme, within this list we identify five main project economic characteristics.

Assessing the five characteristics for the expansion scheme

C1: The ability to separate the revenues, risks and operations from existing assets is low. The project is an inherent part of the wider airport campus with a wide range of geographic and operational interfaces with the existing asset. The scheme will also be fully reliant on passenger charges for revenue support.

C2: The ability of the company to control and predict costs may be relatively low for many aspects of the scheme due to the range of uncontrollable risks and probability that the scope will need to evolve to take account of changing requirements and unforeseen factors. The scheme will also require several surface access projects which may be outside of the promoter's direct control. For these reasons it may be difficult for the CAA to determine a fully scoped outcome requirement for the scheme. There will probably need to be some flexibility in the regulatory framework to cope with ongoing changes in project scope and outcomes.

This means that any financial incentive associated with ex-ante cost estimates will need to incorporate error correction and change control mechanisms to deal with such uncertainties

C3: The ability of the regulator to define and assess efficiency will be relatively limited ex-ante. The project will be unique and there are relatively few appropriate benchmarks to compare the overall costs. This means that the CAA will generally be reliant on ex-post review of costs to identify inefficiency. The scale of the project means that such reviews will probably need to be undertaken on a more regular basis, such as after the completion of major projects or sub-programmes for example.

C4: Customers ability to assess and value efficiency for airport projects is generally high relative to other regulated sectors. For the new airport scheme, airline input will continue to provide useful information on the efficient scope of new projects, particularly for the terminal design for example. There are more likely to be conflicting views amongst current airlines and future airlines and projects with greater complexity where airlines may have less capability to provide oversight. For these reasons the role of the airlines is likely to continue to be a useful part of the regulatory framework but the CAA may need to take on a greater role in the process to represent the views of potential future passengers and airlines.

C5: The scale of the costs of the project and the level of risk is high relative to BAU but not unprecedented for a major UK infrastructure project. Crossrail, HS2 and Hinkley Point C have similar levels of cost and risk. Some parts of the project such as the terminal, transit and surface access projects are subject to a relatively high level of risk and scope change which may require specific regulatory focus.

The high level of cost and risks means that the scheme will face financeability risks. This may limit the level of risk that the promoter can be exposed to and means that cost assessments need to be undertaken on a more regular basis to reduce regulatory uncertainty.

The economic characteristics of the scheme vary quite widely across the individual elements or sub programmes. The terminal and runway sub-programmes for example are different across almost every economic characteristic. This suggests that a single overall approach to the regulation of the scheme may be sub-optimal for some aspects of the scheme and that a framework with wider variation in mechanisms could be beneficial.

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Section 3.4
Dimensions of the regulatory framework for the airport expansion scheme

Introduction to Section 3.4

In the previous section we reviewed the five main economic characteristics of the new expansion scheme and its constituent sub-programmes, we now consider the implications of the project economic characteristics for the choice of regulatory dimensions and the design of the overall framework for the scheme.

We discuss each of the seven regulatory framework dimensions in turn, comparing the appropriate dimensions for:

— Heathrow and Gatwick expansion schemes (with the two Heathrow options being sufficiently similar for this to be considered together for this purpose).

— Individual sub-programmes within the expansion scheme.

— The CAA's current position for both capex and opex based on Heathrow and Gatwick's current regulatory framework.

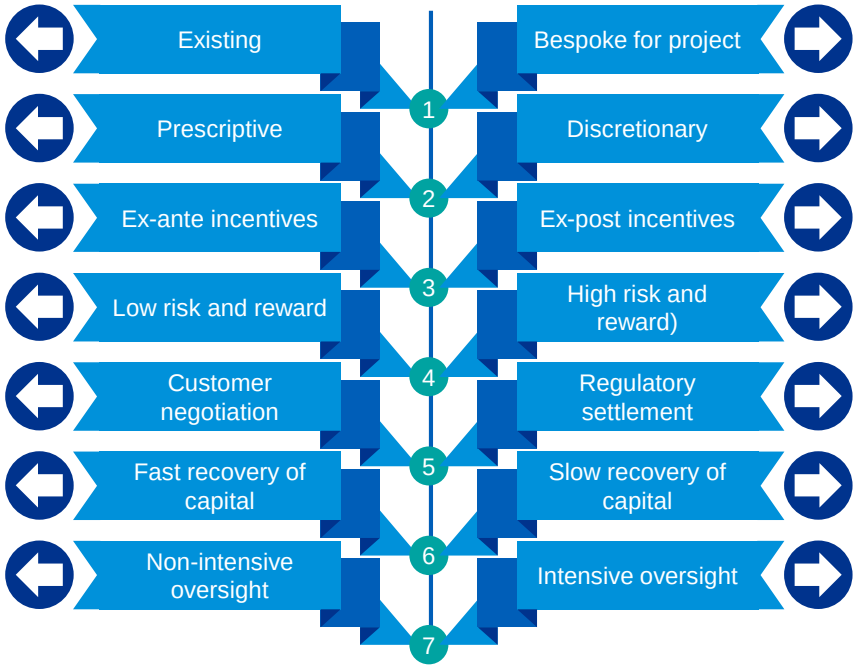
— A number of key case studies.

A summary of the implications for the sub-programmes within the expansion scheme is also provided.

Our assessment is based on a judgement of the relative economic characteristics of each scheme and their likely implications for the regulatory framework. Our 'view' is informed by the issues and precedents set by the CAA in the development of its current framework as well as the issues faced by other regulators. The position of each benchmark is based on our judgement of the relative nature of each framework.

Overall our assessment of each dimension should be interpreted as providing an indicative view of how the CAA could adopt its current approach to the regulatory framework and dimensions. Alternative breakdowns of the elements of the scheme could result in different conclusions.

Dimension



D1. Existing versus bespoke

The choice of an existing versus a bespoke framework

— Most of the larger projects delivered or planned within the UK such as TTT, HPC, HS1 and the Channel Tunnel have or are being delivered under a bespoke regulatory framework separate from that for the wider industry and existing assets. The reasons for adopting a bespoke approach to the regulatory framework are that 'mega' projects such as the new runway tend to have different characteristics and risks which require special treatment or oversight in particular areas.

— There can also be benefits from separating the costs and regulatory treatment of the project from BAU activities. A bespoke approach may also reflect other factors such as the ability to introduce a competitive process or government subsidy to the project which may either allow or require special treatment in the regulatory framework.

— Historically the CAA has applied the same framework to the delivery of major projects including T5 & T2, with some modifications such as pre-funding and specific project triggers. This is partly motivated by the fact that there is only one revenue stream to support the funding of the project: passenger charges.

Rationale for a more (but not fully) bespoke framework for the expansion scheme

— The figure shows the potential framework dimension position of the Heathrow and Gatwick options and their constituent sub-programmes, (in addition to a number of case studies). The expansion scheme is a unique large scale project taking place over multiple price controls. The smaller scale of the Gatwick scheme and its more modular design may make it more appropriate for a bespoke regulatory framework, but it would still have strong linkages with existing airport assets.

— The characteristics of the scheme may create challenges for the current framework. For example the scale of the scheme costs could mean that the existing process of ex-post review of costs may not provide sufficient efficiency incentives as the burden of proof will lie with the CAA and any significant cost escalation could threaten the financial viability of the promoter. Whilst a discretionary framework provides more flexibility, it also creates greater regulatory risk for the promoter which can have an impact on financing costs. A bespoke approach could enable a more targeted approach to deal with the specific areas of market failure.

— For these reasons our assessment is that a more bespoke regulatory framework approach could be adopted for the new runway project, but it may be very difficult to fully separate the project revenues, costs and risks, as well as operations from the existing assets. The existing framework could be adopted but would probably require much greater intensity for the review of cost forecasts, actual costs and triggers etc. In summary it is not likely to be feasible to fully separate the project from the existing assets and regulatory framework. But the existing framework will also require changes to ensure it is fit for purpose.

Existing		Bespoke
Case studies		
Heathrow	HS1	Thames Tideway Tunnel
Gatwick		Channel Tunnel
Water and sewerage		Hinkley Point C
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
Land	Planning	
Community		
Plant, runway & equipment		
Surface access		
Terminal		

D2. Prescriptive versus discretionary

The choice of a prescriptive versus discretionary framework

— Projects such as TTT, HPC and the Channel Tunnel have adopted a more prescriptive regulatory framework whereby the treatment of costs is defined in advance, often based on a forecast allowance. This approach has been possible because these projects have been developed in different ways, for example through competition for the design or not involving an existing operator. This means that the consequences of project failure are less severe for consumers and enable greater risks to be placed on the scheme promoter.

— At Heathrow the CAA's current regulatory framework for capex is highly discretionary relying on the principle that all 'efficient' costs incurred by the operator will be recovered through RAB linked charges. The CAA does not prescribe in detail how it will determine what 'efficient' costs are except for the requirement that users are consulted. The CAA relies upon an ex-post assessment to identify inefficiency and creates incentives through the threat that such spending could be excluded from entering the RAB. The approach at Gatwick is more prescriptive but does partially rely upon a discretionary threat of re-regulation.

Rationale for a broadly discretionary framework for the airport expansion scheme

— This approach has been adopted because it is often difficult for the CAA to define the efficient scope of airport projects in advance due to their irregularity and often complex outcomes, the absence of relevant comparators and the need to accommodate changes in scope. For this reason it can be difficult to prescribe efficient outcomes and costs in advance and the CAA has tended to rely on engagement between the airport and airlines for this purpose through a flexible capex governance process.

— Some elements of the new runway scheme will have the same characteristics in this regard. There will also be greater risks and contingencies, meaning that it may be even more challenging for the CAA to adopt a more prescriptive approach without creating a risk that the promoter will face arbitrary over or under reward due to uncontrollable factors. Where the CAA cannot define efficient outcomes or scope it may also be difficult to assess whether a project has been delivered efficiently or at reduced quality.

— It may be possible to be more prescriptive with some scheme elements where the required outcomes are more tangible and the CAA is able to assess an efficient cost. For example it may be possible to benchmark runway construction costs based on similar projects.

Prescriptive		Discretionary
Case studies		
Thames Tideway Tunnel	HS1	Heathrow
Channel Tunnel		Gatwick
Water and sewerage		
Hinkley Point C		
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
	Plant	Planning
	Runway	Land
	Equipment	Community
		Surface access
		Terminal

D3. Ex-ante versus ex-post

The choice of an ex-ante versus an ex-post framework

— The CAA's current framework for capex at Heathrow relies upon ex-post efficiency mechanisms to create incentives for the airport, though there are some ex-ante and delivery mechanisms applied as part of the framework (including cost assessment and governance processes).

— The current capex framework reflects several economic characteristics including uncertainty over project scope at the time of the regulatory decision, the potential for risks, changes in scope and exogenous factors which may increase the costs of the scheme and the difficulty the CAA faces in defining efficiency in advance of its decisions which would increase the risk of arbitrary over or under reward.

— The major project examples have tended to rely more on ex-ante incentive mechanisms. This reflects the competitive nature and design of these projects, the greater ability of the regulator to define outcomes and assess efficient costs and for example in the case of the Channel Tunnel – the fact that the project cost was (intended to be) financed privately at the risk of the promoter.

Ex-ante		Ex-post
Case studies		
Thames Tideway Tunnel	Gatwick	Heathrow
Channel Tunnel		
Water and sewerage		
Hinkley Point C		
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
	Plant	Planning
	Runway	Land
	Equipment	Community
		Surface access
		Terminal

Rationale for a broadly ex-post framework for the airport expansion scheme

— The new runway scheme will be subject to even greater levels of uncertainty and risk due to the size, complexity and timescales of the project, the impact of a greater number of third parties with differing interests, the various contingencies that might affect the project, and the competitive nature of the AC process which may have created an incentive for greater optimism bias in the costs forecasts. The CAA's ability to define, assess and estimate efficient costs will also be limited for some parts of the scheme.

— This means that cost forecasts are likely to be subject to greater uncertainty than for BAU airport projects meaning that ex-ante efficiency mechanisms are likely to create an even greater risk that the operator could face arbitrary over or under reward for the project.

— For this reason we consider that it may be necessary for the framework to rely primarily upon ex-post efficiency incentives. There may be some scope to adopt ex-ante mechanisms, for example based on the cost forecasts produced for the AC or for selected parts of the project.

— Ex-post costs assessment mechanisms are most effective where the promoter has strong confidence in the CAA's ability to identify cost inefficiency. Strengthening the CAA's capabilities in this regard could be beneficial for the framework.

D4. Low versus high risk/reward

The choice of a low versus high risk/reward framework

— The CAA's current framework for capex exposes Heathrow to a low level of risk and reward. The CAA's implied policy is that all efficient capex will be recovered by the airport. Where costs have been precluded this has tended to be for serious project failures or an explicit failure to consult airlines.

— The CAA's approach to the capex framework is related to typical airport project characteristics in particular the difficulty it faces in defining efficient costs both ex-ante and ex-post. The complexity of projects, potential for scope changes and lack of relevant comparators means that it is difficult for the CAA to determine the true potential for efficiency. Because of this, any framework which allows the operator to outperform a cost forecast will also create incentives for cost overstatement. This may be difficult for the CAA to detect and could therefore lead to systematic over reward for the promoter.

— On other projects, such as TTT and the Channel Tunnel, the 'regulator' or government has been prepared to adopt a framework with higher risk and reward because for example, the selection of the project design and operator has been subject to a competitive process, and/or the risks of project failure have been fully allocated to the project promoter (in the case of the Channel Tunnel for example). In contrast the new runway project has not been subject to competition (in a procurement sense) and customers will to some extent be exposed to the risk of project failure.

Low risk/reward		High risk/reward
Case studies		
Heathrow	Gatwick	Channel Tunnel
Thames Tideway Tunnel	Water and sewerage	
	Hinkley Point C	
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
Planning	Plant	
Land	Runway	
Community	Equipment	
Surface access		
Terminal		

Rationale for a broadly low risk/reward framework for the airport expansion scheme

— For the new runway scheme, the CAA's ability to define efficient scope, forecast and assess efficiency may be limited due to its greater complexity and scale. This means that any framework which creates the potential for higher risk and reward will also create incentives for cost overstatement. As the scheme promoter will also be the airport operator the risks of project failure – non-delivery or cost escalation – will also be shared by passengers. Unlike the other projects highlighted, it may be difficult to separate or control these risks for the new runway scheme.

— The risks of the runway scheme cannot therefore be fully allocated to the promoter which implies that the rewards could also be limited. There may be some scope to create stronger dynamic incentives in some areas of the project where the CAA is better able to define and assess costs.

D5. Customer negotiation versus regulatory settlement

The choice of customer negotiation versus regulatory settlement framework

— The CAA's current framework incorporates a high level of customer negotiation through the Constructive Engagement process, capex governance arrangements and Core and Development capex adjustment mechanisms. There is also a high level of consultation over the airports business plan as part of the regulatory process.

— This approach is possible because airlines are relatively large and well resourced organisations whose interests are generally well aligned with those of passengers. They also have a good understanding of passengers needs and the operations of the airport which helps to provide the CAA with an alternative view of the activities of the airport. Airlines interests are not always perfectly aligned on all issues and therefore the CAA retains an important role in this process.

— In contrast, for most other regulated industries detailed customer negotiation is less viable as customers are not represented by an equivalent third party and they are generally less well informed about technical issues. There has been relatively limited 'customer' negotiation for the TTT, HPC and Channel Tunnel projects for example which have all been led primarily by the regulator or government.

Customer negotiation		Regulatory settlement
Case studies		
Heathrow	Gatwick	Thames Tideway Tunnel
		Channel Tunnel
		Water and sewerage
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
Terminal	Land	Planning
	Plant	Community
	Runway	
	Equipment	
	Surface access	

Rationale for less reliance on customer negotiation in the regulatory framework

— For the new runway project the ability of airlines to negotiate outcomes on behalf of passengers could remain a useful feature of the regulatory framework. However, there are some reasons to consider that regulatory judgement may need to play a bigger role than under the existing framework for Heathrow.

— Firstly the runway project will primarily benefit future passengers and airlines including those not currently operating at the airport. Current airlines interests may not always be well aligned with these groups over some issues which means that the CAA will have to represent these groups.

— Secondly the size and complexity of the project may mean that the airlines lack the capacity to provide effective engagement over many of the issues that will arise as part of the project development and delivery. For example airlines may not be able to provide much insight into the efficiency of surface transport projects and other enabling work without commissioning external experts.

D6. Slow versus fast recovery of capital

The choice of slow versus fast cost recovery of capital

— The CAA's current framework links charges to capex forecasts in a RAB framework (i.e. slow recovery), with pay as you go treatment for opex and commercial revenues (i.e. fast recovery). In this framework the operator recovers capital relatively slowly based on its entry into the RAB and regulatory depreciation profile.

— For Heathrow the RAB is 'rolled forward' at the end of each regulatory period to reflect the actual costs incurred by the business (relative to forecasts). This process is linked to an assessment of the efficiency of those costs. This approach is viable because the typical capex programme for an operator is generally financeable based on the revenues generated by the business.

— For other projects, the speed of capital recovery can vary greatly. At one extreme the Channel Tunnel was funded based on expected concession revenues, i.e. no capital recovery until the operational stage. This approach places a major funding burden on the promoter. At the other, in principle a regulator could adopt a Totex framework with 100% fast recovery meaning that all capital would be recovered within the same year it is expended.

— The depreciation profile for the recovery of capex can also be sculpted and the RAB review process can be altered to become more or less frequent thereby speeding or slowing the recovery of capital.

Rationale for a more bespoke approach for the airport expansion scheme

— Most of the project case-studies have adopted a slow capital recovery approach with some level of pre-funding to ease cash flow constraints and improve financeability. Pre-financing was also used for the T5 project based on bringing forward charges between regulatory periods to reduce the impact on revenues once the project was operational.

Slow recovery		Fast recovery
Case studies		
Thames Tideway Tunnel	Heathrow	Gatwick
Channel Tunnel	Water and sewerage	
E.g. Totex 0% 'pay go'		E.g. Totex 100% 'pay go'
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
	Planning	
	Land	
	Community	
	Plant, runway, equipment	
	Surface access	
	Terminal	

— For the expansion scheme the scale and uncertainty of costs may lead to financeability issues if capital is recovered slowly without any additional upfront funding. This may motivate a more rapid recovery of costs for example through pre-funding or a more regular cost assessment and RAB adjustment process.

D7. Low versus high intensity oversight

The choice of a low versus high intensity oversight framework

— The CAA's current framework has a moderate level of regulatory oversight. At Heathrow the CAA is represented at capex governance meetings and has a formal role in arbitrating over disputes between the airlines and airport and providing the final view on passenger interests in wider areas of the regulatory process. The CAA's approach relies heavily upon airlines approving capex plans and the CAA generally does not provide a view on capex projects unless there is a dispute. The CAA's role is more limited at Gatwick where airlines have less involvement in capex governance.

— This moderate level of oversight has been applied because in general the operator has limited incentives to either over or under spend on capex, but its efficiency and performance is quite hard to assess. One of the challenges for the CAA is to set an efficient scope for investment and airlines are generally better placed to lead this process.

— The Q6 process at Heathrow has also incorporated the Independent Fund Surveyor to provide independent 'real time' assessments of the operators capex performance which provides additional oversight of project efficiency.

— In some of the case studies, the level of regulatory oversight has tended to be limited because the regulatory frameworks have often relied more upon ex-ante incentives that reduce the need for ongoing engagement between the regulator and company.

— In some cases the regulator has taken a much more intensive role in the oversight of the project. The Thameslink and Crossrail projects have both had more intensive oversight from the government due to the complexity of the projects, and their reliance on public funding. This has included project representatives monitoring the performance of the scheme promoters management.

Low intensity		High intensity
Case studies		
Heathrow	Water and sewerage	Thameslink
Gatwick		Crossrail
Thames Tideway Tunnel		
Channel Tunnel		
Airport-level		
		
CAA current framework for Gatwick		Gatwick scheme
CAA current framework for Heathrow		Heathrow scheme
Expansion scheme projects		
	Planning	Land
	Land	Community
	Runway	Surface access
	Equipment	Terminal

Rationale for a more bespoke approach for the airport expansion scheme

— For the new runway scheme, the scale and complexity of the project, greater potential for risk and financial distress, greater range of contingency factors and reduced ability for airlines to provide oversight, plus the CAA's limited ability to rely upon ex-ante efficiency mechanisms means that there will probably be a greater need for regulatory oversight. This could imply for example a more intensive role for the IFS over a greater range of projects, or more intensive ex-ante and ex-post cost scrutiny by the CAA at various stages of the project. Forward looking cost assessment mechanisms could also be more intensively applied given the potential impact of cost overruns. The CAA's role in the capex governance process may also need to become more active and intensive.

Summary of Section 3.4

The table below provides a summary of our assessment of the appropriate dimensions of the regulatory framework for the expansion scheme as a whole.

Assessment of the dimensions of the regulatory framework for the scheme			Rationale based on the programme characteristics
(Low)	Assessment	(High)	
Existing	**Low to med (i.e. based on existing framework with modification)**	**Bespoke for project**	The likely difficulty of separating the scheme from existing airport asset means that a fully bespoke regulatory framework may not be feasible. But the differences between the characteristics of the project and BAU means that some kind of separate regulatory treatment may be justified. This could involve, for example, different adjustment mechanisms for specific costs, a greater level of oversight by the CAA on particular parts of the project or separate treatments for costs and revenues associated with the new runway.
Prescriptive	**Med to high level of discretion**	**Discretionary**	The project is subject to a large number of risks which may be difficult to fully identify and control for in regulatory mechanisms and forecasts. The ability of the CAA to set accurate cost forecasts may also be limited. This implies that a medium to high level of discretion will be required within the framework. A prescriptive approach will only be appropriate if the CAA can define the various exogenous factors for each element of the project and/or passengers can be protected from the impact of those risks.
Ex-ante	**Med to high reliance on ex-post incentives**	**Ex-post**	It will be difficult for the CAA to both define the efficient scope of the scheme and set an efficient forecast for project capex given the current plans and the potential for changes in scope and exogenous factors (and the limited number of comparators for a project of this size and type). This implies using a framework which is reliant on ex-post treatment of costs to create efficiency incentives and to avoid arbitrary over or under reward of the promoter. The AC process could be useful in establishing an ex-ante benchmark. It may also be possible to isolate some parts of the scheme for different treatment.
Low risk and reward	**Low to med risk exposure for promoter**	**High risk and reward**	There are numerous risks and uncertainties for the project which are beyond the direct control of the promoter, the CAA may not be able to set an efficient cost forecast due to the difficulty of defining efficient scope and the lack of benchmarks. It may be difficult for the CAA to distinguish between inefficient cost increase and those due to change in scope for some parts of the project. These factors imply a low risk framework with risk/reward sharing mechanisms for the promoter to deal with risks.

Summary of Section 3.4 (cont.)

The table below provides a summary of our assessment of the appropriate dimensions of the regulatory framework for the expansion scheme as a whole.

Assessment of the dimensions of the regulatory framework for the scheme			Rationale based on the programme characteristics
(Low)	Assessment	(High)	
Customer negotiation	**Low to med reliance on customer negotiation**	**Regulatory settlement**	The CAA has incorporated customer negotiation into the existing regulatory framework for Heathrow and Gatwick to a lessor extent. This is a key mechanism for ensuring the activities of the airport are aligned with stakeholders interests. This feature of the regulatory framework is likely to remain useful for the regulation of the scheme – however there may need to be some refinements to reflect the greater potential for conflicts of interest between current and future consumers whose requirements may not be well aligned in some case. For example the CAA may need to be more involved in the oversight of some aspects of the scheme design to represent the needs of future passengers and airlines. The scale of the project, and the nature of the activities being undertaken could also mean that current airlines may lack the resources or skills to provide effective oversight in some cases.
Slow recovery of capital	**Low to med speed of capital recovery**	**Fast recovery of capital**	The scale and uncertainty of costs may lead to financeability issues if capital is recovered slowly without any additional upfront funding. This could motivate a more rapid recovery of costs for example through pre-funding or a more regular cost assessment and pass through process. Under a BAU approach unanticipated efficient spending would enter the RAB (generally) every five years. Given the scale of the project and potential for cost escalation and risks, it may be necessary to accelerate this process. This would in turn have implications for the frequency of cost review and assessment.
Low-intensity oversight	**Med to high level of regulatory oversight**	**High intensity oversight**	The scale of the project, reduced ability of the airlines to provide scrutiny and conflicting interests between current and future airlines and other groups could mean that the CAA is likely to need to take a greater oversight role. The scale of the project and potential risks also mean that the CAA may wish to undertake more intensive oversight of the capex governance process for example.

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Section 4
Regulatory mechanisms for cost efficiency

Overview of Section 4

This section provides an overview of the potential regulatory methods and mechanisms which could be applied as part of the regulatory framework. We provide a full overview and long list of the potential mechanisms we have identified. The type and focus of the mechanisms applied by the CAA will reflect the type of regulatory framework adopted, as discussed in Section 3. We also discuss the CAA's existing efficiency mechanisms and how they could be adopted for the new runway scheme.

4.1 Cost efficiency methods and mechanisms

- Long list of potential cost efficiency methods and mechanisms.
- Mapping mechanisms to project lifecycle.
- Ex-ante, delivery and ex-post mechanisms.
- Project phases and efficiency mechanisms.

4.2 CAA's existing efficiency methods and mechanisms

- CAA's existing efficiency methods and mechanisms.
- CAA's existing cost assessment process.

4.3 Methods and mechanisms for the new runway scheme

- Potential method and mechanisms for the new runway scheme.
- Recommended methods and mechanisms.

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Section 4.1
Cost efficiency mechanisms and cost assessment methods

Introduction to methods and mechanisms

In this section we describe the regulatory **methods and mechanisms** through which the CAA could seek to strengthen incentives for cost efficiency. To do so we have identified the drivers of cost efficiency enabled by different methods and mechanisms and categorised them by driver and type. This provides a long list of efficiency methods and mechanisms which could be applied to the expansion scheme. Our approach is summarised below.

Drivers for cost efficiency

Based on regulatory precedence and economic theory we have identified six main drivers for cost efficiency; profit motive, regulatory control, competitive pressures, customer choice, external cost/performance scrutiny and threat of loss of control. Each regulatory mechanism works by enabling one or more of these drivers.

Categories of mechanisms

There are six categories of mechanism which broadly relate to each of the cost efficiency drivers; financial incentives, regulatory assessment and approval, competition, customer bargaining, external review and control mechanisms. Within each of these categories there are several types of method and mechanisms that could be applied to the scheme.

Types of mechanism

Each category of efficiency mechanism can be applied in different ways. Within each category we set out examples covering the broad range of options. Each regulatory framework will generally combine a number of different mechanisms which can be calibrated to the specific situation. Some mechanisms only work in combination, others are substitutes. For example financial incentive mechanisms generally require some form of cost assessment method. Different measures may be better suited to different types of project, for example depending on the ability of the regulator to accurately assess costs.

The role of the regulator also differs across the regulatory mechanisms. Some require direct intervention by the regulator (e.g. in setting financial incentives as part of the price control) some are more passive (e.g. placing a requirement for customer consultation, or for the promoter to undertake an activity).

Stages of regulatory intervention

Each mechanism could be designed, calibrated and applied to the project and promoter's activities. This typically requires a phase of research and consultation with stakeholders. Generally efficiency mechanisms fall into three categories: ex-ante, ex-post, or delivery. Ex-ante mechanisms create efficiency incentives before costs are incurred, ex-post mechanisms create efficiency incentives after costs are incurred. Delivery mechanisms create ongoing incentives for efficiency throughout the project.

Drivers and categories of cost efficiency mechanisms

Regulatory methods and mechanism achieve efficiency through influencing the behaviour of stakeholders. There are six main drivers of cost efficiency and six corresponding categories of efficiency mechanism. These drivers and mechanism categories are summarised below.

Cost efficiency driver	Categories of mechanism	Example
Profit motive	1. **Financial Incentives**: direct financial incentives to reduce costs compared to forecast, to minimise cost overruns and/or to deliver on time and on quality. This may be via a penalty, reward or both. Menu regulation provides a financial incentive to reveal costs.	Cost pain-gain sharing mechanisms. Outperformance retention.
Regulatory control	2. **Regulatory Assessment and Approval**: regulatory approval is required to set planned costs, required for changes to planned costs during the project or for additional costs.	Ex-ante review of forecast costs. Approval of changes in project scope.
Competitive pressures	3. **Competition**: competition to win a tender or procurement exercise will tend to result in lower costs and better outcomes. Can occur at different levels i.e. competition for entire scheme or within the supply chain.	Competitive tender for tier one construction.
Customer choice	4. **Customer Bargaining**: the use of customer bargaining to contain costs or reduce or refine project scope to improve oucomes. Power given to customers to negotiate over scope/costs to balance market power.	Customer choice between quality-cost options. Customers selecting projects for review.
External cost/ performance scrutiny	5. **External Review**: Information reporting requirements for review or consultation from any party. This includes independent advisors, key stakeholders or the CAA.	Quarterly progress reporting to the CAA and customers. Ex-post review of costs.
Threat of loss of control	6. **Control Mechanisms**: relationship providing power to a third party based on observable trigger or regulatory discretion. May be contractual or regulatory.	Independent expert review and binding recommendations if project is at risk of failure.

Long list mechanisms and methods

Within each of the six categories, there are a range of different regulatory methods and mechanisms. Each of these can be designed and calibrated in a variety of ways.

Categories of mechanism	Types of mechanisms and methods			
1. Financial Incentives	M1.1 Incentive to reveal true costs	M1.2 Ex-ante financial incentives	M1.3 Ex-post financial incentives	M1.4 Outcome incentives
2. Regulatory Approval	M2.1 Ex-ante approval of cost forecast	M2.2 Approval of changes in planned costs	M2.3 Ex-post approval and treatment of costs	
3. Competition	M3.1 Market structure and design		M3.3 Regulatory rules over procurement	
4. Customer Bargaining	M4.1 Requirement for customer consultation		M4.2 Customer involvement in business planning	
5. External Review	M5.1 Upfront information on cost calculations	M5.2 Monitoring and reporting	M5.3 Review of funding, governance and ownership	M5.4 Project representative
6. Control Mechanisms	M6.1 Outcome trigger		M6.2 Discretionary control mechanism	
7. Cost assessment methods	M7.1 Market testing	M7.2 Top-down benchmarking	M7.3 Bottom-up benchmarking	M7.4 Expert review

Describing cost efficiency mechanisms

Below we set out a template to describe each of the mechanisms described in the long list, the pros and cons of each and the factors which influence the viability of applying a mechanism to a specific project. Appendix 2 provides a list of case study examples of each of the mechanisms (or collection of mechanisms).

Descriptive	**Description**	— High level description of the mechanism — How does it promote efficiency? — What is the role for the regulator? — What variations are there?
	To which stage of the project does it apply	— Planning, design, procurement, delivery, hand over etc. — Ex-ante, delivery or ex-post
	Precedents	— Case study examples focusing on UK regulated industries
Evaluative	**Project requirements/disqualifiers**	— Project economic characteristics required for mechanism to be effective — Information requirements
	Advantages and disadvantages	— Main advantages and disadvantages — Risks when applied to particular types of project
	What is the cost to apply (time/resources)	— Cost for the regulator and other stakeholders
	Wider issues	— Wider comments and potential issues associated with the use of the mechanism — Examples of success or failure associated with the application of the mechanism

— These aspects can be used as the basis for assessing possible options for the design if the regulatory framework and its underlying mechanisms.

— For example the information requirements of any specific mechanism impact its feasibility (i.e. is the information available) and its attractiveness (i.e. what is the cost of gathering and verifying the required information).

— The project requirements or disqualifiers affect the viability of the mechanisms for the specific characteristics of the project.

M1.1 Incentive to reveal true costs

Descriptive	**Description**	— Regulators want to encourage 'truth-telling' so that any outperformance of a regulatory settlement is caused by genuine efficiency rather than gaming and over statement of costs. — Menu regulation incentivises 'truth-telling' by providing incentives to reveal information and relating financial performance to the difference between forecast and actual costs. — Company earns maximum financial gain (or loss) through delivery of actual cost closest to/(or furthest from) forecast cost. — Variations Include: type of expenditure the menu is applied to (i.e. capex, totex), degree of pain gain sharing and caps and collars on impacts. Mechanisms requires the regulator to have a central view of the company's efficient costs, set independently and in advance of the company's own forecast.
	At what stage in the scheme is it applied	— Ex-ante, applied to cost forecasts to influence allowed revenue. The incentive is given effect once actual costs are known.
	Precedents	— Ofwat (water distribution) menu regulation, the 'totex menu incentive' and previous versions applied to capex only. — Ofgem (gas and electricity distribution) menu regulation, the 'IQI' incentive.
Evaluative	**Project requirements/ disqualifiers**	— Requires the regulator to be able to make a credible and accurate forecast of efficient costs, which can be challenging especially in complex and uncertain projects. — Requires outputs to be known and set ex-ante, and for an assessment ex-post of outputs delivered, to avoid under-delivery being mistakenly identified as outperformance.
	What are the advantages and disadvantages	— Can combine 'truth telling' incentives with financial incentives. — Challenges exist in designing and calibrating menus to set cost targets and effective incentives. — Regarded as a highly complex regulatory mechanism, needs to be well communicated and explained to stakeholders.
	What is the cost to apply (time/resources)	— Time and resource intensive from regulatory perspective. — Needs to take place within the context of a price review.
	Wider issues	— Menu regulation provides clarity on cost treatment upfront, which is beneficial for the promoters and tends to reduce financing costs. For maximum impact, the incentive needs to be applied in multiple price controls, so the information revealed in earlier controls can be used to set baselines in future controls. — Menu regulation is also complex to calibrate, imposing a regulatory cost that may only be worthwhile where its effectiveness is high.

M1.2 Ex-ante financial incentives

Descriptive	**Description**	— Financial gain/pain if costs are lower/higher than 'efficient' forecast set by the regulator. Level of outperformance retention can be calibrated from 0 to 100% with caps or collars to prevent excessive risk and reward. Mechanism may also be combined with error adjustment mechanisms where there is uncertainty or identified risks. — Requires the regulator to be capable of defining efficient outcomes and costs with a high degree of confidence. — There are a wide variety of ex-ante financial incentive mechanisms with different levels of incentive rate, symmetric v. asymmetric profiles, cost assessment methods and treatment of outperformance.
	At what stage in the scheme is it applied	— Requires a forecast of efficient costs to be developed, i.e. generally at beginning of the price control period. Can also develop project specific cost forecasts as projects reach design maturity.
	Precedents	— Ofwat. Water distribution, sewerage. — Ofgem. Gas distribution. — CAA. Treatment of opex. — Tideway Tunnel. Treatment of capex during construction.
Evaluative	**Project requirements/ disqualifiers**	— Requires that the regulator can set outcomes and forecast efficient costs for a project or group of projects. If this is not possible mechanism risks incentivising cost overstatement and reduced scope of outcome delivery. — More appropriate where the nature of the costs or activity is repetitive so that efficiency gains can be recaptured, and risk of exogenous cost increases is small. TTT provides a counter-example, where an symmetrical pain/gain sharing mechanism is applied to a large, discrete, new programme.
	What are the advantages and disadvantages	— Creates strong incentives for company to minimise costs. — Can result in over or under reward for the company and encourage cost overstatement if target not robustly set.
	What is the cost to apply (time/resources)	— Upfront time and resources to design mechanism, agree cost forecast and to identify and deal with risks.
	Wider issues	— Financial incentives provide a strong inducement for cost control. The mechanism is reliant on the ability of the regulator to accurately forecast costs. If cost risk is high and largely outside of the control of the promoter additional exemptions may be required, e.g. cost pass through of certain categories or re-opener after a certain threshold. Incentive mechanisms based on ex-ante cost forecasts also provide an incentive for the promoter to over forecast costs, strengthening the requirement for ex-ante information over costs.

M1.3 Ex-post financial incentives

Descriptive	**Description**	— Financial incentive created through an ex-post review of costs incurred by the company. This review will assess if any of the company's costs could be deemed inefficient based on a range of criteria. Such costs are generally removed or prevented from entering the RAB. This creates a financial incentive for the company to behave efficiently, but requires the regulator to be able to undertake an assessment and identify such costs. — The role of the regulator is to define how the ex-post assessment will be carried out. This will often involve the use of an expert review. The regulator may also need to set out principles for how inefficiency will be defined under the review and the treatment of such costs under the regulatory framework. For example the CAA requires Heathrow and Gatwick to consult on their spending plans.
	At what stage in the scheme is it applied	— Ex-post: Mechanisms can only be applied to costs once they have been incurred.
	Precedents	— CAA: Treatment of capex excess or under spend relative to forecast. — ORR: Treatment of capex excess or under spend relative to forecast.
Evaluative	**Project requirements/ disqualifiers**	— Structure of mechanisms and approach to cost treatment will reflect the nature of the project and the regulators ability to forecast. Where difficult to forecast costs ex-post incentives are generally more appropriate because they can provide discretion to deal with uncertainty.
	What are the advantages and disadvantages	— Discretionary treatment of excess costs creates risk of uncertainty for the company or promoter. — Limited knowledge of the scale and scope of an ex-post review will reduce the incentive ex-ante to try to deliver efficiently.
	What is the cost to apply (time/resources)	— Requires time to define treatment of cost overruns and depending on principles may require ex-post cost assessment to determine efficiency. The cost of the ex-post review depends on how large the scope is (e.g. all costs versus a pre-defined sub-set of costs).
	Wider issues	— It can be challenging for the regulator to assess the efficiency of costs ex-post without clear evidence of project management failings and a counter-factual cost estimate. — Retrospective exclusion of costs from the RAB is controversial and can increase perceptions of risk driven by the regulatory framework.

M1.4 Outcome incentives

Descriptive	**Description**	— A bonus and/or penalty linked to the delivery of a particular outcome such as a defined level of service quality, reliability, customer satisfaction or delivery date. Drives efficiency through financial and/or reputational incentives associated with achieving the outcome. — The role of the regulator is to design the mechanism and set the outcome target. This primarily includes defining the metric, setting the target, and the level of bonus and/or penalty for the company for delivery of the defined outcomes. There are numerous variants of outcome incentive including symmetric or asymmetric, use of caps and collars, and whether the incentive takes effect each year or is 'trued-up' during a price control review.
	At what stage in the scheme is it applied	— Outcome incentives are normally set for the operational stage of the project e.g. the achievement of a certain level of service quality. Incentives during the construction stage are less common but could be developed. Incentives can be continuous or limited in time to the duration of a price control.
	Precedents	— Heathrow triggers. Reduced income associated with project outcome delays. — Heathrow Service Quality Rebate scheme — Ofwat. Outcome Delivery Incentives for Water and Waste Water companies. ODIs are suggested by the company and validated or amended by Ofwat. They include a range of quality targets such as leakage, customer satisfaction and environmental quality. Ofwat considers different levels of risk and reward for each mechanism.
Evaluative	**Project requirements/ disqualifiers**	— Project outcomes must be clearly defined with an outcome and timescale. The forecast of this must be set efficiently by the regulator. There must be a reliable metric to ensure the delivery of the outcome has been achieved.
	What are the advantages and disadvantages	— Can be used to drive a particular behaviour when companies' incentives are weak without a targeted inactive, and where metrics available for performance monitoring. — Disadvantages are that it may be difficult to define a single metric to capture the desired outcome. The company will tend to focus on the delivery of that metric potentially to the detriment of non-incentivised outcomes. — Creates incentives to game forecasts of performance. May also lead the company to under deliver on scope and quality if these factors have not been clearly defined in advance, or if the incentive is not calibrated correctly.
	What is the cost to apply (time/resources)	— Costs involved in defining and agreeing a fair outcome timescale for the project.
	Wider issues	— Quality incentives can be useful for aligning the interests of the company to those of wider stakeholders. It may be difficult to define a single metric to capture the desired outcomes. The incentive may also lead to excessive focus on the achievement of the target metric at the expense of other outcomes. The design of the mechanism needs to be considered to ensure that incentives are maintained (for example once a threshold is breeched). Customers' willingness to pay for over-delivery via higher charges needs to be carefully considered.

M2.1 Ex-ante approval of cost forecast

Descriptive	**Description**	— The regulator reviews and approves the company's costs forecasts typically based on a cost assessment method such as market testing, expert review or benchmarking. — Mechanism encourages efficiency by providing a level of regulatory scrutiny to the company's plans in advance of costs being incurred. — The regulators role is primarily to undertake the assessment for example designing the assessment framework and information to be provided by the company. This might include considering the scope of the project. Approval can also take different forms, for example, full approval, rejection, partial approval or contingent approval with notified items. The approved costs may be linked with financial incentives (see 1.1).
	At what stage in the scheme is it applied	— At initiation stage for design/procurement costs. Can also be applied at the implementation stage for unanticipated cost items.
	Precedents	— CAA undertakes an ex-ante review of airport capex plans as part of the price control based on Constructive Engagement and expert review. These forecasts determine the envelope of charges for the regulatory period. Similar mechanisms are applied in relation to NATS and by Ofwat, Ofgem and the ORR.
Evaluative	**Project requirements/ disqualifiers**	— The accuracy and level of scrutiny applied by an ex-ante review is highly variable and is determined by the nature of the project and the availability of comparators. It is difficult to accurately assess and estimate the costs of complex or unusual projects for example and this may limit the impact of scrutiny. This may also preclude financial incentives being linked to the forecast.
	What are the advantages and disadvantages	— Depends upon the role of the cost forecast and any associated financial incentive. — Where project costs are difficult to accurately assess this mechanism is less likely to be effective at identifying cost inefficiency.
	What is the cost to apply (time/resources)	— Can be high depending on the nature of the cost assessment framework. Expert review of project costs and benchmarking data will usually require significant consultancy spending. The regulator may also request specific information from the company.
	Wider issues	— Ex-ante cost assessment and approval is widely applied by economic regulators where competition is not a viable option for setting costs. The accuracy of cost assessment will determine the potential role of the mechanism which may vary from sense checking the forecast to providing a baseline for financial incentives.

M2.2 Approval of changes in planned cost

Descriptive	**Description**	— The regulator must approve or reject significant increases in costs (above the ex-ante forecast) during construction or operation related to previously undefined projects, material changes in circumstances (MCC), efficient changes in scope or 'notified items'. This approval may have a direct link with tariffs or the company's RAB. — The mechanism promotes efficiency by providing an additional layer of regulatory scrutiny for unexpected cost items prior to their being incurred. The regulator may outsource the review to technical advisors and customers may also be consulted on the decision. — The regulator's primary role is to establish a framework for the treatment and scrutiny of such items and the basis upon which they will be approved or rejected. There can be variations in the mechanisms reflecting the approach to cost assessment, regulatory principles and involvement of customers for example.
	At what stage in the scheme is it applied	— Within an existing price control period, once a cost forecast for any discrete phase/project has been established by the company, and when events have occurred that create updated cost information, particularly the availability of costs incurred.
	Precedents	— The CAA currently operates a cost approval mechanism through the core and development capex price control formula and governance arrangements. This involves a formal role for airlines to approve the design and cost of new items of expenditure. — Ofwat also operates a mechanism for altering the basis of the price control for water and waste water companies to reflect the impact of MCC's and notified items. This may trigger price adjustments via an interim determination. Business rates have in the past been identified as suitable for this mechanism. Ofwat has retained some incentives by specifying that only a proportion of any increase in rates above a base line will be allowed in prices.
Evaluative	**Project requirements/ disqualifiers**	— The mechanism is normally only applied to costs associated with unanticipated or contingent events where a forecast cannot be set at the outset. Not appropriate where the costs of the project are large, without additional mechanisms also being employed.
	What are the advantages and disadvantages	— Allows the regulator to reduce the impact of uncontrollable risks by separating them from the core regulatory framework. Can enable on overall price control to be set, even in the presence of material uncertainty, by limiting the future approval only to the uncertain costs. Availability of mechanisms may reduce efficiency incentives and risk management by the company.
	What is the cost to apply (time/resources)	— Depends on the form of cost assessment required. Typically requires expert review, and verified information on the level of actual costs incurred.
	Wider issues	— The ability to approve changes in cost forecast during the regulatory period increases the flexibility of the regulatory framework to respond to risks and unknown factors. They also reduce pressure on the company to manage risks and develop accurate cost forecasts, if it is perceived that cost increases will generally be allowed by this mechanism.

M2.3 Ex-post approval of costs

Descriptive	**Description**	— Where costs incurred by the company are higher than estimated or allowed for ex-ante, the approval and treatment of such costs must be considered by the regulator. — The treatment could include: including excess costs in the RAB with financing costs, without financing costs, or full or partial exclusion. The regulator could also provide some assessment of the efficiency of the excess costs, for example, based on discretion, expert review or cost benefit analysis. The mechanism encourages efficiency by giving the company a process for the treatment of actual expenditure, without providing a guarantee that all cost increases will be allowed.
	At what stage in the scheme is it applied	— After the completion of a specific project i.e. near to or after the operational stage.
	Precedents	— The CAA undertakes an ex-post review of the capital efficiency of the airports costs. This is based on expert review and has a direct impact on the airports RAB. This mechanism is one of the main efficiency incentives for airport capex.
Evaluative	**Project requirements/ disqualifiers**	— The accuracy of an ex-post review is determined by various factors including the intensity of the review, the availability of comparators and the level of information and evidence collected by the regulator over the regulatory period.
	What are the advantages and disadvantages	— Review can be an intensive and adversarial process and places the burden of proof on the regulator to identify areas of inefficiency. This may be difficult in practice and requires expertise and understanding of the business and clear records of the costs and activities undertaken on each project. It may create a culture where the business is focused on delivering information that apparently meets the regulator's requirements rather than driving real efficiencies.
	What is the cost to apply (time/resources)	— The approach generally requires consultancy advice and may also impose information costs on the company to collect, retain, verify and provide information to the regulator to undertake the assessment.
	Wider issues	— Ex-post review is generally applied within frameworks with a low risk/low reward characteristic. Efficiency incentives in such frameworks are generally weaker but crucially depend upon the thoroughness and accuracy of the ex-post review. It is also important the regulator ensures that there is a detailed evidence base in order to conduct the review, to guard against the risks of appeal.

M3.1 Market structure and design

Descriptive	**Description**	— The regulator influences or specifies the market structure for example by mandating a procurement exercise for a particular good or service, or requiring the company to publish information that facilities greater competition. This could include requiring competition for design, management, construction, the promoter role and/or operation of an asset. — Altering market structure may promote efficiency by enabling competition or reducing the extent of market failure. The regulator's role is to define the structure of the market or set rules of conduct to enable competition.
	At what stage in the scheme is it applied	— Depends on the form and level of intervention e.g. major changes to market structure such as divestment might require a long running legal processes. Introduction of competition may require a separate regulatory process running prior to or alongside the wider project, and may require legal changes, licence amendments or both.
	Precedents	— Competition Commission, Break up of BAA. — Ofgem tender process for OFTO/CATOs. — Ofwat review of competition in the water sector (and introduction of competition to parts of the water and sewerage value chain). — CAA consideration of market conditions for Terminal Air Navigation Services, Terminal based competition.
Evaluative	**Project requirements/ disqualifiers**	— Requires conditions for competitive market (or sub-market).
	What are the advantages and disadvantages	— Can potentially introduce competition and reduce the impacts of market failure. — Very intrusive form of economic regulation, highly disruptive to the market and may require legal proceedings. — Requires extensive analysis and judgement to apply effectively. — High risk. Regulator becomes responsible for the outcomes of the intervention.
	What is the cost to apply (time/resources)	— Research and analysis to prove the case for the intervention likely to be significant and could involve legal challenge.
	Wider issues	— In practice many interventions in market structure and design are made by the CMA. An economic regulator may make interventions at a variety of levels such as requiring the company to undertake a procurement exercise for particular activities.

M3.2 Regulatory rules over procurement

Descriptive	**Description**	— The regulator sets rules over the approach of the company to procurement. At one level this could include the regulator defining the procurement approach, alternatively it could involve prescriptive requirements that the company must adhere to prescriptive rules or seek discretionary approval for a proposed approach. The mechanism drives efficiency by increasing the competitiveness of the procurement process. The role of the regulator varies depending on the nature of the intervention. For example the regulator may run a tender process directly, or oversee a process run by the company.
	At what stage in the scheme is it applied	— Mechanism is applied during the procurement stage of the project.
	Precedents	— Ofgem designed and runs the tender process for OFTOs. — ORR review of Network Rail supply chain management. — ORR review of Highway England Supply Chain Capability.
Evaluative	**Project requirements/ disqualifiers**	— Requires identified market failure in company's procurement process and suitable regulatory intervention. — Regulator must be capable of overseeing a procurement process.
	What are the advantages and disadvantages	— May help to enable or improve competition in a segment of the market. — Potentially intrusive form of regulation.
	What is the cost to apply (time/resources)	— Depends on the nature of the intervention. Potentially intensive if regulator seeks to take an active role in the procurement process. The examples of the framework for the TTT, OFTO and CATO operators in electricity transmission each took several years to develop. In some cases the legal framework has had to be amended (e.g. the TTT required primary and secondary legislation.
	Wider issues	— Procurement is a complex area and a regulator should only seek to apply rules where it has strong evidence of market failure and can be sure that intervention is likely to improve outcomes. — There are relatively few clear example of this form of intervention. In some cases, such as Ofwat's new proposals for direct procurement, the regulator has considered actively designing the procurement process, and at present proposes to leave implementation to company discretion.

M4.1 Requirement for customer consultation

Descriptive	**Description**	— Regulators often require companies to consult with customers through a formal or informal consultation process e.g. through surveys, interviews, formation of customer groups and regulator-designed processes. Customers highlight issues and outcomes they want to be addressed to influence the business plan. Promotes efficiency through improving the alignment between customer outcomes and the business plan. — There are variations of this mechanism based on the role of customers, the level of influence they have on outcomes/costs being approved, the period over which they are involved, and the extent of remaining regulator decision-making. The mechanism could be supported by regulator led activities such as direct customer consultation and research.
	At what stage in the scheme is it applied	— Initiation phase and planning stage. Can also be applied as a rolling mechanism – for example in the Core and Development capex process, or for evaluation of project outcomes following delivery.
	Precedents	— CAA. Constructive Engagement process for Heathrow, Gatwick and NATS. — Ofwat. Customer Challenge Groups provide input into business plans before and after submission. — Ofgem. Customer research 'Tracking survey' etc.
Evaluative	**Project requirements/ disqualifiers**	— Requires effective customer representation. Can be challenging to apply where there are limited customer groups or where customers have different views. Can also be difficult for customers to provide views on technical issues. Customers are typically better placed to inform outcomes and deliverables than efficient costs.
	What are the advantages and disadvantages	— Provides customers views on efficient outcomes and can reduce the need for regulatory intervention. — Can only be applied where customers can provide valid inputs, and conflicts of interest between different groups are limited. — Cannot substitute for regulatory decision making where customers views are in conflict.
	What is the cost to apply (time/resources)	— Time and resources for customers and promoter. — Requires regulator to develop an effective framework and process and provide oversight and dispute resolution.
	Wider issues	— Customers may have different views over ideal outcomes. — Customers may have different views over cost-quality trade offs. — Customers may not have the technical knowledge to accurately scrutinise cost forecasts.

M4.2 Customer involvement in business planning

Descriptive	**Description**	— A regulator may also require that customer representatives are actively involved in the business planning, for example, providing formal approval of capex plans with disputes between customers and the company decided by the regulator. This mechanism drives efficiency by ensuring that customers have direct control over the business plan. The role of the regulator is to design or approve this process and to arbitrate in the case of a dispute.
	At what stage in the scheme is it applied	— Typically requires formal design of the governance processes. Customers could be involved in all stages or at specific points for approval.
	Precedents	— CAA. Heathrow capex governance protocols. Airlines representatives and views embedded in structure of process.
Evaluative	**Project requirements/ disqualifiers**	— Effective customer representation and resources, homogenous customer views on key issues.
	What are the advantages and disadvantages	— Reduces the burden on the regulator to determine business plan outcomes and helps to meet customers needs. — May not be effective or appropriate where customers have divergent views, or lack resources and technical capability to provide input.
	What is the cost to apply (time/resources)	— Process likely to require large commitment from customers, also requires company to provide overall facilitation, record keeping and management of the process.
	Wider issues	— Involving customers directly in business planning can be useful for reducing the need for the regulator to define outcomes. The regulator will generally need to retain a role in the process to oversee disputes or where customers have different views over the requirements of the business plan.

M5.1 Upfront information on costs calculations

Descriptive	**Description**	— As part of the assessment of a company's business plan or project a regulator may request specific information, or set out criteria upon which the business plan will be assessed. This could include detailed breakdowns of costs, the provision of information on cost drivers, forecasts, assumptions and risk allowances. — This information could be linked to a contractual trigger or regulatory incentive mechanism e.g. numbers of passengers or prices of input factors. The business plan and cost calculations could also be independently assessed through an expert review to determine if there is further scope for efficiency. — This mechanism can be linked with financial incentives by setting an ex-ante allowance. Can also be used to apply 'fast tracking' and to create behavioural incentives through reputational effects. — Creates efficiency incentives through enabling greater scrutiny of the company's performance and pressure to exceed expectations and benchmarks. May also enable better comparisons between companies.
	At what stage in the scheme is it applied	— Ex-ante. As part of the formal regulatory process. Could also be applied to individual projects pre-construction.
	Precedents	— Ofwat. Business plan enhanced versus standard decisions, where the overall quality of the plan and approach is assessed, not just the level of costs. — ORR. Enhancement Adjustment Cost Mechanisms. — Ofgem. Cost assessment of OFTOs.
Evaluative	**Project requirements/ disqualifiers**	— Is most effective where the regulator has the ability to determine efficient costs, for example, through benchmarking.
	What are the advantages and disadvantages	— Light touch with regulatory discretion on whether additional measures are introduced. — Review party may not be capable of providing technical or independent review. Review on its own is a relatively weak tool.
	What is the cost to apply (time/resources)	— Costs depend on the level of information required and the intensity of the regulatory assessment. May require expert review for example.
	Wider issues	— Most regulators require some level of information on costs forecasts. The level of scrutiny, process for review and potential financial incentives can differ significantly. Where there are multiple companies – standardisation of business plan formats can be helpful to enable benchmarking. Ensuring consistency of information over time is also important. — The regulator may be involved in the quality of the forecasting process, as well as the level of costs.

M5.2 Monitoring and reporting

Descriptive	**Description**	— Reporting and monitoring of information on actual cost spend and project progress compared to plans. This provides reputational incentives for the company and can help to provide the regulator with advance warning of project risks which may lead to failure and trigger regulatory intervention. — The nature of the monitoring or reporting may differ for example focusing on costs, risks, outcomes etc. The mechanism could also involve the development and monitoring of specific output metrics such as service quality, accidents, customer satisfaction etc. Monitoring could be provided by the company, by the regulator or by a third party. Third party assurance or audit of monitoring is often used to ensure approach is robust and reliable. — External scrutiny of costs. Additional pressure may be applied if linked to a contractual trigger or financial incentive mechanism.
	At what stage in the scheme is it applied	— Varies. Monitoring will tend to be ongoing throughout the life of a project, but could be linked to a specific stage such as construction and delivery. Regular reporting of costs, outcomes, delivery and quality measures is a common feature of regulatory frameworks.
	Precedents	— CAA. Service Quality Metrics. — CAA. Independent Fund Surveyor cost reporting. — ACCC. Annual airport monitoring reports. — Government gateway review process. — ORR. Monitoring of Network Rail performance. — Ofwat. Requires annual reporting of performance against totex and ODI incentives.
Evaluative	**Project requirements/ disqualifiers**	— Outputs of the project need to be clearly defined to enable monitoring to be effective. Project plan timescales and risks should also be reviewed and monitored. The reporting requirements may be defined by the regulator or left to the discretion of the company or third party.
	What are the advantages and disadvantages	— Ongoing monitoring of performance and outcomes can help to highlight potential issues proactively. Can create a burden for the company and a requirement to manage the monitoring process as well as the project.
	What is the cost to apply (time/resources)	— Depends upon the nature of the monitoring regime. Could be integrated into the company's own reporting process. Independent monitoring body would create greater costs.
	Wider issues	— Australian airports are primarily regulated through a price and service quality monitoring framework. The annual monitoring reports provide a range of metrics which are used to give the regulator information on the performance of the company over time. There are several examples of monitoring frameworks applied by government agencies for public projects. A key consideration is whether action is automatically triggered by reports that indicate off-track performance, or whether action is at the regulator's discretion.

M5.3 Review of funding, governance and ownership

Descriptive	**Description**	— The project governance structure is the overall system through which the programme is directed and controlled by the company/promoter and linked with wider corporate governance. It sets out the responsibilities of each party and escalation channels. This ensures that organisations and individuals are well managed, risks identified and stakeholders needs taken account of. The effectiveness of this process is important for the outcomes of the project. — Potential interventions which could be implemented include: Reviewing, making recommendations and signing off on the corporate governance structure; Requiring a specific programme delivery board separate to the wider company potentially with independent directors; Requiring the promoter to establish specific working groups with stakeholders with escalation channels; Requirement that the regulator has access to or input into the governance structure; ring-fencing of licenced operations; influence over Board composition; representation on the Board.
	At what stage in the scheme is it applied	— The governance structure must be in place from an early stage of the project. It may be possible for the regulator to require changes mid way through a project as a remedial measure in response to project failure.
	Precedents	— Ofgem, review and reform of funding, governance and ownership of Xoserve. — Project governance for Crossrail, developed by DfT, TfL and ORR. — ORR, Project and Programme Management Capability Improvement Study. — Ofwat requires licenced companies to follow the UK code for corporate governance.
Evaluative	**Project requirements/ disqualifiers**	— Where the project is complex and has multiple stakeholders the project governance structure is especially important for efficient delivery. — The project management experience of the organisation and whether a governance structure has previously been applied will be important for the ability for the regulator to intervene effectively.
	What are the advantages and disadvantages	— A clear corporate governance structure is important for the successful delivery of any project, and appropriate decision-making representing the interests of various stakeholders. Poor governance can lead to communication breakdown and will likely have implications on cost. — The prescription of governance arrangements is a highly intrusive form of regulation and requires that the regulator understands the advantages, disadvantages and trade-offs of different approaches.
	What is the cost to apply (time/resources)	— Would typically require an expert review of existing arrangements. Company may object to having to implement alternative measures.
	Wider issues	— The ability of the regulator to set or influence the corporate governance structure might be fairly limited, especially in the context of a private company delivering the scheme.

M5.4 Project representative

Descriptive	**Description**	— A project representative is an independent third party body embedded within the promoter's project management structure. The role is essentially to act as a critical friend to the promoter whilst also providing the government agency or regulator with pro-active information on the performance and progress of the project, and assess the potential for risks and other issues. The mechanism drives efficiency by providing challenge and support to the promoter, and transparency to the regulator over the progress and efficiency of the project. — The role of the regulator is to define the scope of the project representative role and engage with its findings, for example, with further interventions and guidance where appropriate. The precise role and scope of activities undertaken by the project representative can vary widely.
	At what stage in the scheme is it applied	— The role of the project representative can vary depending on the priorities and concerns of the regulator. Generally the role is focused on the delivery stage, but monitoring planning and procurement could also be considered part of the role.
	Precedents	— Several major infrastructure projects have use a project representative including Crossrail, Thameslink and HS2.
Evaluative	**Project requirements/ disqualifiers**	— Most appropriate when the government agency is actively funding the project i.e. implies the regulator has a role in the delivery of the project. This may be less appropriate for privatised businesses for example, where the regulator should be careful not to substitute itself in responsibilities that rightly belong to the promoter.
	What are the advantages and disadvantages	— Provides pro-active review and challenge of the promoter's project management, without requiring the regulator to directly intervene. Provides the promoter with a critical friend to challenge and improve its performance. To be effective the representative must be competent and capable to perform the role.
	What is the cost to apply (time/resources)	— Depends on the defined role and level of expertise and resource required but likely to be a significant cost which needs to be considered against the potential benefits.
	Wider issues	— Project representatives are deployed on projects where a government organisation is actively funding the project and therefore has some responsibility for its delivery. — The role of a project representative on a privately financed project is more ambiguous as the regulator is not part of the delivery team and is not directly responsible for funding. Project representative reports could be used as part of the evidence base for an ex-post review for example, or to raise issues which require further intervention by the regulator.

M6.1 Outcome triggers

Descriptive	**Description**	— Contingent regulatory contract based on a predetermined cost, outcome or event – not necessarily linked with financial inventive. For example if the delivery of a project is delayed beyond a particular date or delivered early the regulator may undertake a review of performance to inform future RAB adjustments for example. — Triggers could also be process based, for example cost or project thresholds could trigger project review or regulatory decision. Triggers could also be set based on overall costs or outturn events such as cost inflation indices or volume measures. — The mechanism drives efficiency by enabling the framework to be flexible in response to unexpected or uncontrollable events. It can be helpful in managing risks and promoting lower cost of capital. This in turn enables greater application of ex-ante efficiency incentives. — The role of the regulator is to define the outcome trigger, and the impact for the regulated company via the regulatory framework.
	At what stage in the scheme is it applied	— Regulatory triggers must be pre-defined before the construction and delivery stage. The triggers could in principle apply at any stage of project life, but are most likely to be linked with project construction and operation.
	Precedents	— CAA. NATS trigger associated with deliver of London Airspace Management Programme. — Ofwat. Fast tracking of business plans for high quality water companies. — Ofwat. Notified items allowing for re-opening of price controls. — TTT. Cost over-runs above a pre-defined threshold trigger a different regulatory framework, and in some pre-defined circumstances the Government Support Package can be invoked.
Evaluative	**Project requirements/ disqualifiers**	— Need to have clearly defined outcomes and measures to link to trigger. Regulator must be able to define outcome, time and quality to set trigger effect. — May be difficult to apply where project outcomes are uncertain.
	What are the advantages and disadvantages	— Can be used to create incentives for specific outcomes which might be weak or limited by the wider framework. Can help to manage project risk by specifying treatment of uncertain issues. — Can be difficult to apply where exact outcome cannot be defined. May be difficult to calculate appropriate value of the trigger.
	What is the cost to apply (time/resources)	— Costs associated with developing the trigger and monitoring outcomes.
	Wider issues	— Outcome triggers may be useful for creating incentives for specific outcomes, and for ‘error correction’ associated with false assumptions in the original price control decision. Triggers can be linked with project delivery, contingency factors or wider factors as a bonus or penalty mechanism.

M6.2 Discretionary control mechanisms

Descriptive	**Description**	— Mechanism through which the regulator alters the regulation of the company in response to a given factor or issue on a discretionary basis. This could be pre-defined such as an increase in construction cost inflation or an unexpected change in the design of a project as a result of a change in the law for example. The mechanism ensures efficiency by enabling the regulatory framework to take account of risks and uncontrollable factors which might otherwise lead to arbitrary over or under reward for the company. — The role of the regulator is to identify the risks and issues which might occur and where possible define a treatment of those factors or set out a set of principles to guide the application of regulatory discretion.
	At what stage in the scheme is it applied	— Mechanism is specified in advance and applied at the time the risk or specified circumstance occurs.
	Precedents	— Ofwat. IDOK process. — ORR. Enhancement Cost Adjustment Mechanism. — CAA. Core and development capex mechanism. — Special administration regimes in water, energy and other sectors.
Evaluative	**Project requirements/ disqualifiers**	— Mechanism is often required where the company is subject to ex-ante financial incentives and also faces major uncontrollable risks which might result in arbitrary over and under reward.
	What are the advantages and disadvantages	— Enables financial incentives by creating flexibility to deal with uncontrollable risks. — Can weaken overall financial incentives for efficiency by creating expectation that regulatory framework can be altered.
	What is the cost to apply (time/resources)	— Depends on the design of the mechanism. May require the regulator to carry out interventions at times that do not coincide with regular price reviews. Significant changes in regulatory decisions may undermine confidence in framework.
	Wider issues	— Discretionary control mechanisms can be linked with wider mechanisms such as customer negotiation or direct financial incentives, for example where there are potential risks which could undermine the robustness of the regulatory framework.

M7.1 Market testing

Descriptive	**Description**	— Cost assessment is undertaken through direct market testing by the company or regulator to estimate the efficient costs of a service or activity. This may require packaging a project into a defined work package and tendering to determine an outline efficient cost, or seeking such evidence from other sources. The role of the regulator is to define or mandate this process as part of its cost assessment process. — The company can be obliged to accept a market solution that is more efficient than its own proposal. — Market testing can be for discrete elements of a project, for the project as a whole or on a solutions basis, where a set of needs are identified, and bidders propose solutions rather than bid for a pre-defined project.
	At what stage in the scheme is it applied	— Can be applied ex-ante (based on a scope) or ex-post based on an evaluation of outcomes.
	Precedents	— Most regulated companies undertake some form of market testing as part of their planning and procurement process. Regulators may seek to develop market tested cost data as part of a cost assessment. For example some airports have out-sourced security functions which provide a market tested benchmark of the costs of such activities which could be compared to a companies in house provision. — In PR14 Ofwat required some companies to demonstrate that proposed costs for projects were based on market prices based on tenders. — For PR19, Ofwat has suggested large discrete projects could voluntarily be put to tender for 'direct procurement' where ownership and financing could be open to external promoters.
Evaluative	**Project requirements/ disqualifiers**	— For market testing to be viable there must be a viable competitive market from which to source bids. Tenderers need reasonable certainty that they can win work, not just provide cost estimates.
	What are the advantages and disadvantages	— Where the market is competitive and process is effectively designed, market testing can provide an estimate of the efficient costs of a project. In practice it may be challenging to create a credible process as part of a cost assessment exercise as there would be significant costs for the bidding companies.
	What is the cost to apply (time/resources)	— Depends on the nature of the cost being tested. More complex cost elements imply greater costs for market testing.
	Wider issues	— In practice it may be difficult to run effective market testing exercise for activities where the costs or risks to bidders are too high to ensure that the market testing is reliable. In these situations evidence from procurement exercises at other companies may provide useful evidence which can be used to estimate costs.

M7.2 Top-down benchmarking

Descriptive	**Description**	— Cost assessment undertaken by comparing overall costs of an activity or project against other similar examples. Can be used to develop an indicative assessment of the potential efficient cost of a project based on external independent examples. The role of the regulator is to define the methodology and process for the benchmarking and to undertake the analysis.
	At what stage in the scheme is it applied	— Can be applied ex-ante or ex-post.
	Precedents	— ORR. Top-down benchmarking of Network Rail renewal and maintenance costs. — Ofwat. Top-down benchmarking of totex. — Ofgem. Proposed benchmarking of OFTO project costs.
Evaluative	**Project requirements/ disqualifiers**	— Top-down benchmarking can be undertaken a variety of ways. To be effective it requires a theoretical understanding of the cost drivers and comparable data to derive an efficient cost estimate. This often requires the use of econometric modelling techniques. Can be difficult to apply where project is highly bespoke and has few relevant domestic comparators. Top down analysis will generally require a high level of interpretation, sense checking and validation to ensure that findings are robust. — Top-down benchmarking most effective where there are a wide range of domestic comparator organisations. International comparisons are more difficult as differences in exchange rates and factor prices, and technical and legal requirements are difficult to fully account for.
	What are the advantages and disadvantages	— Top-down benchmarking can provide an indication of the level of efficiency than can be achieved based on actual examples. — Process can be complex and contentious for stakeholders.
	What is the cost to apply (time/resources)	— Potential for extensive time and resource costs where regulator has to develop a process and capture data. — Any method must be as rigorous as possible, as cost assessment methods often feature in appeals of price control decisions to the CMA.
	Wider issues	— Top-down benchmarking is most effective where the cost or activity is competitive or there are a wide range of domestic or international benchmarks which can be used to derive comparisons. Airports projects can be benchmarked, but differences in design, input costs, currency fluctuations etc. complicate analysis and interpretation.

M7.3 Bottom-up benchmarking

Descriptive	**Description**	— Cost assessment can be undertaken by breaking down costs or activities into components and comparing with other benchmarks. This generally enables a greater range of benchmarks to be applied, for example for staff costs, process efficiency, energy costs and other elements which can be easily compared across businesses and projects. The role of the regulator is to define the benchmarking process, obtain the data and expertise to undertake the assessment for example. — Can be applied to individual cost components of a project, or used to build a view of the total costs required to deliver a project.
	At what stage in the scheme is it applied	— Can be applied at any stage, but typically used as part of the ex-ante or ex-post review of costs.
	Precedents	— CAA. Bottom-up benchmarking of staff costs. — ORR. Gap analysis of Network Rail procurement strategy, possessions strategy, and approaches to asset management. — Telecoms. Development of bottom-up models prior to introduction of access prices.
Evaluative	**Project requirements/ disqualifiers**	— Suitable breakdown of activities and costs and identification of suitable benchmarks. This will often require bespoke dataset and information from a variety of sources.
	What are the advantages and disadvantages	— Appropriate benchmarks are more likely to be available for individual cost activities which may strengthen the reliability of the analysis. On the other hand, bottom-up approach may fail to account for the wider performance of the business or project which might off-set any apparent bottom-up efficiency gap. E.g. potential for trade-offs between staff costs and staff numbers, quality of outcomes etc. — Difficult for bottom-up models to asses all costs of corporate activity as opposed to a discrete project.
	What is the cost to apply (time/resources)	— Depends on the form of the analysis typically requires consultancy support to provide specialist modelling and benchmarking skills or data.
	Wider issues	— Bottom up benchmarking is widely applied by economic regulators to estimate project costs. The approach is generally more viable when the nature of the project is unusual and there are few relevant comparators. Heathrow and Gatwick also hold their own price databases which are used to estimate project costs for example.

M7.4 Expert review

Descriptive	**Description**	— Review of costs based on expert opinion (often based on the methods described above) supported with views and evidence on wider process efficiency for example. This form of cost assessment is reliant on the skills and experience of a consultant expert. Drives efficiency by providing independent third party view on the scope for greater efficiency. The role of the regulator is to define the scope of the assessment and to procure consultancy support effectively.
	At what stage in the scheme is it applied	— Can be applied at any stage but typically used as part of the ex-ante or ex-post review of costs.
	Precedents	— CAA. Ex- post review of costs at Heathrow and Gatwick. — Ofgem. Ex-post review of National Grid's capital expenditure. — Ofgem. Cost assessment of OFTOs to estimate transfer value. — TTT. An Independent Technical Assessor must agree that cost meet the definition for inclusion in the RAB.
Evaluative	**Project requirements/ disqualifiers**	— Consultancy expertise available on area of cost/expertise required. — Independence of the views provided from the interests of the promoter.
	What are the advantages and disadvantages	— Expert reviews can provide a useful independent view of the efficiency of a cost or cost forecast and can help to bring useful information to the regulators attention. Such reviews often require the regulator to rely on an experts professional judgement, against that of the company.
	What is the cost to apply (time/resources)	— Generally requires consultancy support. The cost depends on the nature of the project, but are likely to be included in regulated charges.
	Wider issues	— The CAA has historically relied on expert review to assess the efficiency of the airport capital investment programme both ex-ante and ex-post. This reflects the wide range of projects and costs invested in by the airport which preclude reliance on one method for estimating costs and the need to bring in expertise to assess the wide range of projects undertaken by the airport.

Stages of regulatory intervention

Regulatory methods and mechanisms can generally be separated between ex-ante, delivery and ex-post based on the stage in which they impact upon the promoter:

— **Ex-ante:** mechanisms are implemented during the initial phases of the project before costs have been incurred (e.g. defined by the project gateways). Ex-ante mechanisms tend to be prescriptive in order to create stronger efficiency incentives for the company.

— **Delivery:** mechanisms are implemented during the delivery of the project.

— **Ex-post:** mechanisms are implemented after the project has been delivered.

Most regulatory frameworks incorporate some form of mechanism for each stage but will generally place emphasis on the use of either ex-post or ex-ante mechanisms for incentivising efficiency (particularly for the creation of financial incentives).

Each mechanism must also be developed and applied through several stages:

— The regulator will need to **design** the mechanism, for example ex-post mechanisms may be designed up-front during the initial stages of the project. The criteria and approach to an ex-post review may also be pre-determined as part of the regulatory process. This process will typically require some research by the regulator and consultation with stakeholders before the mechanism can be implemented. More complex mechanisms such as changes to market structure or project governance may require extensive consultation and research.

— Once designed and implemented, mechanisms will also **impact stakeholder behaviour**. This will reflect the nature and timing of the mechanisms. Ex-post mechanisms, though implemented after project delivery, will also impact promoter incentives during the initial and delivery phases of the project.

— Mechanisms can also **impact financial outcomes** at different stages, for instance a mechanism may have a financial impact in the same year it is implemented or through an adjustment to the RAB at the end of the regulatory period.

— **There are three main stages for regulatory intervention – ex-ante, during the delivery phase or ex-post. These stages broadly correspond to the project stages of the scheme (and gateway process for individual projects).**

— **Most regulatory frameworks incorporate some kind of intervention mechanisms for each of these stages.**

— **When evaluating a mechanism the regulator also needs to consider the stages at which the mechanism is designed and how and when it impacts financial outcomes and stakeholder behaviour.**

Stages of regulatory intervention (cont.)

To be effective regulatory mechanisms should create incentives for efficiency throughout the life-cycle of a scheme: planning, procurement and delivery. Inefficiency can occur at any of these stages and this may be mitigated through regulatory mechanisms. A key challenge for the regulator is to distinguish between inefficiency and uncertainty and at what point cost forecasts can be linked with regulatory mechanisms.

Cost forecasts evolve over the course of the project, in the early phase forecasts have a higher margin of error but the actual level of expenditure may be limited. As the project progresses risk and potential error may reduce, spending will begin to increase in the execution and delivery stage. Generally the procurement stage is a key point in the project cycle when the promoter will have a clear understanding of the costs of the scheme or project with a manageable level of risk and uncertainty. At this point it may be feasible for the regulator to link cost forecasts to regulatory mechanisms.

The table below gives an illustrative evolution of forecast and actual costs and the forecast error margin. For example in period one the forecast of total costs is 80, by period 15 final outturn costs are 100. The forecast error margin is therefore 20%.The table also shows how expenditure is distributed over the different project stages with the bulk of spending in the procurement and execution stage.

These factors are useful in understanding how and when different mechanisms might be applied. For example a robust cost forecast is required for an ex-ante agreed cost recovery mechanism with fixed cost risk sharing bands. At initiation or planning and development the forecast error margin may create excess risk for the promoter or lead to cost overstatement.

	Ex-ante mechanisms							Delivery mechanisms					Ex-post mechanisms		
Criteria	**Initiation**			**Planning/development**				**Procurement**		**Execution/Delivery**			**Handover/operation**		
Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Gateway stage	0	0	0	1	2	3	3	4	4	5	5	5	5	6	7
Total cost forecast	80	80	80	90	90	90	95	95	95	95	95	95	100	100	100
Forecast error margin	*20%*	*20%*	*20%*	*10%*	*10%*	*10%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*0%*	*0%*	*0%*
Actual expenditure in period	0.5	0.5	0.5	1.5	2	2	10	10	10	20	20	20	1	1	1
Cumulative spending	0.5	1	1.5	3	5	7	17	27	37	57	77	97	98	99	100
% of total cumulative	*1%*	*1%*	*2%*	*3%*	*5%*	*7%*	*17%*	*27%*	*37%*	*57%*	*77%*	*97%*	*98%*	*99%*	*100%*

Cost forecasts and spending will evolve over the course of the project cycle. A key issue for the regulator is to distinguish between inefficiency and potential error. The procurement stage gateway is a key point at which the company should have market tested information on the costs of the project, which may be linked to regulatory mechanisms.

Stages of regulatory intervention (cont.)

As described in Section 2, each project will progress through five stages: initiation, planning, procurement, execution and operation. Each of these stages will involve a variety of activities and broadly correspond to the project gateways. Each mechanism could be broadly aligned with the stages of the project. Some mechanisms operate across the whole life of the project

Project stage:	**Initiation**			**Planning/development**			**Procurement**			**Execution/Delivery**			**Handover/operation**		
Period:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Gateway stage:	**0**	**0**	**0**	**1**	**2**	**3**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**6**	**7**
Project activities:	Defining project outcomes Strategic plan/feasibility Scope options analysis Financial risk analysis Business planning Communications strategy Contracting options analysis			Option development Stakeholder consultation Risk review Work schedule Outline plan Commercial structuring Financial model			Procurement process Contract design Negotiation Final plan Bid evaluation Fairness assessment Supply chain management			Reporting Change control Risk management Programme control assessment Due diligence Programme management Commercial management Prime contract management Sub-contract management Claims and dispute resolution Design management Interface management			Benefits realisation Evaluation Operational planning Operational readiness Airline Transfer Facility cost forecasting Transition planning Operation strategy advice Project close out review Prime contract close out Claims and dispute resolution		
Potential regulatory mechanisms at each stage:	Requirements for customer engagement Review of funding governance and ownership Market structure and design Project representative			Customer involvement in business planning Ex-ante approval of cost forecast Up-front information on cost calculations Rules over procurement Project representative			Incentives to reveal true costs Up-front info on cost calculations Market testing Top-down benchmarking Bottom-up benchmarking Expert review Rules over procurement Project representative			Ex-ante financial incentives Outcome incentives Monitoring and reporting Outcome triggers Discretionary control mechanisms Approval of changes in planned costs Project representative			Ex-post financial incentives Ex-post approval and treatment of costs Market testing Top-down benchmarking Bottom-up benchmarking Expert review		

Cost assessment methods

The ability to define the scope and intended outcomes of the project, and assess and estimate efficient costs is a key issue for the design of the regulatory framework. The ability of the regulator to define scope and assess costs affects the viability and risks associated with different efficiency mechanisms. These implications are summarised in the table below.

Aspect of efficiency 'assessment'	Regulator's ability is low	Regulator's ability is high
Ability to define efficient scope or outcomes of a project or scheme	Regulator does not know what outcomes are required or how they should be achieved. Regulator is reliant on company and or customers to define the scope and design of the project. Regulator's understanding of customers priorities is limited.	Regulator can define outcomes and may have view over how these should be achieved. Regulator can intervene to define or alter project scope to improve or incentives outcomes. Regulator has extensive insight into customer priorities
Ability to estimate efficient costs (ex-ante)	Difficult for regulator to set an efficient cost forecast without creating risks of over or under reward for company. Limited ability to create dynamic incentives for company to outperform binding cost forecast. Ex-ante financial incentives will incentivise cost overstatement.	Greater ability to create dynamic incentives for efficiency by encouraging company to outperform binding (and efficient) cost forecasts. Regulator capable of seeing through cost overstatement.
Ability to assess efficient costs (ex-post)	Limited ability to create ex-post incentives for efficiency without risk of arbitrary over or under reward. Implies linking revenues with actual expenditure with limited risk/reward sharing to prevent excess profits.	Greater ability to create ex-post incentives for efficiency, through identification and treatment of expenditure. Less risks of arbitrary over or under reward. Threat of ex-post treatment creates incentive for efficient behaviour.

Where the regulator can define, assess and estimate the efficient outcomes, scope and costs of a project it has a wider range of options for encouraging efficiency. The ability to define and accurately estimate the efficient costs of a project means that the regulator can create high power dynamic incentives for the company. Where this is not possible it could rely on cost assessment and ex-post incentives.

The ability of the regulator to define, assess and estimate efficient costs is an important issue for the design of the regulatory framework. The regulator's ability to undertake these aspects will significantly influence the design of the framework and the viable mechanisms for cost efficiency.

Cost assessment methods (cont.)

There are four main methods for undertaking a cost assessment with different levels of complexity and effectiveness depending on the nature of the costs they are applied to. These broad methods are summarised in the adjacent table. Customer negotiation and truth revelation could also be considered as cost assessment methods (but are covered separately within our long list of regulatory mechanisms).

Each method has advantages and disadvantages and regulators often seek to apply more than one when considering the costs of a major project. A key distinction for the application of cost assessment methods is whether the method is applied ex-ante or ex-post. In principle each of the methods described above could be applied at either stage.

The effectiveness of each of these methods will vary depending on the nature of the cost item, the availability and quality of information and benchmarks and the relative expertise and capacity of the regulator or consultant in evaluating such costs.

A wide range of specific methods exists within each of these approaches, which could be developed depending on the element of cost being reviewed. For example top-down benchmarking can be undertaken using simple metrics such as cost per passenger or using more advanced econometric models. There are also a wide range of construction cost benchmarking datasets and 'price books' which could be used to compare actual scheme costs for specific elements. The scheme promoters are likely to have access to their own cost database which will have informed their cost forecasts.

For capex, the CAA has historically tended to rely on expert review of capital costs (other methods have been applied to opex). This is because airport capital projects are usually unique and designed for the specific characteristics and constraints of the airport. This makes the actual level of efficient costs hard to distinguish from differences in design and quality and exogenous factors. For the same reasons top-down benchmarking of such projects tends to be difficult to rely upon for setting an efficiency cost benchmark.

Method	Description
Market testing	Comparison of the costs of an item against an efficient market outcome, e.g. via competitive tendering or other competitive process.
Top-down benchmarking	Comparisons of the overall costs of an entire scheme, or element of the scheme based on external comparators and/or historic performance, e.g. via international price and cost comparisons, models that predict total company costs
Bottom-up benchmarking	Comparisons of the specific costs of individual cost items based on external benchmarks and historic performance, e.g. engineering cost databases, econometric models that build up cost components, or identify 'frontier' and 'catch-up' efficiency
Expert review	Independent review of scheme or item costs based on the expert review by an independent body. Typically based on the techniques described above and expert judgement on the company's performance, process efficiency and adherence to best practice in project management etc.
Customer negotiation	Customers will often have a better understanding of the operations, costs and efficient outcomes of a regulated business. Engagement and negotiation with customers can provide information on costs.
Truth revelation – cost curve	It is possible for a regulator to derive information on cost efficiency by seeking to explore options with the regulated company. Costs associated with different levels of output for example. This can enable the regulator identify the company's cost curve.

Cost assessment methods (continued)

The table below provides examples of the four main cost assessment methods described on the previous pages as applied by different economic regulators. Each of these provides an example of the form of analysis and data that can be used by regulators to assess costs. Reflecting the differences in each industry there are differences in the methods applied in each case study, but there are also some similarities in the issues they consider and approach to benchmarking for example. Many of the expert review examples are based on top-down and bottom-up benchmarking, often drawing on bespoke, private and proprietary datasets.

Assessment method	Examples	
Market testing	— Ofwat tender process for TTT project ownership (cost of capital bidding). — Channel Tunnel. Competition for ownership and construction (1986). — Ofgem Offshore transmission licence tenders.	
Top-down benchmarking	— ORR econometric benchmarking of Network Rail maintenance and renewals costs (2013). — Ofwat econometric totex benchmarking of water and waste water companies (2015). — Eurocontrol ATM cost effectiveness benchmarking (2013).	
Bottom-up benchmarking	— CAR Review of Dublin Terminal 2 Non Construction costs (2007). — HAL Estimating rate database (used to develop the Q6 Management Business Plan). — CAA Review of employment costs at Heathrow (2012).	
Expert review	— CAA Ex-ante review of NERL RP2 Capex (2014). — CAA Ex-ante review of Heathrow and Gatwick Q6 capex plans (2013). — CAA Ex-post review of Gatwick Q5 capex (2013). — CAR Dublin Capital Expenditure Assessment (2009). — ORR Gap analysis of Network Rail costs (2010).	— ORR ECAM assessments (2014). — ORR Review of Network Rails Planning, Management and Delivery of Enhancements (2015). — Ofgem review of Interconnector (Project Nemo) costs (2013).

Economic regulators have adopted a range of approaches to cost assessment. Expert review is widely used, particularly where the project is unusual. Expert assessments generally rely on benchmarking and process review.

Potential benchmark data sources

There are several potential sources of benchmarking data which could be used as part of the cost assessment process:

— Recent airport projects.

— Airport specific cost databases.

— Generic construction cost databases.

— promoter's own internal benchmarking datasets.

— Other sources such as government and BCIS indices.

There have been several recent major airport projects over which might provide informative benchmarking data for the new runway project either for bottom-up, or top-down analysis. This data would need to be secured from the airports or their regulators.

Based on a high level review of the analysis and sources of evidence used in the case studies described on the previous page There are also numerous sources of price and cost information which could be used to benchmark the costs of the new runway project.

These include airport specific cost datasets and models usually developed as proprietary datasets and also generic construction cost datasets which could be used to derive bottom-up estimates of construction costs for specific items of the project such as car parks, runways, and parts of the terminal building.

Heathrow and Gatwick have also developed their own benchmarking datasets largely based on their own and historic BAA projects. These datasets are often used as part of their internal cost estimates.

Source	Description
Recent airport projects	— Heathrow Terminal 5 (opened in 2008). — Heathrow Terminal 2 (opened 2014). — Manchester Airport New Terminal (in planning). — Dublin Airport Terminal 2 (opened 2010). — Dublin Airport New Runway (in planning). — Berlin Brandenburg Airport (under construction). — Istanbul Third Airport (under construction). — Munich airport third runway (in planning). — Changi Singapore, East development (in planning).
Airport specific cost datasets	There are several airport specific cost benchmark datasets which may provide useful evidence for cost assessment. For example, Davis Langdon, Airport cost models, Compass International Regional Airport cost model, EC Harris cost databases, ACI Airport Capital Development costs.
Generic construction costs datasets	Wide range of propriety cost benchmark datasets with different levels of coverage and focus. These include Gardiner and Theobald international construction cost survey, AECOM Blue Book of property and construction costs, Tuner and Townsend International Cost Survey, The Bruce Shaw Handbook and Arcadis construction cost indices.
HAL & GAL – Internal cost databases	Both Heathrow and Gatwick maintain internal cost benchmark datasets which are used to inform costs estimates where appropriate. These databases are partially based on historic BAA projects and wider data supported by external consultants
Other sources	The BCIS is provided by RICS and provide a source of cost and price information to the construction industry. Cost indices and benchmarks are available for a range of sectors and have often been used as regulatory or contractual benchmarks. For example the SPONS price book is cited as part of the CAA's Q5 capex review. Some of these indices are published by BIS.

Summary of Section 4.1

There are six main behavioural drivers of cost efficiency: profit motives, regulatory control, competitive pressure, customer choice, external cost scrutiny, and the threat off loss of control.

These drivers broadly correspond to seven categories of regulatory mechanisms: financial incentives, regulatory approval, competition, customer bargaining, external review, control mechanisms and cost assessment. Within each category there are several types of mechanism which can be applied and within each type there may be numerous variations – for example related to the calibration of ex-ante financial incentives.

The potential strength and viability of each driver and mechanism is influenced by a range of factors. For example financial incentives are most effective if the company is in private ownership, regulatory control requires that the regulator is well informed about the business and customers requirements, competition requires a viable market structure and supply chain, customer bargaining requires organised and informed customer groups and the threat of loss of control is only effective if it can be credibly enforced by the regulator i.e. it can be achieved without imposing major disruption on customers.

Reflecting these issues, different categories and types of mechanism may be better suited to different types of project, for example depending on the ability of the regulator to accurately assess costs and define efficient outcomes.

Mechanisms can either be active requiring the regulator to define a target, outcome or process, or passive requiring the company to comply or have regard to principles or directives set by the regulator, or for the regulator to grant approval. Active mechanisms can provide stronger incentives but require much greater information and engagement by the regulator. This also creates risks associated with regulatory decisions.

Passive mechanisms may result in weaker incentives but enable greater discretion and flexibility for the regulator. They can also create greater risks for the company where the process for regulatory decision making is unclear or inconsistent.

Each regulatory mechanism also has several stages including the design of the mechanisms (consultation with stakeholders, definition of principles and parameters), intervention (when the mechanism has effect), impact on stakeholder behavior and impact on financial outcomes.

There are three main stages of regulatory intervention at which regulatory mechanisms can be applied – ex-ante, during delivery, and ex-post. Some mechanisms can only be applied at one of these stages, for example competition and customer bargaining can only be applied ex-ante, others may have effect across all three.

Most regulatory frameworks apply mechanisms at each of these stages but often place emphasis on either the ex-ante or ex-post stage to create financial incentives. The CAA's current framework for Heathrow is more reliant on the creation of financial incentives through a discretionary ex-post review of capex for example.

The framework for the new runway scheme could include a range of ex-ante, delivery and ex-post mechanisms. These mechanisms could be applied at the level of the overall programme, and/or or for individual sub-programmes and projects.

The choice of regulatory mechanisms needs to consider mechanism design and impact on stakeholders' incentives in addition to the practical issues associated with implementation and impact on financial outcomes.

Summary of Section 4.1 (cont.)

The ability of the regulator to define, estimate and assess the efficient costs and outcomes of a project is a key factor for the design of the regulatory framework.

To assess cost efficiency the regulator will firstly need to be able to define an efficient output or outcome for a project. This may be difficult where the business faces complex trade-offs between design quality, cost and other factors. Where a regulator cannot define efficient outputs or outcomes it is very challenging to assess the 'true' efficiency of a project. This may be the case for some parts of the new runway scheme such as the terminal area where choices will need to be made over design quality and cost.

Even if project outcomes can be defined it may remain difficult for the regulator to assess efficient costs in advance, for example due to the absence of relevant benchmarks. In this case the regulator will have to rely on an ex-post cost assessment process. This limits the scope for ex-ante efficiency mechanisms and financial incentives.

There are six main cost assessment methods: market testing, top-down benchmarking, bottom-up benchmarking, expert review, customer negotiation and truth revelation. Each has pros and cons and is more or less viable depending on the scheme or project under consideration.

Top-down benchmarking is only effective where there are a range of comparable benchmarks. This can be challenging for airport projects which can vary in design. Bottom-up benchmarking can be more effective as many of the costs and activities undertaken by an airport are also undertaken for other construction projects and may be compared directly to some extent e.g. staff costs, contingencies, material costs etc.

Reflecting the strengths and weakness of different approaches regulators often apply more than one cost assessment method. The methods can also be applied either ex-ante or ex-post. Naturally there is normally a wider range of evidence available ex-post which facilities a more detailed and accurate assessment of cost efficiency.

The CAA has tended to rely upon expert review for both ex-ante and ex-post review of capital costs. This reflects the complexity of airport projects, the potential for changes in scope and the lack of relevant benchmarks. The new runway scheme is likely to share many of the same characteristics as existing runway projects meaning that this method is likely to remain the most viable for the estimation or assessment of the scheme costs.

Other regulators have adopted a wider range of methods including greater use of market testing, top-down and bottom up benchmarking and truth revelation. These approaches have been facilitated by the ability of the regulator to segment the market for a competitive process (such as for OFTO licences, TTT and the Channel Tunnel) or the costs of the projects are repetitive with a wide range of benchmarks (Ofwat totex benchmarking for example).

For example the ORR has applied several cost assessment methods including top-down international benchmarking, bottom-up analysis and expert review, 'triangulating' between these approaches to set a cost allowance. These methods have been applied to different types of cost incurred by Network Rail.

Based on a review of the methods applied by different regulators there are a wide range of sources of evidence which could be used to develop airport cost benchmarks. These sources include new and recent airport projects, airport specific cost datasets, generic construction cost datasets and HAL and GAL's own cost benchmarking datasets. These sources have been widely cited throughout the cost assessment reports reviewed and could be considered by the CAA.

Top-down benchmarking evidence may provide a useful cross check on the overall costs of the scheme and its sub-programmes and projects. However the feasibility of using benchmarking evidence alone to set an efficient costs for an airport project as a whole is probably limited due to the complexity of the overall scheme. The CAA is likely to have to rely upon more detailed bottom up evidence and expert review for the assessment of cost elements. Truth revelation methods could also be used – the cost estimates developed as part of the AC process for the three main scheme options may also provide a useful high level benchmark.

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Section 4.2
CAA's existing regulatory mechanisms

CAA's existing efficiency mechanisms

The mechanisms applied in the existing regulatory framework for Heathrow and the rationale for their application is summarised in the table below.

Mechanism/method	Description and purpose
Constructive Engagement with airlines Customer consultation	The CAA requires that the airport engages with airlines over the development of its business plan with particular focus on the scope of capital investment. This helps to ensure that the business plan meets customers needs and reduces the need for the CAA to define outcomes. Airlines have a good understanding of the outcomes passengers require and airport operations and are well resourced – they are therefore well placed to perform this role.
Ex-ante review of cost forecasts Ex-ante approval of cost forecast	The airports business plan and cost forecasts are reviewed by the CAA in advance of the settlement. This has typically involved an expert review of the efficiency of the business plan forecasts and assumptions, assessment of the scope for greater efficiency and the robustness of the processes involved in their development.
Charges based on forecast capex (Limited) Ex-ante financial incentive	Based on the ex-ante review the CAA sets charges based on forecast and not actual capex spending and depreciation during the period. This creates incentives for the operator to spend up to but not over the cap within the regulatory period. It can also create some incentives for back loading expenditure to reduce financing costs relative to the CAA's assumptions. To counter this incentive the CAA has introduced triggers, the core and development capex process and the RAB roll-forward adjustment (these mechanisms are discussed on the next page).
Governance protocol for capex development Customer involvement in business planning	The CAA requires the airport to publish a Capex Governance Handbook which defines the process for the governance of the capital programme through the course of the regulatory period. This includes an overview of the governance framework, key committees, rules for consultation with airlines, decision points and process for escalation to the CAA. This provides clarity to stakeholders over how the capex programme is managed and their opportunity to influence the process.
Core and Development capex process Discretionary control mechanism	Recognising the potential for changes in scope for many projects in the business plan over the five years following the settlement, the CAA has developed a mechanism which adjusts charges to reflect differences in actual and forecast capex by adding or subtracting the return associated with the over/under spent capex. This enables the operator to adjust the scope of the capex programme in response to passengers requirements without incurring short term financial penalties.

CAA's existing efficiency mechanisms (cont.)

Mechanism/method	Description and purpose
Project triggers Outcome trigger	Reduction in level of charges (equivalent to a penalty) triggered by failure to deliver a specified project outcome by pre-defined date and specification. Penalty is equivalent to the cost of capital on the project value for the duration of the delay. The intention of the mechanism is to create penalties for late delivery of project outcomes assumed in the business plan used to agree the overall regulatory framework.
Independent Fund Surveyor (IFS) Monitoring and reporting	As part of the capex governance process the IFS provides an independent ongoing 'real time' review of key projects nominated by the Capital Programme Board. These reports examine progress against forecasts and highlight potential issues and risks for mitigation. These reports are also intended to provide part of the evidence base for the ex-post efficiency review undertaken at the end of the price control period.
Ex-post review of costs Ex-post financial incentives	At the end of the regulatory period the CAA undertakes a review of the airports expenditure, with a particular focus on projects highlighted by the airlines and other stakeholders. This review is undertaken by experts and seeks to highlight 'inefficient spending' to be excluded from the RAB.
Adjustment for inter-temporal indifference Ex-post financial incentives	The charging framework is based on forecast expenditure rather than actual expenditure. This creates a financial incentive for the airport to underspend relative to forecast in the early years, and overspend in the later. To mitigate this an inter-temporal adjustment is applied to the RAB as part of the roll-forward to make the airport 'inter-temporally indifferent' to the timing of capex.
RAB roll-forward Ex-post financial incentives	Based on the ex-post review, adjustment for inter-temporal indifference and the overall differences between the forecast and actual expenditure. The CAA undertakes a RAB roll-forward whereby the RAB is adjusted to take account of these factors.

CAA's existing cost assessment methods

The CAA has made use of experts to review operators forecast capital expenditure to determine whether the estimate was in-line with expected expenditure given the business plan. These studies have typically involved expert review of different elements of costs, based on a detailed assessment of specific projects. These reviews tend to make use of high level benchmarking and consideration of the operators process for developing the forecasts. Some recent examples of this analysis are shown below.

Report	Cost assessment method	Summary
Q6 Capex Review Heathrow Airport, Final Report, November 2013, Alan Stratford and Associates	Expert review	Provides an assessment of Heathrow's proposed capital expenditure programme as set out in the Q6 Alternative Business Plan between 2014 and 2019. The study was based on a review of business cases from HAL and Airlines, meetings with HAL and written responses under the IRS scheme. As part of this 12 major capex projects were considered in detail. The review considered the project costing process, the cost estimating process, nature and level of project costs, the risk allowances and cost benchmarking undertaken amongst other factors.
Gatwick Airport Q6 Capex Review for the CAA, Phase Three Report – Final, August 2013, Davis Langdon	Expert review	Provides an assessment of Gatwick's proposed capital expenditure programme between 2014 and 2019, as part this an assessment of project capital costs and associated business cases was undertaken. For significant projects a more detailed review was undertaken based on the definition of scope, methods of costing and level of costs relative to high level internal and external benchmarking. It is noted the report did not comment on schemes where GAL and the airlines had agreed upon the outcomes and costs.
NERL RP2 Capex Review, Arup and Helios Phase 1 Report, January 2014	Expert review	As part of this report into NATS, both capital expenditure plans for the next regulatory period and previous delivery was considered. As part of the review planned expenditure was compared to actual expenditure over the previous period.

CAA's existing cost assessment methods (cont.)

The CAA has also made use of expert reviews to undertake ex-post cost assessment. This is key to providing the airport with ex-post efficiency incentives. Any inefficiency identified as part of the ex-post review could result in reductions in the RAB value. These studies tend to rely on a combination of expert judgement over the conduct of the operator supported by cost and process benchmarking where appropriate.

Report	Cost assessment method	Summary
Gatwick Airport – Review of Q5 Capex, March 2013, URS	Expert review	As part of its regulatory function, the CAA carried out an assessment of the efficiency of the Capital Investment Programme (CIP) at Gatwick Airport at the end of the regulatory cycle. This report consisted of an assessment of capital efficiency in relation to best practice, cost planning, management of risk, actual outcomes and lessons learnt. Specific projects were considered and these were reviewed based on project management benchmarks such as; whether toll gates were passed through correctly, whether change management processes were followed, whether consultation occurred and whether the procurement approach was consistent. In addition whether GAL undertook cost benchmarking in relation to the project was reviewed and where applicable revisited to consider whether the costs incurred was reasonable given comparable costs within a range. Where benchmarking had not previously been undertaken this was noted, with the rationale being that for certain projects it is not always possible and depended on the nature of the project.
Review of Heathrow Airport capital investment plan for Q5, November 2007, Currie & Brown	Expert Review	Report made an assessment of the overall viability of BAA's Capital Investment Plans (CIPs), focussing on those elements where consensus was not reached through Constructive Engagement (CE). The review covered the efficiency and effectiveness of the plan, in terms of scale, design and sequencing of the CIPs for Heathrow and Gatwick. This took account of the current use of the airports, the range of forecasts for future traffic, and the impact of any uncertainties related to scale, specification, sequencing and timing of capital investments.
Review of Gatwick Airport capital investment plan for Q5, November 2007, Currie & Brown		

The complexity, variety of scope and lack of relevant top-down comparators has meant that the CAA has typically had to rely upon expert review of operators capex costs forecasts and actuals. The new runway project will probably require a similar approach.

CAA's existing regulatory mechanisms for Heathrow

The mechanisms and methods applied in the CAA's existing framework can be summarised against the long list diagram shown below. The highlighted cells indicate the mechanisms applied by the CAA.

Categories	Types of mechanisms and methods			
1. Financial Incentives	M1.1 Incentive to reveal true costs	M1.2 Ex-ante financial incentives	**M1.3 Ex-post financial incentives**	M1.4 Outcome incentives
2. Regulatory Approval	**M2.1 Ex-ante approval of cost forecast**	**M2.2 Approval of changes in planned costs**	**M2.3 Ex-post approval and treatment of costs**	
3. Competition	M3.1 Market structure and design		M3.3 Regulatory rules over procurement	
4. Customer Bargaining	**M4.1 Requirement for customer consultation**		**M4.2 Customer involvement in business planning**	
5. External Review	M5.1 Upfront information on cost calculations	**M5.2 Monitoring and reporting**	M5.3 Review of funding, governance and ownership	M5.4 Project representative
6. Control Mechanisms	**M6.1 Outcome trigger**		**M6.2 Discretionary control mechanism**	
7. Cost assessment methods	M7.1 Market testing	M7.2 Top-down benchmarking	M7.3 Bottom-up benchmarking	**M7.4 Expert review**

CAA's existing regulatory mechanisms for Gatwick

The mechanisms and methods applied in the CAA's existing framework for Gatwick can be summarised against the long list diagram shown below. The highlighted cells indicate the mechanisms applied by the CAA.

Categories	Types of mechanisms and methods			
1. Financial Incentives	M1.1 Incentive to reveal true costs	**M1.2 Ex-ante financial incentives**	M1.3 Ex-post financial incentives	M1.4 Outcome incentives
2. Regulatory Approval	**M2.1 Ex-ante approval of cost forecast**	M2.2 Approval of changes in planned costs	M2.3 Ex-post approval and treatment of costs	
3. Competition	M3.1 Market structure and design		M3.3 Regulatory rules over procurement	
4. Customer Bargaining	**M4.1 Requirement for customer consultation**		M4.2 Customer involvement in business planning	
5. External Review	M5.1 Upfront information on cost calculations	**M5.2 Monitoring and reporting**	M5.3 Review of funding, governance and ownership	M5.4 Project representative
6. Control Mechanisms	M6.1 Outcome trigger		M6.2 Discretionary control mechanism	
7. Cost assessment methods	M7.1 Market testing	M7.2 Top-down benchmarking	M7.3 Bottom-up benchmarking	**M7.4 Expert review**

Summary of Section 4.2

The CAA's approach to capex efficiency has evolved over several regulatory periods to deal with various regulatory issues associated with airport projects including: the potential for changes in scope, challenges associated with defining efficient outcomes and estimating and assessing efficient costs and the ability of the airlines to represent customers interests and play a pro-active role in the development of the capital plan.

At Heathrow these characteristics have led to an approach which is largely discretionary, reliant on ex-post efficiency incentives, low risk/reward, with a high level of customer engagement and low intensity oversight by the regulator. This existing framework provides a potential option for the regulation of the new runway scheme, although the economic characteristics of the scheme are not the same as business as usual (and differ for both Gatwick and Heathrow options). This suggests that changes to the regulatory framework could help to strengthen incentives for efficiency.

The CAA's current framework for Heathrow contains a range of specific cost efficiency mechanisms and assessment methods as part of its efficiency framework including: Constructive Engagement, ex-ante cost assessment (primarily based on expert review), an adjustment process for core and development capex, capex delivery triggers, ex-post review of expenditure, inter-temporal adjustment to account for differences between forecast and actual spending and a RAB roll-forward mechanism. Because of the potential for changes in scope in airport business plans, the CAA has tended to rely upon ex-post expert review to set efficiency incentives for the airport through adjusting the RAB to exclude inefficient costs.

For Gatwick the CAA has introduced a framework based on licence-backed commitments from the airport. This framework has been developed against a RAB based benchmark – but essentially applies a light touch discretionary monitoring mechanism with the potential threat of re-regulation to create incentives for efficiency.

These frameworks have been developed to deal with the specific economic characteristics of the airport projects reflecting different levels of market power and may continue to be usefully applied to the new runway scheme. It may be beneficial to consider how each of the mechanisms could be developed or intensified to increase their effectiveness. In particular it is possible that the intensity and scope of cost assessment mechanisms (ex-post and ex-ante) could be increased to strengthen the incentives faced by the promoter. It may be beneficial to review the structure and governance of the core and development capex process and Constructive Engagement to give the CAA greater input into this process where airlines lack the capacity or have conflicting interests with potential new airlines.

There are a range of other regulatory mechanisms which are not currently applied and which could be viable for the scheme. The new capacity scheme will share some of the same economic characteristics as BAU projects, but there will also be differences – in particular the scale of the project and the potential for customer negotiation. This means that the CAA's existing framework may provide a useful benchmark to compare with other potential regulatory approaches, but may not be considered optimal.

For example, the CAA could seek to review the governance and ownership model of the promoter, and its plans for procurement, risk and project management. This could be achieved through an expert review and audit of the promoter's own project management approach to ensure that it meets best practice and is actively adhered to by staff. Similarly there could be potential to expand and intensify the role of the IFS to cover a wider range of the promoters activities and decisions. We discuss these options for developing the regulatory framework and mechanisms in more detail in the next section.

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Section 5
Developing the regulatory programme and strategy

Overview of Section 5

The development of a regulatory framework for the new runway scheme requires the selection of regulatory mechanisms and assessment methods.

This section of the report considers the specification of an overall regulatory programme and strategy based on the mechanism and methods identified in Section 4. We cover the stages in the process of designing, constructing and operating new capacity at which the CAA could intervene, the level at which it could intervene and how the approach might vary as the scheme progresses. The proposed approach is indicative given the scope of this engagement. Our recommendations are therefore subject to further refinements and development.

The section brings together key findings from:

— Section 2: Breakdown of a generic airport expansion programme, including specific proposals for Gatwick and Heathrow airports.

— Section 3.3: Description of alternative regulatory frameworks linked to seven regulatory dimensions.

— Section 3.4: Identification of the key economic characteristics of the airport expansion programme, sub-programmes and projects that will both guide and constrain the design of the regulatory framework.

— Section 4: Assessment of the pros and cons of individual regulatory mechanisms and cost assessment methods that contribute to a package of measures within the overall regulatory framework.

5.1 Methodology	— Methodology for defining the regulatory programme and strategy
5.2 Regulating at programme level	— Overview of potential frameworks for regulating at a programme level, including cost-based, incentive-based and a 'hybrid' or layered incentive approach
5.3 Regulating at sub-programme level	— Overview of potential framework for regulating at sub-programme level to better match mechanisms and methods to sub-programme characteristics
5.4 Conclusions	— Conclusions and recommendations

A new regulatory framework

The economic characteristics of the new runway scheme are likely to be sufficiently different from existing airport operations to motivate changes to the existing regulatory framework, and mechanisms and methods applied by the CAA to Heathrow and Gatwick.

Regulatory mechanisms and methods

We have identified a range of efficiency mechanisms and cost assessment methods that have been applied to infrastructure schemes in the UK and elsewhere. These mechanisms and methods can be applied at programme, sub-programme and project level, with varying levels of intensity, and at different times, to create efficiency incentives whilst balancing stakeholder risk and reward.

Individual efficiency mechanisms and cost assessment methods are interdependent and operate as part of an overall regulatory framework. The selection of individual mechanisms and methods therefore needs to be guided by the selection of an overarching framework based on the seven regulatory dimensions and five economic characteristics of the project.

Developing options for the regulatory framework

The economic characteristics of the expansion scheme will influence the viability and effectiveness of different regulatory frameworks.

For instance at Heathrow the existing framework can be characterised as a low risk cost-based approach with a high level of customer negotiation largely based on ex-post financial incentives. This framework has been designed to take account of the important role of airlines, and difficulties the CAA faces in defining efficient outcomes and costs directly.

The challenge for the CAA is to develop an approach to regulation which takes account of these characteristics whilst creating stronger efficiency incentives for the promoter and the much larger costs, risks and uncertainties associated with the new runway scheme.

Differences related to the scale of the scheme and the potential role of airlines may motivate changes to the existing framework. This could involve different approaches across different parts of the airport expansion programme, or an intensification of existing mechanisms for example.

Regulating at the programme, sub-programme and project level

Regulatory mechanisms and methods can be applied at an overall programme level, at a sub-programme level, or a project level. The airport expansion scheme may be broken down into a number of sub-programmes such as the terminal, runway, surface access, etc. Those sub-programmes can be further decomposed into a number of projects, for example terminal buildings, baggage handling system, car parks etc. The economic characteristics of these elements is often very different.

As the sub-programmes and projects have different economic characteristics, there may be some potential for variations in mechanisms applied at sub-programme and project level to deliver better outcomes. This ‘sub-programme’ approach could enable stronger financial incentive mechanisms for simpler elements of the scheme, whilst retaining a lower risk discretionary approach for more complex parts where the CAA is not able to define outcomes or efficient costs. This approach may have wider implications for example requiring a greater number of separate cost assessment processes, more intensive scrutiny of cost allocation and a general increase in the level of regulatory complexity and workload which may have wider implications.

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Section 5.1 Methodology for developing the regulatory programme and strategy

Introduction to Section 5.1

The application of regulatory mechanisms and methods requires the selection of an overall regulatory framework

The mechanisms and methods described in Section 4 provide a range of tools which could be applied by the CAA to ensure the efficient delivery of the airport expansion scheme. Whilst these tools can be applied at different levels (programme, sub-programme and project) with different intensity and at different times they are usually applied together to achieve the desired outcomes. The rationale for the application of a specific mechanism or method can only be understood when considered as part of the wider regulatory framework and the economic characteristics of the project.

It is important to select an overall approach for the regulatory framework for the new runway, within which specific regulatory mechanisms and methods can be identified and developed. This includes determining the level of appropriate exposure to risk and reward for the promoter, the structure, length and timing of the process, the intensity and level of resources available and the overall level of complexity and risk which is acceptable for stakeholders.

The CAA's existing framework and mechanisms provide a template of well-developed tools for the regulation of a project within a cost-based framework. These tools include a light touch approach to ex-ante cost assessment, intensive customer engagement over project specification and outcomes and change control processes to account for risks and uncertainties. Financial incentives are ultimately driven by ex-post review of costs and outcomes and discretionary treatment of the RAB.

These mechanisms (and their design and intensity) would not, in their current form, be compatible with an alternative regulatory framework, for example based on creating stronger financial efficiency incentives for the promoter.

The choice of regulatory framework should be linked to the economic characteristics of the scheme and wider regulatory objectives and constraints

Different schemes have been delivered under different regulatory frameworks. In each case the regulator has made a choice which reflects the economic characteristics of the project and wider objectives and constraints such as the availability of benchmarking evidence, availability of public funding to support the project or the desire to stimulate competition.

There is no one optimal regulatory framework which can be applied to the entire scheme and any particular choice involves trade-offs. There are important economic characteristics which can constrain the viability of a particular approach by creating potential implementation challenges and risks. The regulator's capacity to implement and to deal with potential risks is therefore an important consideration.

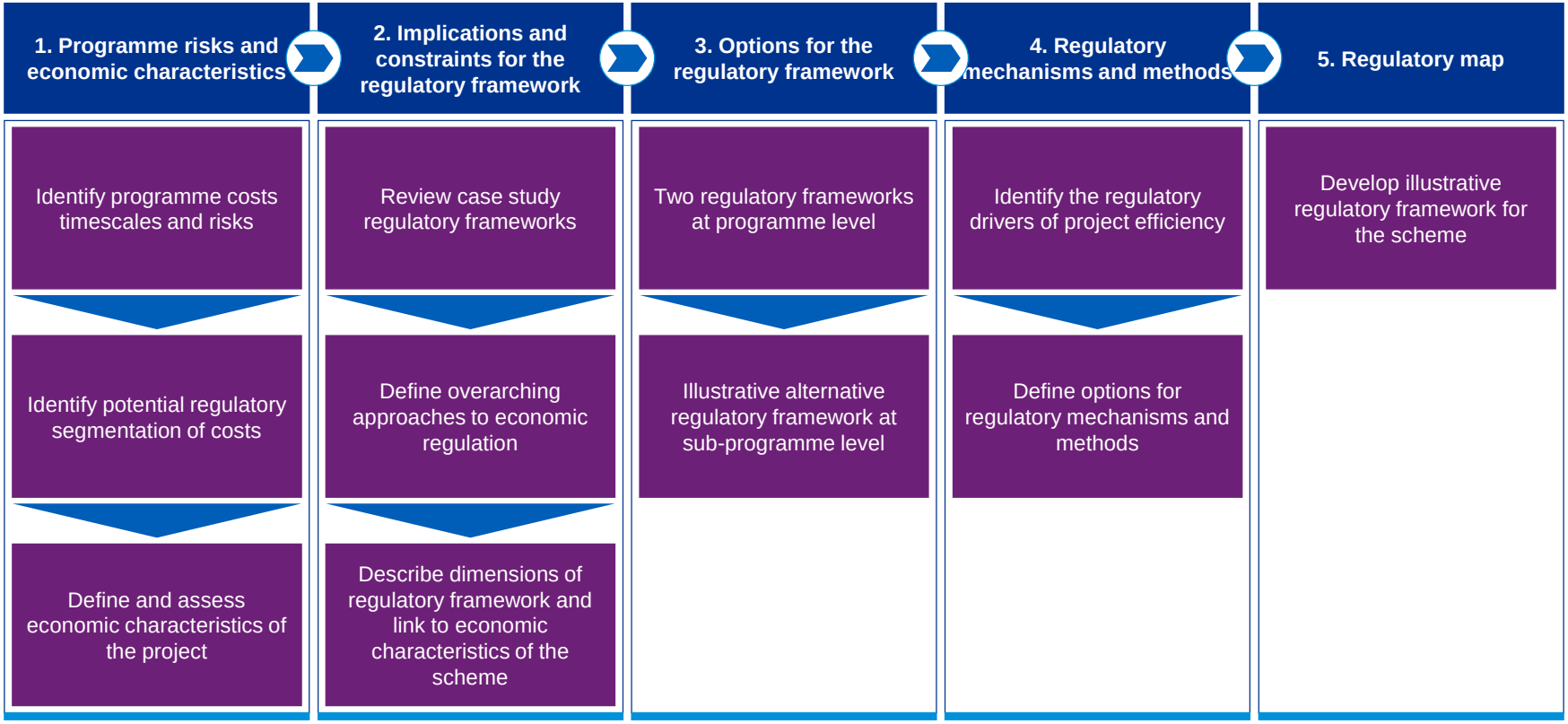
The application of regulatory mechanisms and methods can also be considered at different levels of the scheme

Regulatory mechanisms can be applied at the level of a programme, sub-programme or project and different frameworks have different levels of emphasis. The approach applied in each case will have implications for the overall complexity of the regulatory framework and the ability of the regulator to tailor incentives.

In this section we provide a methodology for identifying an appropriate overall regulatory framework for the scheme focussed at a programme level before exploring the potential for placing greater emphasis on mechanisms and methods which could be applied at lower levels of the scheme.

Our approach

Our approach to developing an overall regulatory programme and strategy starts with a review of the costs, timescales and risks of the scheme and identification of the economic characteristics of the programme, sub-programme and projects of the scheme. The economic characteristics inform the specification and **dimensions** of **the regulatory framework** and **selection of incentive mechanisms and cost assessment methods** and ultimately the specification of the **regulatory map**.



Economic characteristics of the scheme

We have identified five main economic characteristics which influence the development of the regulatory frameworks. These are:

- **C1: The ability to separate the projects revenues, risks and operations from existing assets –** may support a bespoke framework which can isolate the costs, revenues and risks of the project from existing users and enable the introduction of direct competition for the scheme. Where separation is difficult, the risks of cost escalation or scheme failure may impact on existing users and may need to be controlled and managed through greater risk sharing.
- **C2: The ability of the promoter or company to control and predict costs** – if limited (e.g. due to exogenous risks or potential changes in scope) may motivate a discretionary, low risk, ex-post framework with mechanisms to account for efficient changes in scope. On the other hand where the costs are highly predictable and recurrent, it may be feasible to introduce a more prescriptive, high risk, ex-ante framework which may create stronger incentives for efficiency and innovation.
- **C3: The ability of the regulator to define and assess efficiency –** will influence the degree to which the framework can create ex-ante or prescriptive incentives for cost efficiency. If the regulator cannot define efficient costs or outcomes (e.g. due to high project complexity or asymmetric information) then a more discretionary, low risk, ex-post framework with stronger customer engagement may be required. In broad terms cost-based regulation may be more appropriate. Even if efficient outcomes can be defined upfront, a low ability to estimate an efficient cost benchmark will limit the potential for incentive-based frameworks. The inability to define an efficient outcome and cost could result in arbitrary over- or under-reward for the company and encourage regulatory gaming and cost-overstatement by the promoter.
- **C4: The ability of customers to determine the outcomes and efficient costs –** of the scheme will directly determine the potential scope for customer engagement in the regulatory framework – for example in defining the outcomes of the project or business plan. Customers need to be well informed, have effective representation and their views need to be coherent for this to be effective. In some cases customers may lack the expertise to provide constructive input, or their interests may conflict with the promoter and other stakeholders such as future customers.
- **C5: The scale of cost and risk exposure –** for the promoter has implications for the extent of cost and risk sharing between customers and the promoter. There may be limits to the risk that can be imposed on the promoter. The scale of cost and risk exposure and how risk is shared is also closely related to the frequency of capital recovery (fast versus slow). Faster recovery (i.e. through resetting charges to reflect costs incurred) provides additional financial resources to the promoter which may be motivated if the promoter is exposed to a high level of risk.

These characteristics can be identified at the programme, sub-programme and project level.

Defining the regulatory framework

We have identified five broad types of regulatory framework based on the nature and intensity of the mechanisms applied within a range of examples. These types include:

Monitoring-based. Regulatory intervention applied with discretion based on formal or informal performance monitoring regimes (e.g. Regulation of airports in Australia and New Zealand based on annual monitoring reports).

Cost-based. Revenues directly linked to costs incurred (e.g. Thames Tideway Tunnel (TTT), Heathrow T5, Stansted new runway, Scottish electricity transmission, Lee Tunnel, and OFTOs (construction)).

Incentive-based. Target cost allowance based on forecasts with incentives for outperformance (e.g. Phoenix Gas, OFTOs (operation) Interconnectors, Scottish transmission) and Hinkley Point C.

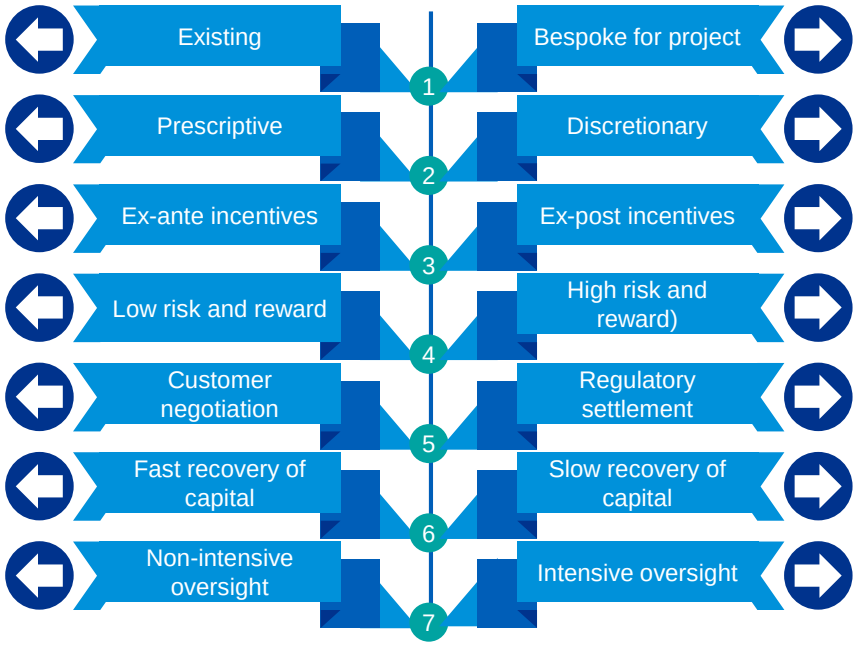
Outcome-based. Revenues linked to outcome targets set by regulator (e.g. NHS Payments by Results).

Competition for the market. Form of competitive process for the market (e.g. Channel Tunnel, TTT and OFTOs (operation bidding process, rail franchising, direct procurement in water sector)).

The scale and complexity of the airport expansion scheme means that it is unlikely that a single type of approach will provide an optimal solution and a blend of these types of framework may be more appropriate.

To develop the framework, it is necessary to consider the fundamental dimensions of the framework which are likely to be appropriate. To that end, we have identified seven regulatory framework dimensions that will help to guide the development of the framework and underlying mechanisms and methods.

Each dimension is defined on a scale between two points as shown below. The dimensions of a framework may vary over time and between different parts of the scheme or regulatory framework.

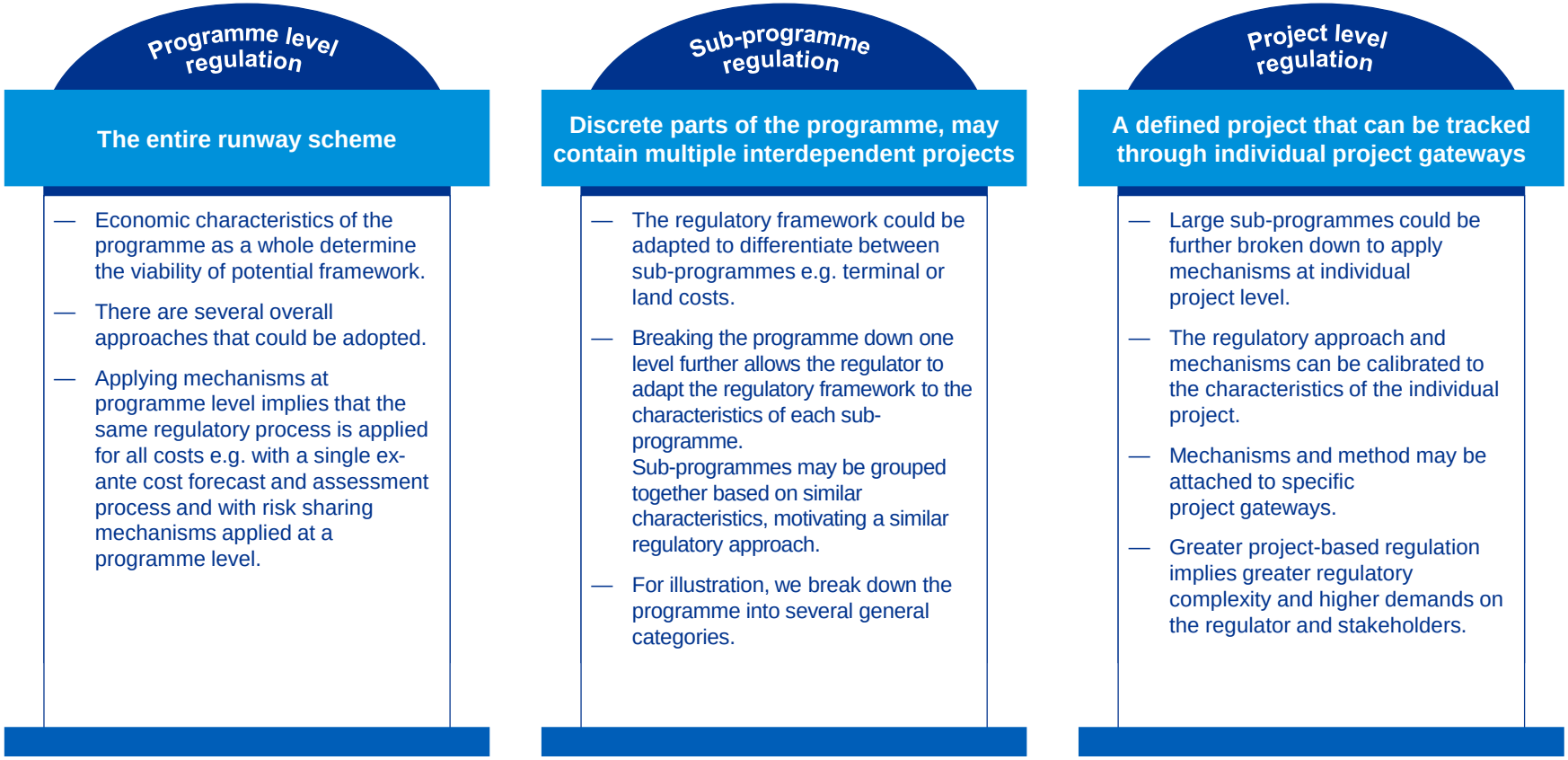


There are inter-linkages and overlaps between these dimensions, for example ex-ante incentives generally require a higher level of prescription over the treatment of costs, and there are also significant variations within each dimension.

Consideration of these dimensions and their linkages with scheme characteristics is helpful to identify the potential design of the regulatory framework.

Programme and sub-programme regulation

Regulatory mechanisms and methods can be applied at a programme, sub-programme, or project level with implications for the effectiveness and complexity of the overall regulatory framework.



General options for programme-based regulation are discussed in Section 5.2 and options for sub-programme/project based regulation are discussed in Section 5.3.

Programme and sub-programme regulation

Regulatory mechanisms and methods can be applied at different levels – to the overall costs of the programme, a sub-component or element of the programme, or a specifically defined individual project. Different regulatory frameworks apply different types of mechanism at different levels with greater or lesser focus on different levels. Most frameworks make a distinction between opex and capex for example, some make further distinctions between types of opex and capex such as – pension, staff costs, load related and non-load related capex, renewals and enhancements for example. Some frameworks also apply mechanisms at the specific project level. Some examples of regulatory frameworks and mechanisms applied at each level are shown in the table below.

Framework	Programme level	Sub-programme level	Project level
Monitoring-based Regulatory intervention applied with discretion	— Gatwick commitments framework — New Zealand airport monitoring framework — Crossrail – Project representative	— Heathrow – Independent Fund Surveyor	— Heathrow – Independent Fund Surveyor
Cost-based Revenues directly linked to costs incurred	— Heathrow – capex ex-post review and RAB adjustment	— Heathrow – treatment of pension costs	— Heathrow – Core and development capex mechanism
Incentive-based Target cost allowance for company based on forecasts	— Water and waste water – Totex allowance and incentives	— Heathrow – opex cost allowance and incentives — Ofgem – mechanisms for 'load related capex' — Heathrow – commercial revenue allowance and incentives — Network Rail – Route Efficiency Benefit (REBS) mechanism	— Ofgem – Interconnectors, cap and floor regime — Heathrow – risk sharing mechanisms for security and rates costs
Outcome-based Revenues linked to outcome targets set by regulator	— Water and waste water – Outcome Delivery Incentives	— Heathrow – bonus and penalty regime for service quality (SQR) — Water and waste water – Outcome Delivery Incentives	— Heathrow – capex triggers — NATS – London approach incentive — Water and waste water – Outcome Delivery Incentives
Competition for the market Form of competitive process for the market	— Channel tunnel – DBO competition — Rail franchise – Competitive bids	— Ofwat – Direct procurement for customers	— Ofwat – Direct procurement for customers

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Section 5.2 Programme focussed regulation

Programme focussed regulation

Most regulatory frameworks are focused on applying regulatory mechanisms and methods at the overall programme level, for example the existing regulatory framework for Heathrow sets an overall envelope for the total level of capital expenditure and applies the same regulatory processes to all sub-programmes and projects through the ex-post cost assessment process and RAB adjustment. There are project related triggers and core and development cost adjustments which relate to specific projects, but the framework as a whole could be characterised as being focussed on programme level regulation with similar treatments for all types of cost and activity.

A similar overarching framework is applied to Gatwick whereby the airport is required to constrain charges under a commitment-based price cap with a variety of service quality and spending commitments. In general there is no distinction between different sub-programmes or types of cost with the framework.

The main **advantage of programme-focussed regulation** is that it simplifies the regulatory process by reducing the number of mechanisms, methods and processes which need to be designed, managed and applied by the regulator and promoter. This is appropriate where the projects within a scheme are relatively simple and homogenous in terms of their economic characteristics.

The main **disadvantage of a programme-focussed regulation** is that where project economic characteristics are significantly different the framework will be constrained by the most challenging element generally resulting in reliance on cost based regulation and relatively weak efficiency incentives. In this case a regulator's options for introducing strong efficiency mechanisms may be limited because its ability to define and assess efficiency across the programme as a whole may be low. In contrast a sub-programme or project based approach would allow greater variation in regulatory mechanisms – at the cost of a more complex regulatory framework.

The new runway scheme consists of a wide variety of different projects with different economic characteristics which creates complexity for the CAA including the definition of outcomes and estimation of efficient costs.

Under the CAA's current regulatory framework there would be no major distinction in the regulatory treatment of terminal and runway related costs for example despite the differences in their economic characteristics. The CAA's ability to assess the efficient costs of the runway are likely to be much greater than the terminal for example and it is possible that these sub-programmes could benefit from different mechanisms.

Programme economic characteristics

Based on our understanding of airport expansion programmes as well as wider regulatory case studies, we have assessed the main characteristics of the expansion schemes at a generic programme level and compared these to BAU investment (for Heathrow). The table below summarises our assessment of programme economic characteristics and the implications of each for the design of the regulatory framework.

Characteristic	Assessment and implications
C1. Ability to separate project	**Low:** The scheme has inherent links with parts of the wider airport campus with a wide range of geographic and operational interfaces. The asset is also fully reliant on passenger charges for revenue. This means that it will be difficult to separate the new runway from the existing airport assets from an operational and regulatory perspective. Programme will need to be integrated into the overall existing framework and RAB but could adopt some bespoke mechanisms and methods to account for the size, scale and risk of the project.
C2. Ability of business to control costs	**Relatively low for many aspects of the scheme:** due to the range of uncontrollable risks and probability that the scope will evolve to take account of changing requirements and unforeseen factors. The scheme will also require several surface access projects which may be outside of the promoter's direct control. Regulatory protection for the promoter from uncontrollable risks may be required. It may be difficult to fully define the main risks ex-ante therefore there may be some need for ex-post assessment and/or prescriptive and discretionary risk sharing mechanisms within the framework.
C3. Regulator's ability to define and assess efficiency	**Relatively limited (particularly) ex-ante:** There are relatively few appropriate benchmarks to compare the overall costs of the scheme. Bottom up benchmarking may be more effective but fully defining efficient outcomes and costs will be challenging for many aspects. The Airports Commission (AC) analysis may provide a useful cost benchmark based on the promoters submission. Ex-post cost treatment of costs is likely to be most appropriate for the regulation of the scheme. There may be some scope to use the AC analysis and customer consultation to develop high level ex-ante cost benchmarks, but in general it is likely to be difficult for the CAA to fully define outcomes and set an efficient target cost.

Programme characteristics (cont.)

Characteristic	Assessment and implications
C4. Customers' ability to define and assess efficiency	**High, but need to account for future customers:** airlines input will continue to provide useful information on the efficient scope and design of the project, particularly for passenger focused elements such as the terminal design. Airlines views may not be as useful on some other aspects of the scheme and there is potential for conflicting views amongst current and future airlines. The scale and complexity of the scheme will mean that it will be difficult for airlines to be consulted on all aspects of scheme design. Airline consultation will continue to be important for passenger focused projects but may be less useful for other areas. The CAA may need to be more involved in the oversight of the project to ensure that the needs of future passengers and airlines are represented.
C5. Scale of cost and risk exposure	**High relative to BAU but not unprecedented** for a major UK infrastructure project. Some parts of the project such as the terminal, transit and surface access projects are likely to be subject to a relatively high levels of risk and scope change which may require specific regulatory focus and the application of risk sharing or error correction mechanisms. Cost escalation could create financing challenges for the promoter which will need to be taken into account when considering the promoters exposure to risk. Promoter risk exposure should be limited to account for uncontrollable risks and potential changes in scope. The framework may require relatively intensive regulatory oversight.

Regulatory framework dimensions

Based on our assessment of the programme level economic characteristics, the table below provides an analysis of the desirable dimensions for the regulatory framework at an overall programme level.

Dimension	Assessment and implications for the regulatory framework
D1: Existing versus Bespoke	**Semi-bespoke:** The difficulty in separating the project from the existing asset and single revenue stream means that a fully bespoke regulatory framework may not be feasible and the scheme will need to be linked with the existing RAB. The differences between the characteristics of the scheme and 'business as usual' projects means that some kind of separate regulatory treatment or focus may be justified.
D2: Discretionary versus Prescriptive	**Mainly discretionary:** The project is subject to a large number of risks which may be difficult to fully identify and control for in regulatory forecasts. The ability of the CAA to set accurate cost forecasts and project outcomes may also be limited due to lack of benchmarks, the variety of projects and general information asymmetry. This implies that a level of discretion will be required within the framework. A prescriptive approach would only be appropriate if the CAA could define the various exogenous factors for each element of the project and/or passengers can be protected from the impact of those risks. This is likely to be quite challenging at the programme level.
D3: Ex-ante versus Ex-post	**Limited role for ex-ante financial incentives:** It will be difficult for the CAA to define efficient scope or set an efficient forecast for project capex given the current plans and the potential for changes in scope and exogenous factors (and the limited number of comparators for a project of this size and type). This suggests a framework based on ex-post treatment of costs to create efficiency incentives, and minimise cost overstatement and arbitrary over or under reward of the promoter. Given the scale of the project and the ex-post burden of proof this would place on the regulator, the role for ex-ante cost treatment should still be explored, even if it is limited. For instance the AC process and customer negotiation could be useful in establishing an ex-ante benchmark, which may be combined with low levels of risk sharing or an ex-post review for costs over a certain threshold. It may also be possible to isolate some parts of the scheme for different treatment.
D4: Low versus high risk and reward	**Low-medium:** There are likely to be numerous risks and uncertainties for the scheme which are beyond the direct control of the promoter. Uncontrollable cost risks in addition to the lack of available benchmarks and difficulty in defining efficient scope means that the CAA may not be able to set an overall efficient cost forecast ex-ante with a high level of confidence. Ex-post it may be difficult for the CAA to distinguish between inefficient cost increases and those due to change in scope for some parts of the project. These factors imply a low risk framework with a high level of ex-ante or ex-post sharing of risk between the promoter and customers.

Regulatory framework dimensions (cont.)

Dimension	Assessment and implications for the regulatory framework
D5: Customer negotiation versus Regulatory settlement	**Moderate to high levels of customer engagement:** Airlines views on the outcomes and scope of the scheme will continue to be important – particularly for passenger focused elements of the scheme. Current and future airlines' requirements and preferences over cost and scope options may not be well aligned and should be accounted for. This could weaken the effectiveness of customer negotiation and would imply a greater need for CAA involvement in the oversight of the scheme to represent the needs of future passengers and airlines. The scale of the scheme costs, and the wide range of the activities being undertaken could also mean that current airlines may lack the resources to provide effective input and oversight across all aspects of the scheme.
D6: Slow versus Fast recovery of capital	**Slow-medium:** The scale and uncertainty of costs may lead to financeability issues if capital is recovered slowly without any additional upfront funding. This could motivate a more rapid recovery of costs for example through sculpted depreciation, frequent RAB adjustments or increasing the 'pay go' ratio. A more regular cost assessment and pass through process would also increase the speed of cost recovery. Under a BAU approach unanticipated efficient spending would enter the RAB every five years. Given the scale of the project and greater potential for cost escalation it may be beneficial to accelerate this process if efficient cost escalation becomes significant and causes financeability problems.
D7: Low versus High intensity of oversight	**Medium-high:** The scale of the project, ability of the airlines to provide scrutiny and potential for conflicting interests between current and future airline and passenger groups means that the CAA may be required to take a greater oversight or mediating role in the framework. Cost assessment and project oversight mechanisms may also need to be more intensive to reflect the scale of the scheme and the need to strengthen ex-poste efficiency incentives.

Regulatory options to consider

The characteristics of the programme limit the viability of some of the potential regulatory framework options. The monitoring, outcome and competition-based frameworks are not likely to be appropriate for several reasons.

Framework constraints

Monitoring-based. This framework is not likely to be appropriate for the overall regulation of the scheme as the scale of the project costs are high, the market power of the promoter will be significant and the promoter and airlines are likely to desire a high level of regulatory certainty over the scope of the project and regulatory treatment of costs in advance. The incentive effects of this framework are not likely to be sufficient for a scheme of this scale and complexity.

Outcome-based. The outcomes of the scheme are highly complex, difficult to fully define and likely to be subject to ongoing change. It will be difficult for the CAA to fully define outcomes with a high degree of confidence or to place value on achievement of those outcomes. It may be possible to choose some specific metrics such as passenger capacity and service quality for targeted incentivisation but these metrics are unlikely to be sufficient to cover all aspects of the project.

Competition-based. This approach for wholesale elements of the project would require a fully bespoke framework which is not appropriate given the low ability to separate the project from existing airport operations. Any third party undertaking the design or construction of the airport would be dependent on the same revenue stream to recover costs, whilst having no responsibility for the wider operations of the airport.

The potential for ongoing changes in scope also reduce the feasibility of a competition-based approach. The regulatory framework would be complicated due to the interactions between the promoter, airlines, CAA and third-parties.

Framework options

The characteristics of the programme as a whole suggest that the most appropriate option for the regulatory framework is likely to involve a semi-bespoke approach that is broadly discretionary with a limited role for ex-ante cost treatment and a low to medium level of risk borne by the promoter. There may be greater need for CAA oversight of customer negotiation and a need for greater intensity of cost scrutiny and project management. This implies a framework that is broadly cost-based. It may also be possible to develop an incentive based framework – although this is likely to be more challenging.

Cost-based regulation could be applied through the development of the CAA's existing approach for capex regulation at Heathrow. This would probably require altering the structure of the Constructive Engagement process and greater oversight of project activities and costs by the CAA. Ex-ante and ex-post cost assessment would also need to be more intensive and regular to create effective incentives for efficiency.

Incentive-based regulation could be applied based on developing an overall target price for the scheme with some level of risk and reward sharing mechanisms to manage outperformance and exogenous factors.

This would require the CAA to estimate an efficient target cost for the scheme with associated outcomes which may be difficult. Scheme uncertainties and potential for changes in scope would need to be managed and mean that risk exposure would also need to be limited (this framework would be similar to Gatwick's commitment proposal).

A key issue under an incentive-based approach is the overall exposure to risk and reward for the promoter. The high level of risks and uncertainty in the project mean that the CAA will need to incorporate risk sharing and/or error correction mechanisms into the overall framework to manage the overall risks of the project. Under either framework relatively intensive regulatory oversight will be required, with processes aligned with the approach to cost assessment.

Options for programme-based regulation

There are two main regulatory frameworks which could be applied to the runway expansion scheme at the programme level. The main features and requirements of these frameworks are summarised below.

Framework 1: *Cost-based* – Low risk and reward, ex-post, discretionary framework with high level of customer engagement and regulatory oversight

- Based on CAA's existing regulatory framework, mechanisms and cost assessment methods. Efficiency is driven by customer and regulatory control and monitoring and ex-post financial incentives.
- Greater intensity and scope of existing CAA mechanisms required, in particular the level of scrutiny applied during ex-ante and ex-post review.
- Framework relies upon credible threat of ex-post efficiency assessment and discretionary treatment of RAB. This requires CAA to undertake detailed ex-post cost assessment and develop evidence that costs are not efficient.
- Ex-post cost assessment occurs at multiple points during the programme.
- Requirement for more intensive cost assessment processes to reflect scale of costs and risks for passengers, based primarily on intensive expert review.
- Greater involvement by the CAA in the capex governance process and more explicit consideration of the needs of future passengers and airlines (to balance the interests of current users).
- Greater intensity and scope of IFS monitoring for example to ensure that costs are being efficiently incurred and to actively highlight risks.
- Intensive customer engagement during specification stage to define efficient scope of the project and target key elements of the project.

Framework 2: *Incentive-based* – Medium – high risk and reward, ex-ante, prescriptive, with limited regulatory oversight and extensive risk sharing mechanisms

- Alternative regulatory framework based on setting overall target cost for scheme with range of incentives and risk sharing mechanisms to drive efficiency. Efficiency is driven by ex-ante financial incentives.
- Requires customer engagement with airlines and CAA to define efficient scope of project.
- Intensive ex-ante review of cost forecasts and clear definition of outcomes of project scope. Mixture of expert review, top-down benchmarking and other evidence for cost assessment and target cost estimate.
- Detailed risk register for project and development of explicit prescriptive treatment of potential risks, notified items and criteria for potential for re-opener.
- Definition of criteria and principles for material changes in circumstances.
- Additional risk sharing mechanisms, capping the risk borne by the promoter. For instance by setting a cap and collar mechanism with different levels of risk bearing and a boundary above which costs are subject to ex-post review.
- Mechanisms to monitor and ensure the financial viability of the promoter to prevent project failure impacting on existing operations.
- Some scope for monitoring mechanisms to reflect level of passenger risk exposure.

Framework 1: Cost-based approach

A cost-based framework could be developed based on the CAA's existing regulatory framework for Heathrow. The main feature of this approach is the need to create efficiency incentives through the ex-post review of costs and direct monitoring of the promoter's activities to inform an ex-post discretionary treatment of spending linked to the RAB. This will require an intensive cost assessment process drawing on a range of methods. The frequency of the ex-post review may also need to be increased to reduce the burden of proof at the end of the regulatory period. If serious under or overspend is identified, the CAA may need to take discretionary measures such as re-opening the control and commissioning an independent review to determine the appropriate treatment of costs.

The relatively weak incentives for efficiency under this approach also means that there is more need for the CAA to provide oversight of the promoter's approach to project management, delivery and procurement and to ensure that customers views are accounted for. There could be an upfront review of programme governance and reporting leading to an enhanced role for the IFS. This mechanism is key to providing a strong evidence trail for the ex-post review and treatment of costs. The CAA could also undertake an upfront review of the procurement strategy, with focused or triggered reviews linked to particular projects (e.g. where a project is sole sourced).

Output incentives may be applied to major individual projects within the programme, aligned with the project review process. Outputs could include 'project triggers' associated with delivery to a timescale for example. Customer negotiation will be intensive at the specification stage, but limited during construction with CAA oversight due to concerns over the role of the current customers in embodying the interests of future customers.

Framework mechanisms	Start of programme	Programme: Delivery of new airport capacity		End of programme
Financial Incentives	Selection and calibration of output incentives	Output incentives applied to major individual projects including project triggers Slow recovery of capital linked to RAB through charges		Output review and incentives
Regulatory Approval		Ex-post approval and RAB update 1	Ex-post approval and RAB update 2	Ex-post approval and RAB update 3
Competition	Review of procurement strategy	Updates on any major changes in strategy provided to the CAA. Intensive IFS monitoring of projects with fewer than 2 bidders		
Customer Bargaining	Specification and output consultation	Customer consultation on scope changes		Output review
External Review	Review of governance and reporting	Enhanced IFS, intensive monitoring and oversight of high risk projects		
Control Mechanisms	Calibration of project review process	Projects within the programme progress through a gateway process to assign output triggers and provide discrete points for CAA and customer consultation.		
Cost assessment	Ex-ante cost assessment	Ex-post review 1	Ex-post review 2	Ex-post review 3

Framework 1: Pros and cons

Pros

- Framework can be developed from the CAA's existing approach for Heathrow and previous major projects such as T5 and T2. This means that the CAA and stakeholder are familiar with the approach and the mechanisms and methods which could be applied.
- This framework could be developed and adopted for the new runway scheme, for example increasing the intensity and/or frequency of the cost assessment process to cover elements of the scheme in more detail, or by enhancing the intensity and scope of monitoring by the IFS. As already applied this approach is well understood by stakeholders, notably airline customers.
- The cost based framework could also be developed to intensify regulatory monitoring of the promoters activities and process – for example undertaking greater regulatory scrutiny of the promoters procurement and management processes.
- The cost based framework enables a high level of flexibility to alter the scope of projects and cope with uncertainty and risk through the discretionary ex-post treatment of costs and risks. It also reduces the need to identify and set treatments for all potential risks in advance. This significantly reduces the burden on the regulator and business to explicitly identify risks and uncertainties make decisions and set forecasts.
- The cost based framework also removes incentives for cost overstatement and under delivery and reduces the need to develop binding cost estimates at an early phase of the project which may be difficult due to the characteristics of the project and potential for changes in scope.
- The promoter is implicitly given some scope to incur efficient cost overruns. This may help to supports the financeability of the project and reduces the potential for financial distress, especially in the case of significant cost risk.

Cons

- The strength of the efficiency incentives under the cost based framework is arguably weak (economic theory suggests that cost-based regulation tends to create incentives for greater capital intensity in the industry for example) as the promoter has a weak budget constraint for the overall project.
- Also as the promoters financial returns are directly linked to costs incurred there is limited incentive for the promoter to innovate in the design and specification of projects – which might reduce the scope for investment.
- Customers are protected from cost risk only to the extent that the ex-post review can identify cost inefficiency. The framework places a burden of proof on the CAA to demonstrate that a given level of cost is inefficient which may be difficult in many cases due to the absence of benchmarks and information asymmetry.
- The strength of efficiency incentives depend upon the effectiveness of the process for the ex-post review of costs, which may be limited even where it is intensified to cope with the greater scale and scope of the project. The use of the AC cost estimates in assessing ex-post efficiency may also be limited by changes in scope and other external factors during project delivery.
- Given the potential difficulties associated with assessing ex-post efficiency the framework would requires the CAA to be more pro-active in monitoring costs and the promoters behaviour in order to create a strong evidence trail for review at the cost assessment stage.
- The lack of upfront certainty on cost recovery may also increase financing risks and cost. This could be significant given the scale of the project despite increased frequency of any ex-post review process to ensure that any inefficient costs are correctly identified in a timely manner and so that the promoter has certainty over cost treatment.
- The CAA may also be required to take on a greater role in defining the project outcomes and to represent the views of passengers and future airlines e.g. in the design process.

Framework 2: Incentive-based

An incentive-based framework could also be developed – this would represent a departure from the CAA's exiting approach. Under this framework the promoter is required to produce an overall ex-ante cost estimate associated with defined project outcomes and identify a set of factors used to calculate the cost with an explanation of the estimation process, cost drivers and project risks. The CAA could assess this cost estimate through a range of analysis including reconciliation with the AC forecasts, benchmarking and expert review to set an efficient cost target for the promoter against which it will be incentivised using a variety of mechanisms. The cost review must be effective enough to deter and detect cost overstatement. Outcomes will also need to be specified to ensure that the promoter does not under deliver. The level of risk exposure under the incentive framework could range from 0 to 100% of under or out performance with various refinements such as cap and collar limits, dead bands and asymmetric risk profiles.

Under this framework risks that are not defined and assessed ex-ante are implicitly borne by the promoter. The identification and treatment of key risks is therefore an important part of this framework. Any deviation from key assumptions in the CAA's cost forecast (e.g. regarding land and community costs) could be taken into account through an adjustment to the target cost. This could be achieved through the identification of 'notified items' of uncertainty based on a risk assessment undertaken jointly by the promoter and the CAA. The CAA would then set out a prescriptive treatment of these items.

The CAA could also set out principles for discretionary adjustments to the target price for major uncontrollable risks. As the promoter will be strongly incentivised against an efficient cost, there may be less need for the CAA to undertake an upfront review of the promoter's project management procurement strategy. Output incentives may be applied to individual major projects within the programme-based on consultation with customers and aligned with the project review process. Customers are consulted notably on output and scope changes as well as at discrete points during the programme to limit the potential for changes in project scope.

Framework mechanisms	Start of programme	Programme: Delivery of new airport capacity	End of programme
Financial Incentives	Identification of output incentives	Output incentives applied to major individual projects (e.g. time of delivery) Slow capital recovery based on RAB WACC value linked to target cost	Output review and incentives
Regulatory Approval	Agreement of notified items based on risk assessment	Ex-ante target cost approval Monitoring and approval of notified items with changes to target cost	
Competition		No review of procurement or governance processes as promoter has full risk exposure	
Customer Bargaining	Output consultation	Limited scope for ongoing changes in project scope	Output review
External Review	Risk assessment	No IFS or governance oversight as promoter has full risk exposure	
Control Mechanisms	Calibration of project review process	Projects within the programme progress through a gateway process to assign output triggers and provide discrete points for CAA and customer consultation.	
Cost assessment	Highly intensive ex-ante cost assessment process		

Framework 2: Pros and cons

Pros

- The main advantage of the incentive framework is the creation of strong efficiency incentives for the promoter through setting a hard budget constraint with exposure to risk and reward.
- This limits the risk of cost escalation for passengers and creates incentives for cost reduction and innovation in the promoter to deliver project outcomes. The promoter has exposure to all unidentified risks.
- The framework also reduces the need for the regulator to undertake ongoing monitoring and review of the promoters activities and behaviour as the promoter is strongly incentivised against the target cost. For example IFS monitoring and ex-post review of costs would not generally be required under this framework.
- Incentives and risk sharing mechanisms can be applied in different ways through the use of caps and collars, dead bands, and thresholds which can enable a layered approach to incentives and risk, taking account of the characteristics of the scheme including the promoter's ability to control costs and the CAA's confidence in the target cost estimate. This would enable the CAA to tailor the risk profile of the scheme to a suitable level.
- The framework is akin to the approaches adopted in other sectors such as for the Thames Tideway Tunnel and for water, gas and energy companies where there is generally a higher degree of risk exposure for capital projects reflecting the greater ability of the regulator to assess costs in these sectors (due to the greater availability of benchmarks and more repeatable nature of costs).
- The application of this framework would requires an intensive ex-ante assessment process to ensure that cost estimates are set at an efficient level and the scope of the project defined. Once this is achieved the intensity of regulatory activities would be quite limited as the promoter is strongly incentivised to achieve efficiency against the target cost.

Cons

- It may be difficult to fully define the scope of the project in advance, or to estimate an efficient cost forecast with a high level of confidence, particularly for elements such as the terminal, equipment, plant and surface access where changes in scope are likely and the project costs are subject to major risks or third party influence. The size and complexity of the project will require an intensive cost assessment process at the outset of the scheme.
- The framework will also need to incorporate 'error correction' and scope change mechanisms to account for risks and uncertainties which might change the target cost.
- It would also be necessary to define what outcomes or outputs are to be delivered by the promoter including for example the specification of the terminal building: Size, capacity, level of quality, quantity of desks, security lanes, seating etc. If such outcomes are not defined it is possible that the promoter may reduce the scope of projects and undermine the benefits of the scheme for passengers to enhance its financial returns. The implications of failure to deliver the agreed scope will also need to be defined.
- The need to define scope upfront will limit the flexibility to alter scope during delivery to some extent, although efficient changes could be taken into account through a change control mechanism such as the existing core and development process supported with additional cost assessment processes to ensure efficiency.
- This framework will create incentives for the promoter to overstate its cost forecasts to maximise its own financial returns, it is important for the CAA to be able to scrutinise cost estimate in advance. The complexity of the project and lack of benchmarks means that it may generally be difficult for the CAA to assess efficient costs ex-ante with a high degree of confidence.
- A high level of risk bearing by the promoter may also lead to financeability issues and increases the risk of financial distress e.g. due to a capex overrun. There may be limits to the level of risk that the promoter or regulator are able to bear and significant cost escalation could affect the viability of the project.

Assessment of programme level approaches

Each of these frameworks has different pros and cons related to the trade-off between creating stronger efficiency incentives against the risk of information asymmetry, cost overstatement and the potential for exposing the promoter and passengers to excessive risk/reward.

Framework 1. Cost-based

Advantages

- Well understood by stakeholders
- Framework can be developed based on existing mechanisms
- Enables high level of flexibility to alter scope of project and cope with uncertainty and risk
- Avoids requirement to identify and set treatments for all potential risks in advance
- Reduces incentives for cost overstatement or under delivery of outputs
- Likely to reduces potential financeability difficulties
- Promoter could be subject to on-going monitoring to create strong efficiency incentives
- Airlines and customers can retain involvement in scheme design

Disadvantages

- Weak incentives for efficiency for promoter
- Passengers implicitly exposed to risks and 'efficient' cost escalation
- High burden of proof for CAA to identify inefficiency ex-post
- Requires oversight of procurement, project management and other processes to drive efficiency
- CAA may be required to take on greater role in defining project outcomes and representing passenger interest throughout the project
- Revenues linked to costs blunts incentives for innovation and focus on outputs

Framework 2. Incentive based

Advantages

- Potential for stronger efficiency incentives for promoter
- Flexibility to design incentive and risk sharing mechanisms to match profile of the scheme through cap & collar dead bands etc.
- Passengers exposure to cost escalation is limited to target cost estimate and identified risks
- Once framework is established, regulatory monitoring can be limited due to financial incentives on promoter
- Reduces burden of proof for the regulator to identify efficiency
- Target cost could be linked with AC cost estimates as a benchmark

Disadvantages

- New framework will create new workload and activities for regulator – ex-ante efficiency assessment will be critical to effectiveness of the framework
- Stakeholders likely to be less familiar and comfortable with approach
- Requires CAA to estimate efficient costs and outcomes in advance, which may be challenging
- Need to identify risks and uncertainties and define regulatory treatment
- More difficult to alter scope of project after forecasts set
- Creates incentives for cost overstatement and under delivery of scope
- Increases potential financeability risks, may not be credible for the CAA to allow promoter to fail

Assessment of programme level approaches

In summary there are a range of potential regulatory frameworks that could be applied to the new runway scheme at a programme level. Of these the most viable options are likely to be based on either cost or incentive regulation. Within each of these frameworks there is a wide variety of permutations based on the application of different regulator mechanisms and methods.

Each of these frameworks has pros and cons. The cost-based framework we have described is similar to the CAA's existing approach for Heathrow. It is therefore highly familiar to stakeholders and has been successfully applied to previous major airport projects. The cost-based framework has the advantage of providing the CAA with discretion to deal with uncertainty, risk and changes in scope whilst also controlling profits and removing incentive for the promoter to overstate cost forecasts.

The cost-based framework arguably creates weak incentives for efficiency in terms of both costs and innovation. It also places a higher burden of proof on the CAA to identify inefficiency by the promoter ex-post, which in turn requires intensive monitoring of the promoters activities.

The incentive-based framework may create stronger incentives for both cost and innovation efficiency, but also creates incentives for cost overstatement that may be difficult to overcome without significant investment in cost assessment processes. Under this framework the CAA will need to undertake more intensive ex-ante cost assessment to identify an efficient target cost for the scheme.

The incentive-based framework also requires a more comprehensive identification of outcomes, risk and uncertainties, and the design of prescriptive risk treatments for these issues. Under this framework there is a risk that the promoter could achieve either higher profits or losses relative to the target cost due to regulatory error and uncertainty in setting the target cost and outcome specification.

This risk could be mitigated to some extent through the use of 'layered incentives' based on the use of different thresholds, dead-bands, caps and collars to manage the level of risk exposure for the promoter and passengers.

The choice between the cost and incentive based framework is therefore largely driven by an assessment of the relative importance of three issues:

— The ability of the CAA to set an efficient target cost and outcome specification for the scheme with a high level of confidence taking account of potential changes in scope, risk and uncertainty to set an efficient cost target for the scheme and mitigate potential for cost overstatement or under delivery.

— The CAA's ability to strengthen its ex-post assessment of costs through more extensive engagement and oversight of the promoters activities throughout the duration of the scheme with periodic review to identify cost inefficiencies.

— The relative weakness of efficiency incentives under the cost-based framework relative to the incentive based approach.

The complexity of the new runway scheme and range of risks mean that it may be difficult for the CAA to set an efficient cost target for the scheme and overcome the incentive for the promoter to overstate its costs. To do so the CAA is likely to need to invest significant resources in developing its ability to undertake cost assessment and identify risks.

For this reason we consider that at a programme level a cost-based framework based on the development of the CAA existing framework is likely to be the most viable approach for the regulation of the scheme. An incentive based approach with a low level of risk and reward exposure for the promoter and a wide range of risk sharing and uncertainty mechanisms may be possible but is likely to present a range of challenges for the CAA and stakeholders.

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Section 5.3 Sub-programme and project focussed regulation

Sub-programme/project focussed regulation

In general, a programme focused approach may not be the optimal framework for the regulation of new runway capacity. The diverse nature of the individual projects within the airport programme, level of risks and uncertainty, and likely difficulty in estimating an efficient target cost at the outset mean that it will be difficult to apply one set of mechanisms to the whole scheme without either weakening incentives or creating risks for the promoter and customers. Segmentation of the framework to focus on sub-programme or project based mechanisms may therefore be beneficial.

The new runway scheme can be segmented into several sub-programmes. Each of these elements have different costs, timescales and project characteristics which may motivate a different regulatory approach. Based on the AC cost analysis, there are at least eight major sub-programmes within the overall scheme and a much larger number of individual projects. Some of these represent major projects in their own right.

By adopting a framework with greater focus on the application of regulatory mechanisms and methods at the sub-programme or project level the CAA may be able to apply more targeted efficiency incentive mechanisms and assessment methods where the risks are less significant and efficient costs easier to assess due to the economic characteristics of the projects.

The CAA could tailor the regulatory framework to apply specific efficiency mechanisms and methods to specific sub-programmes or projects. In the same way that there are separate mechanisms for opex and capex, different approaches could be used for particular cost types of identified projects.

To some extent a project-based approach is already applied through the application of project triggers and the core and development capex process which effectively operates at the project level. The CAA could extend this approach by broadening the types of mechanisms applied at this level to include variations in financial incentives and cost assessment processes for example.

Other regulatory frameworks such as Ofgem (RIIO – T1/GD1) also make a distinction between different types of capex expenditure including load related, non-load related and non-operational which are each linked with different regulatory mechanisms and cost assessment processes reflecting the characteristics of the underlying projects.

This approach to economic regulation would require the CAA to identify specific cost types and activities for different treatment and would tend to require a greater number of regulatory processes which would need to be designed and managed by the CAA. This will generally increase the complexity of the regulatory framework.

A sub-programme approach will also increase the importance of cost allocation processes as different treatments of different types of expenditure may create incentives for the promoter to manipulate cost allocation to maximise financial returns.

Under a sub-programme based framework, the CAA would need to consider what the most appropriate breakdown of sub-programmes and projects would be. This is a key task for the design of the regulatory framework.

There is a balance between developing a more refined regulatory framework through greater segmentation of costs into individual regulatory groupings, and an increasing regulatory burden associated with managing different mechanisms and processes.

At one extreme the CAA could adopt different mechanisms for every sub-programme, at the other a grouping of sub-programmes into two or three regulatory categories could provide a suitable balance between targeted incentivisation and regulatory burden.

Airport expansion sub-programmes

Sub-programmes within the airport capacity programme

As an illustration of the sub-programme approach we break the overall scheme down into eight sub-programmes based on the categories provided by the AC. We have also considered further breakdowns into specific projects. Alternative breakdowns could be considered based on the promoters detailed project plan. An overview of the main sub-programmes defined by the AC is shown below.

The **specification** stage will directly inform the design and required outcomes of the scheme and structure of the regulatory framework. This will require consultation between the promoter airlines and the CAA.

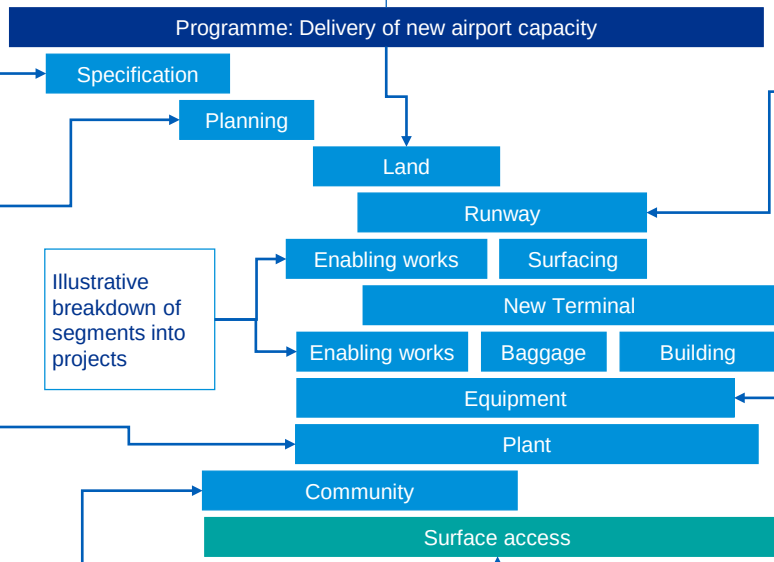
The **planning** stage will be critical for securing planning permission, setting an overall design for the project, and ensuring that impacts on wider stakeholders are identified, minimised and mitigated.

This stage includes developing the planning documentation and engaging with the Planning Inspectorate to secure planning permission through a Development Consent Order.

Plant costs include building plant such as air conditioning, power and utilities generation and distribution equipment.

Community costs include wider community impact compensation and mitigation costs for noise and environmental impacts, including for example work relating to archaeology, ecology, architectural heritage, compensation, blight and Section 106 costs.

Land costs will involve the compulsory purchase of land from third parties around the airport site including commercial businesses and residential properties and the provision of removed facilities. As such these costs will not be incurred as a project, but through the legal process associated with the purchase and compensation. This also includes the provision of serviced plots for third party development.



The new **runway**, including landing systems and new taxiways and aprons and their associated systems.

The **Terminal** including passenger terminal buildings, piers and satellites, passenger transit systems and car parks.

Equipment costs will include a wide range of different items such as baggage, transport, de-icing etc. It also includes other facilities such as the control tower, rescue and firefighting, fencing and airside roads.

Surface access costs include the costs associated with wider surface access projects such as changes to road alignment or supporting rail projects required as a direct part of the scheme.

Characteristics by sub-programme

Assessment of sub-programme characteristics

Each sub-programme has different economic characteristics which could motivate a different range of mechanisms and cost assessment methods.

For example, it may be difficult for the promoter to estimate the costs of the terminal sub-programme, and also for the regulator to define and assess efficient outcomes. This suggests that a cost-based framework may be most appropriate.

Conversely, the runway sub-programme costs are likely to be more predictable and easier to define and assess for the regulator, which suggests that incentive-based regulation may be more effective. There are also significant differences in the importance of these two sub-programmes to customers in determining service quality which might influence the role of customers in defining outcomes and setting efficient costs. This suggests that different parts of the project could be subject to different regulatory frameworks, mechanisms and cost assessment methods.

Some sub-programmes have special characteristics which make them particularly important for the overall outcomes and efficiency of the scheme or mean that they require different treatment. The specification sub-programme for example is key to ensuring that design and outcomes of the project are optimal though the actual costs incurred in this stage are relatively low. This stage will require intensive consultation and engagement between airlines, the promoter and the CAA as a representative of future customers. Similarly the planning sub-programme could result in significant changes to the design of the scheme to ensure the mitigation of externalities. Land, community and surface access sub-programmes will also be influenced by wider issues such as negotiations with third parties and legal decisions which may mean that the treatment of these costs needs to be considered.

Illustrative grouping of sub-programmes

We have assessed the characteristics of each sub-programme contained in the AC commission cost breakdown and drawn out the implications for the design of its potential regulatory framework in a sub-programme approach. Based on this assessment, the table on the next slide provides an illustrative regulatory grouping of sub-programmes based on their project economic characteristics.

For clarity these groupings are intended to illustrate the mechanisms, methods and approaches which could be adopted by the CAA. In developing the framework the CAA is likely to have a wider range of considerations including resource constraints and new information from the promoter which could mean that a different number of sub-programme frameworks could be adopted.

We have chosen to develop six sub-programme groups which we consider provides balance between providing a high degree of differentiation to the mechanisms and methods applied to each sub-programme, whilst preventing the framework becoming overly complex. This provides an illustration of the sub-programme approach based on the information submitted to the AC.

For each sub-programme we have then developed an illustration of the potential regulatory framework which could be applied based on the identification of key issues and the range of mechanisms and methods that could be applied. The CAA could consider alternative groupings based on a more detailed analysis and information of the scheme costs and projects.

Characteristics by sub-programme (cont.)

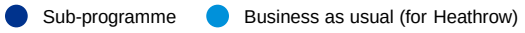
Project characteristics	Specification	Planning	Terminal	Plant	R'way	Equip	Land	Community	S. Access
C1. Ability to separate costs	High	High	Low	Med	Med	Med	Med	Med	High
C2. Ability to control costs	High	High	Low	Med	High	Med	Low	Low	Low
C3. Regulators ability to define and assess efficiency	Med	Med	Low	Med	Med	Med	Med	Low	Low
C4. Customers' ability to define and assess efficiency	High	Low	High	Med	Low	Med	Low	Low	Low
C5. Scale of cost and customer risk exposure	Low	Low	High	Low	Low	Med	Med	Low	High
Grouping of sub-programmes within the regulatory approach.	Separate as key to project definition and costs	Separate as precedes other projects and key stage for scheme finalisation	Separate as large scale with specific characteristics and customer focus	Grouped as high-medium ability to control costs and for the regulator to assess efficiency, scale does not justify separate cost treatment for each sub-programme. High overlap between sub-programmes			Grouped as low ability to control costs (driven by legal/policy process) and medium-low ability for the regulator to assess efficiency. Scale does not justify separate treatment for each sub-programme		Separate as large scale with specific characteristics, major third party influence
Framework implications	High intensity customer engagement	Cost-based discretionary, ex-post, low risk approach	Cost-based discretionary cost treatment, ex-post, low risk approach with customer engagement	Incentive based, prescriptive ex-ante treatment of costs with high risk and limited customer engagement. Need for range of risk sharing and error correction mechanisms			Cost-based, discretionary ex-post treatment of costs with low risk. High intensity oversight of promoter's activities to encourage efficiency		Cost-based, discretionary, ex-post treatment of costs and high level of oversight

Within each grouping of the regulatory sub-programmes, different cost efficiency mechanisms and cost assessment methods could be applied based on the project economic characteristics reflecting the scope for error, potential for inefficiency and cost overstatement. The approach to cost assessment will vary across each sub-programme as required. Activities such as regulatory scrutiny of cost estimates and expert review will generally be applied across the programme with varying levels of intensity. In the following slides we illustrate the specific mechanisms and methods that could be applied to each based on the economic characteristics and wider activities undertaken within each.

Specification sub-programme framework

The **specification stage** of the scheme will involve the refinement of the scheme design submitted to the AC into a final design through design work and consultation with customers. This will then be taken forward for the development of the National Policy Statement and the Development Consent Order. The specification stage will be key for identifying the optimal design of the scheme for both existing and future customers and will therefore have major impacts on the costs and outcomes of the scheme, although the costs associated with this stage will be relatively low. The characteristics of the sub-programme and implications for the framework are shown below.

Characteristic		Dimensions of regulatory approach		
C1. Ability to separate project	High	Existing		Bespoke for project
C2. Ability to control costs	High	Prescriptive		Discretionary
C3. Regulator's ability to define and assess efficiency	Med	Ex-ante		Ex-post
C4. Customers' ability to define and assess efficiency	High	Low risk/reward		High risk/reward
C5. Scale of cost and risk exposure	Low	Customer negotiation		Regulatory settlement
		Slow recovery of capital		Fast recovery of capital
		Non-intensive oversight		Intensive oversight



The key features of this sub-programme are the need for intensive engagement between the promoter, CAA and airlines over the required outputs, design and costs of the final scheme to take forward through the planning process.

The relatively low level of cost involved and the potential to identify major cost savings and the most appropriate cost/quality trade-off mean that a cost-based framework is likely to be most appropriate for this framework. This could mean for example treating specification costs as part of the wider planning process and treatment under the CAA's policy for 'category B' costs.

Specification sub-programme mechanisms

The specification sub-programme will require the CAA to develop a framework to facilitate engagement between the promoter, airlines and other stakeholders to identify an efficient specification for the scheme.

This will include outcomes the promoter is required to achieve, a target cost for those outcomes, identification of risks and an appropriate breakdown of the scheme into sub-programmes and projects for the application of direct regulatory mechanisms.

The objectives of this process include the identification of cost savings and appropriate trade-offs between cost and quality factors. The process will identify the structure for the sub-programme regulatory framework by highlighting aspects of the scheme which can be directly targeted with specific incentive and risk sharing mechanisms. It will also set an overall cost envelope for the scheme which could be used to set an overall budget constraint with associated risk sharing mechanisms.

The framework for this sub-programme should build upon the CAA's existing Customer Engagement process for the development of the capex programme.

Mechanisms and methods

— The main mechanism for this sub-programme will be a process of Constructive Engagement between the promoter, airlines, passenger groups and the CAA over the design, outcomes and cost envelope for the overall scheme.

— A key objective of this process will be to identify efficiencies and trade-offs between cost and quality in the specification of different aspects of the scheme such as the terminal.

— The consultation process will also help to determine the appropriate breakdown of the scheme for the application of the sub-programme regulatory framework. This will include the identification of specific areas of the scheme for direct regulatory mechanisms.

— The CAA could seek to facilitate this process by placing obligations on the promoter to provide detailed information on its assumptions and cost estimates for independent scrutiny and to identify a range of options for different aspects of the scheme such as the terminal, satellites and baggage handling equipment.

— There could be clear rules for engagement including for dealing with disagreement and escalations of decisions to the CAA.

— The CAA could specifically request that the promoter identifies options for reducing costs by a given percentage or amount. This would help to identify potential trade-offs in the design and outcomes of the scheme. The CAA could also seek to appoint its own advisors to provide an independent third party view on specification and cost estimates.

— The promoter could also be required to identify key risks and costs, including those which are likely to be sensitive to the NPS and DCO process. This would be important to ensure that stakeholders understand where cost savings might have implications for the delivery of the scheme. The CAA would also need to recognise these risks and develop a regulatory policy for their potential impact on the scheme target costs.

— A key objective of this process is to ensure that customers views are taken into account in the design of the scheme. In this process the CAA has a duty to ensure that the wider interests of passengers are taken into account. This requires that the CAA take note of the potential for conflict between the interests of current and future passengers and airlines and different groups of customer.

— The CAA could therefore give final approval to the design of the scheme and arbitrate over any dispute between the promoter and other stakeholders. The CAA may need to consider the equivalent levels of service between the terminals for example to ensure that different airlines are not disadvantaged.

Specification sub-programme mechanisms (cont.)

- The CAA could seek to understand passengers preferences for the design of the scheme. This could involve undertaking willingness to pay or stated preference research on key issues. The CAA's proposed Consumer Challenge Board (CCB) could play a key role in this process.
- The output/design/cost specification would be the key output from this sub-programme. This would enable the estimation of an initial scheme cost envelope linked with a detailed outcome specification to prevent under delivery of outputs.
- This would be based on the target cost of the project, plus some level of contingency allowance. The CAA will need to consider what level of contingency is appropriate based on the maturity of the business plan, level of risk and uncertainty and passengers willingness to pay.
- This envelope could form the basis of a binding upper cost limit for the overall scheme linked with layered risks sharing mechanisms to protect customers from potential cost escalation (this mechanisms is illustrated in more detail on a following slide).
- The scheme cost envelope would be subject to review at several stages of the programme including the DCO review and may be altered to account for specific pre-identified risks through the addition or subtraction of 'notified' items to the envelope.
- Each year the promoter could be required to notify the CAA of its expectation of the total final cost of the project. If that estimate exceeds the risk thresholds set by the CAA it could trigger an intervention in scheme governance. This could involve for example the appointment of a Project Representative to the scheme governance board or enhanced IFS cost scrutiny. The CAA could also call a pause to the project and require the promoter to identify cost savings to bring the project back within the risk threshold.
- At key points throughout scheme delivery the CAA will need to verify that the promoter has achieved the agreed speciation. Where the specification is not met, there may need to be an assessment of the detriment to customers which could then be linked to a reduction in the RAB for example.
- The promoter could also be required to present its plan for procurement and project governance for the CAA's approval. This could explain the promoters approach to allocating risk to the supply chain and highlight aspects of the project where competitive outcomes are likely to be difficult to achieve.
- The CAA could undertake a review of the promoter's governance and procurement process based on an expert review to highlight potential risks and improvements.

Specification sub-programme regulation map

The specification sub-programme will require a variety of mechanisms and cost assessment methods linked to the customer engagement process. The CAA could place requirements on the promoter to provide information, develop and identify options and assess risks for its plans. Airlines will have a key role in this process. The CAA will also have a key role in representing wider passenger interests and undertaking research on their requirements.

Early activities

- The promoters submission to the AC will form the starting point for the consultation.
- The promoter could also be required to provide an indicative breakdown of the scheme to highlight key sub-programmes and major projects which could form the basis of the sub-programme regulatory framework.
- The promoter and airlines will seek to develop these plans to reduce costs and select an appropriate trade-off between cost and quality.
- The CAA will also have a key role to represent wider passenger interests, undertake research and provide scrutiny of the cost forecasts.

Specification

Promoters initial plan	Consultation	Agree scheme specification
Promoter required to provide overall programme setting key timelines, sub-programmes and projects with reconciliation to AC submission	Promoter required to identify options for cost savings	CAA approval of scheme specification for submission to NPS/DCO process
	Consultation with airlines over scheme design/costs/outcomes	Assessment of appropriate contingency allowance
Promoter required to undertake risk assessment and highlight key risks, processes and contingencies, linked to sub-programmes	CAA appointed expert to provide review of promoters scope and cost estimates	CAA to set initial cost envelope for overall scheme and design layered incentives
CAA develops 'rules of engagement' for Constructive Engagement	Promoter assessment of costs sensitive to NPS and DCO approval	CAA approval of cost envelope supported by expert review to verify cost estimates
Promoter required to develop governance and procurement plan	CAA review of promoters governance and procurement plan	CAA approval of key risks and development of regulatory policy for treatment

CAA/CBB research on customer preferences for scheme design (WTP and SP research)

Development of sub-programme regulatory framework

Late activities

- The design, costs and outcomes of the scheme specification will largely be driven by consultation between the promoter and airlines, but the CAA will need to provide final approval.
- There will be a need to identify key risks and develop a regulatory policy to account for these issues.
- Failure of the promoter to deliver the scheme specification will result in a financial penalty.
- Need to consider appropriate level of contingency allowance.

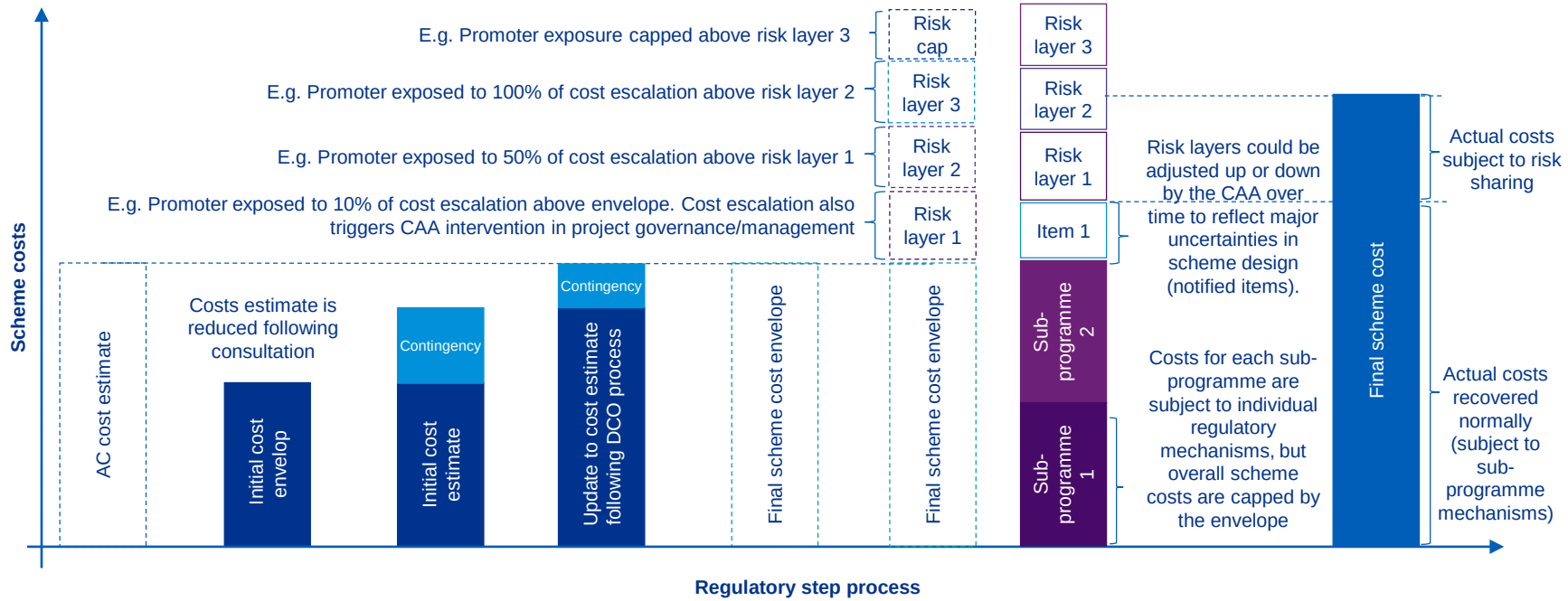
Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

The main objective for this sub-programme is to identify win-win cost savings and also to take account of customers views on the cost/quality trade off. Through the process the CAA should also seek to identify an appropriate cost structure for the programme, potential risks and contingencies and regulatory policy to account for these.

Scheme cost envelope and layered incentives

A key objective for the specification stage is to identify a cost envelope for the overall scheme. This could be used to set overarching risk layers to determine the promoters exposure to cost escalation (after accounting for sub-programme risk mechanisms). This would provide the promoter with an overarching budget constraint for the scheme which will help to incentivise the management of overall costs, ensure that forecasts are as accurate as possible and all major risks identified at an early stage. It will be necessary to review the cost envelope at key points when additional information is made available including following the DCO stage. It will also be necessary to reconcile the envelope with sub-programme mechanisms. A illustration of the mechanism is illustrated below. The promoter would be required to provide regular updates on estimated scheme costs and notify the CAA when and if it expects to breach the envelope and risk layers. This could trigger further intervention by the CAA such as intervention in the delivery of the project or intensified IFS oversight.

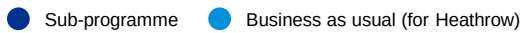
Specification stage	Update to cost estimate and setting cost envelope	Final cost envelope
The specification stage will result in changes in scheme specification and target cost. There may also be a need for a contingency allowance to account for uncertainty and changes in scope. The CAA could be guided by the AC estimates and research on passengers willingness to pay.	The scheme cost estimates will need to be updated to take account of uncertainties such as the DCO process. The cost envelope can then be set with an allowance for contingency to reflect the potential uncertainty.	The promoter will be strongly incentivised to keep overall costs below the risk thresholds. Breaching the thresholds will impose penalties on the promoter and trigger intervention by the CAA such as intensified IFS oversight or halting the project to identify cost savings for example.



Planning sub-programme framework

The **planning sub programme** of the scheme is one of the key preliminary stages of the overall programme and will occur in advance of the construction stages following the development of the specification. The planning stage will primarily involve securing NPS and DCO approval for the scheme through Parliament and the Planning Inspectorate respectively. The characteristics of the sub-programme and implications for the regulatory framework are shown below.

Characteristic		Dimensions of regulatory approach	
C1. Ability to separate project	High	Existing	Bespoke for project
C2. Ability to control costs	High	Prescriptive	Discretionary
C3. Regulator's ability to define and assess efficiency	Med	Ex-ante	Ex-post
C4. Customers' ability to define and assess efficiency	Low	Low risk/reward	High risk/reward
C5. Scale of cost and risk exposure	Low	Customer negotiation	Regulatory settlement
		Slow recovery of capital	Fast recovery of capital
		Non-intensive oversight	Intensive oversight



The costs of this sub-programme are relatively small (1% of LHR – NWR) and will be largely under the control of the promoter. It should also be relatively straightforward to benchmark a high level cost allowance for the process based on previous experience of achieving planning permission at Heathrow and on other major projects. The complexity and importance of the process and potential risks for later stages of the scheme, combined with the relatively low costs relative to the overall scheme mean that any apparent 'efficiency' savings at this stage could be more than off-set through higher costs at a later stage.

It will be difficult for the CAA to determine whether this sub-programme has been delivered efficiently, i.e. ensuring that the design of the scheme and the outcome requirements of the planning process is optimal for all stakeholders. For this reason it will be difficult to create strong efficiency incentives in this sub-programme although some form of incentive for success and failure may be appropriate. If possible this should be linked to changes in the overall cost of the scheme relative to the original cost envelope.

Planning sub-programme mechanisms

The CAA has developed a policy for the treatment of planning costs (termed Category B costs). This policy is summarised below based on the February 2017 Policy Statement.

CAA policy for planning costs

- Promoter is entitled to recover costs of up to £10 million per year directly through charges (fast recovery).
- Costs over £10 million per year to be capitalised and added to the promoter's RAB subject to an efficiency assessment.
- The starting date and profile of regulatory depreciation for Category B costs in the RAB will be set consistently with broader considerations on the affordability of charges and the financeability of HAL's expenditure programmes.
- Capitalised costs will be subject to a risk sharing mechanism with a 5% uplift to costs added to the RAB for successful achievement of the DCO and 15% reduction for failure or potentially more where there is compelling evidence that HAL has unilaterally withdrawn from the planning process.
- The creation of an Independent Planning Cost Reviewer to provide ongoing monitoring of the efficiency of planning costs to inform the efficiency assessment.
- Requirement for the promoter to make planning materials and reports available to the CAA and airline community.
- A policy review trigger point if cumulative planning costs exceed or appear likely to exceed £265m (equivalent to HAL's estimate of the planning costs).

Commentary and potential development on CAA policy

- The application of the risk sharing mechanism is an effective way of managing the costs of the DCO process in the event of failure to achieve a positive outcome. We consider that it may be possible to refine this mechanism to also create incentives for the promoter to consider the cost implications of the planning process for the wider project.
- The criteria for the risk sharing mechanism is the successful achievement of a DCO. This criteria does not distinguish between the wide variety of potential outcomes of the process and the potential for significant cost escalation between the specification stage led by the promoter and the outcomes of the DCO process.
- The CAA could attempt to refine the mechanism by linking the level of uplift to the level of cost escalation (or reduction) which might occur through the planning process.
- This could be achieved for example by linking the level of cost sharing to the escalation or reduction of the scheme target cost between the speciation stage and the granting of the DCO.
- For example if the DCO results in an increase in the scheme target cost of 10%, the pass through of category B costs could be reduced by 10%. Conversely if the DCO results in a reduction in the scheme target cost of 10% category B cost could be passed through with a 10% uplift. The overall pass through/uplift could be capped between +5 and -15% to maintain the intended balance of risk between the promoter and airlines.
- This refinement would provide the same incentives for the promoter to achieve a positive DCO outcome whilst also seeking to ensure that the costs of the scheme are not increased by the DCO process.
- To be effective this mechanisms would require that the CAA is able to estimate an appropriate target cost for the scheme prior to the commencement of the planning stage and is also able to identify the impact of the DCO process on the overall scheme costs.
- This could be achieved through the promoters risk assessment and analysis of key assumptions for example with regard to the level of compensation, environmental mitigation and other factors which may be affected by the DCO process. Where the DCO process results in changes to these assumptions the impact on the target cost would need to be estimated to assess the impact on the target cost.

Planning sub-programme regulation map

The specification sub-programme will define the scheme, outcomes and costs which are considered through the planning process. The planning phase of the project will require the promoter to explain the scheme design to the public and ensure that impacts on wider stakeholders are mitigated. The planning stage will impose direct costs on the promoter, but could also have a significant impact on the design and costs of the overall scheme. The CAA should seek to ensure that the promoter has incentives to manage this phase efficiently.

Ex-ante activities

- Target cost and scheme outcomes set in specification stage through consultation with airlines and the CAA.
- Promoter required to identify key assumptions about outcomes linked to NPS/DCO decision and the potential impact on target cost as a result of changes in the DCO decision.
- Will likely include levels of compensation, environmental compensation and mitigation, extent of compulsory purchase, number of houses, levels of surface access mitigation etc.

Planning

Specification of scheme	NPS/DCO process	Outcomes
Target cost and outcomes developed in specification stage	Fast recovery of planning costs up to £10 million per year	Ex-post cost efficiency assessment of cat B costs over £10m
Key assumptions and risks for DCO process identified by promoter, with estimate of cost impacts/sensitivities to be agreed with CAA.	Slow recovery of capital over £10 million per year subject to efficiency review	Assessment of DCO outcomes – Impact on target costs and key assumptions
	IFS monitoring of planning process and costs	Bonus/penalty linked to change in target cost and key assumptions
	Requirement to provide information to CAA and airlines	Addition of category B costs + bonus/penalty to RAB subject to efficiency review

Ex-post activities

- The NPS and DCO process are key risks for the overall costs of the scheme.
- The process may result in requirements for mitigation and changes to the scheme which might increase costs. The promoter should account for these costs in the original forecast.
- The promoters incentives should be linked to the level of cost escalation relative to the original target cost.
- The CAA could then reset the target cost-based on the outcomes of the DCO process.

Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

Cost assessment of the planning sub-programme could be achieved through high level benchmarking based on similar major project planning processes and the identification of key cost drivers such as the number of complaints or submissions and estimated number of days for the planning process. The assessment of efficiency is likely to require expert opinion based on evidence provided by the IFS.

Land and community sub-programme framework

The **land and community** sub-programme includes costs required for the compulsory purchase of land from third parties around the airport site. This includes compensation for commercial businesses, residential properties and the provision of removed facilities as well as compensation and support of the wider community through noise insulation and other support schemes. As such these costs will not be incurred as a 'project', but primarily through policy decisions and the legal process associated with the purchase of land and determination of compensation payments. These costs will therefore be strongly linked to the outcomes of the NPS and DCO process and negotiation with third parties. This sub-programme accounts for around 16% of the total costs for the LHR – NWR scheme.

Characteristic		Dimensions of regulatory approach		
C1. Ability to separate project	Med	Existing		Bespoke for project
C2. Ability to control costs	Low	Prescriptive		Discretionary
C3. Regulator's ability to define and assess efficiency	Med	Ex-ante		Ex-post
C4. Customers' ability to define and assess efficiency	Low	Low risk/reward		High risk/reward
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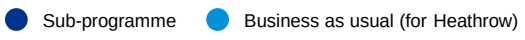


The promoter is not fully in control of the costs of this sub-programme, but may seek to provide a higher level of compensation than required by law for policy reasons. It will be important for the wider objectives of the scheme that property owners and other local stakeholders are properly compensated for blight, noise and other issues etc. For this reason incentive or outcome-based regulation is unlikely to be appropriate as this would create incentives for the promoter to minimise its compensation payments to third parties. The framework for the sub-programme should be low risk with a relatively high level of discretion and regulatory oversight. Airlines may not have a strong understanding of the issues associated with land/compensation costs and therefore the CAA may need to play a greater role in the process than in other parts of the framework to ensure that the promotor is not required to pay more than required by the legal processes. A key issue for this framework is the promoters approach to compulsory purchase and the extent to which savings can be achieved through early purchase by the promoter.

Land and community sub-programme mechanisms

The need to ensure fair compensation of stakeholders, limited ability of the promoter to control costs due to the unpredictable nature of the legal process and the limited ability of the regulator to define and assess the efficiency of the compensation process motivates a low risk approach for this sub-programme. The framework could provide a high level of discretion to account for changes in assumptions and cost forecasts and incentivise the promoter to implement the compensation requirements of the DCO process efficiently.

The cost of compulsory purchase and community compensation payments will be primarily driven by the DCO process. The promoter may have some scope to reduce these costs through early engagement with stakeholders to buy land and property voluntarily at an earlier stage and the CAA should seek to understand the promoters intended approach.

The compensation process for residential and commercial property owners will be different. The compensation of commercial property owners may be more complex and subject to greater negotiation to reflect the specific needs of different companies for example. This will mean that the efficiency of the process will be difficult to assess and is likely to require a highly discretionary approach.

Mechanisms and methods

Ex-ante mechanisms

— The specification process will result in a set of key assumptions to estimate costs for land and community compensation. This will include key factors such as the number of properties being purchased or compensated, with the average price and other cost drivers. There will be separate estimates for residential and commercial property and other types of community compensation.

— The compensation process will differ for different types of property and the promoter will have some discretion over this process.

— For residential properties Heathrow has proposed a 25% premium to market prices for 3,750 properties. For commercial properties this may involve negotiation over replacement facilities based on the estimation of Equivalent Reinstatement Value. The CAA and airlines could approve the proposed level of compensation as part of the specification stage.

— The DCO/planning process will ultimately determine the key parameters of the costs of this sub-programme and may alter the proposed level of compensation set at the specification stage. This will result in a new target cost for the sub-programme.

— An expert review of target cost estimate with focus on the potential costs of the commercial property purchase will be required to set a target cost for the sub-programme.

— As part of this sub-programme, the promoter could develop and agree a strategy for minimising the costs of land and community compensation within the parameters of the DCO decision. This will primarily involve the timing of purchases and opportunities for the promoter to begin purchasing properties prior to the compulsory process to reduce costs. The CAA could develop a policy for the future treatment of these costs in different scenarios.

— Residential compensation costs could be treated as a pass through for slow recovery onto the RAB.

— Commercial costs could be weakly incentivised against the target cost to create incentives for the promoter to manage the compensation process efficiently. For example the promoter could be exposed to costs up to ± 10% above or below target cost for commercial property compensation.

Ex-post mechanisms

— Limited ex-post review of residential compensation costs to ensure that costs are added to RAB with appropriate adjustments for timing.

Land and community sub-programme regulation map

The land and community sub-programme will involve the costs associated with compensating residential and commercial property owners affected by airport expansion. Retail and commercial properties will be subjected to different processes. These costs will largely be determined by the planning process but there will be some limited scope for the promoter to drive efficiency through its approach to commercial negotiation and potential for early purchase of land.

Ex-ante activities

- The specification stage will result in target costs and key assumptions about the outcomes of the DCO process.
- Separate estimates of cost and regulatory treatment for residential and commercial properties.
- DCO process may result in changes to those assumptions and target costs.
- The promoter will need to agree a policy for compensation with the CAA and airlines.

Land and community

Policy/strategy	Negotiation and CP	Outcomes
Promoter, airlines and CAA to agree compensation policy for residential and commercial properties (level above statutory minimum if any) and estimate target costs at specification stage	Promoter to develop strategy for minimising costs through early engagement and opportunities to purchase land early	Residential property compulsory purchase costs added to RAB directly as incurred subject to audit
Key assumptions and target cost for residential and commercial property reset following DCO process	CAA sets target costs and incentive mechanisms for commercial property (exposure of ±10%)	Commercial property target costs added to RAB based on target costs and assumed profile, subject to occurrence of identified risks. Promoter exposed to under/out performance.
Expert review of target costs with focus on commercial cost replacement value	Identification of specific risks associated with commercial compensation. Regulatory policy to specify treatment of outturn risks.	

Ex-post activities

- Residential costs will be passed through to the RAB based on actual costs with a light touch review.
- Commercial costs will be added to the RAB based on target costs set following the DCO process.
- This will incentive the promoter to ensure commercial negotiations are effective and provide low level of exposure to cost escalation.

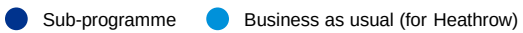
Financial Incentives **Regulatory Approval** **Competition** **Customer Bargaining** **External Review** **Control Mechanisms** **Cost assessment**

Cost assessment of land and community will differ between residential and commercial properties. Residential property compensation costs are driven by the number of properties, market values and level of compensation. These are largely exogenous outside of the direct control of the promoter. Commercial property compensation costs will require expert judgement and negotiation over appropriate reinstatement values.

Plant, runway and equip. sub-programme framework

The plant, runway and equipment sub-programmes will include a range of different projects with different levels of complexity. For some of these it will be possible for the promoter to specify outcomes and control costs, for others this will be more challenging. Depending on the balance it may be possible for the regulator to identify an efficient target cost for this sub-programme and create stronger efficiency incentives through setting hard budget constraints.

Characteristic		Dimensions of regulatory approach		
C1. Ability to separate project	Med	Existing		Bespoke for project
C2. Ability to control costs	Med	Prescriptive		Discretionary
C3. Regulator's ability to define and assess efficiency	Med	Ex-ante		Ex-post
C4. Customers' ability to define and assess efficiency	Low – med	Low risk/reward		High risk/reward
C5. Scale of cost and risk exposure	Med	Customer negotiation		Regulatory settlement
		Slow recovery of capital		Fast recovery of capital
		Non-intensive oversight		Intensive oversight



The projects within these sub-programmes are generally technical and non-passenger facing. For this reason the outcomes and design may tend to be more clearly defined than other parts of the scheme. The promoter may therefore have a reasonable ability to control costs and define outcomes. This could mean that it is possible to adopt a more prescriptive framework with greater potential for risk and reward for the promoter. In total these sub-programmes will account for a significant part of the scheme costs (10% for LHR – NWR) which means that regulatory oversight will need to be proportionately intensive.

There are likely to be some risks or uncontrollable factors which need to be incorporated into the regulatory framework. Passengers and airlines may have some interest in the scope of the equipment being used, but may lack the skills and understanding to provide oversight of the project or identify efficiency. This could mean for example that the sub-programme requires greater oversight by the CAA through more intensive expert review for example.

Plant, runway and equip. sub-programme mechanisms

The promoter has a high degree of control over the costs within these sub-programmes. Some elements such as the runway may be a relatively simple part of the overall scheme with a limited number of risks and uncertainties. It may also be possible for the CAA to identify an efficient cost benchmark with a relatively high level of confidence for some aspects of the sub-programme.

This means that some ex-ante financial incentives could be applied to the sub-programme without placing major risks on the promoter. The framework will require some flexibility to account for uncontrollable factors and uncertainties. It may also be beneficial to allow customers to provide input into the scope of the sub-programme for specific passenger facing projects.

Mechanisms and methods

Ex-ante mechanisms

— The outcomes of the sub-programmes will be determined in the specification stage and updated following the DCO process. This will result in a specification and target cost for these sub-programmes linked to individual projects.

— The specification stage will also identify key risks within each sub-programme which will require specific regulatory policy or discretionary treatment by the CAA (notified items). This might involve a commitment to alter the target cost by a given amount in the event that a risk does or does not occur.

— The CAA to undertake a further assessment of the target cost estimate based on scrutiny of the promoter's assumptions, comparison with competitors, top-down benchmarking of runway cost relative to historic projects and expert review.

— Based on this assessment the CAA will estimate a final target cost for the sub-programme. The target cost will be recovered slowly through forecast additions to the RAB.

— As part of the cost assessment the promoter could be required to undertake or provide evidence of extensive market testing for projects and items within the sub-programme to ensure that the business plan is efficient.

— The CAA to determine appropriate incentive mechanisms linked to the target cost with cap and collar risk sharing mechanism applied to the sub-programme target costs, for example full exposure to ±20% of cost variance relative to the target costs with discretionary treatment of costs above or below this threshold.

Ex-post mechanisms

— If actual costs are significantly above or below the target costs and outside the risk sharing thresholds the CAA may seek to undertake an ex-post review to inform the discretionary treatment of such costs.

— Otherwise no ex-post cost assessment is undertaken and the promoter is exposed to any variance in actual and target costs.

— Based on this review the CAA may choose to make adjustments to the RAB to account for inefficient costs.

Plant, runway and equip. sub-programme map

Some parts of this sub-programme may have relatively clear outcomes, costs drivers and a wide range of potential benchmarks which could enable the CAA to assess efficient costs with a higher level of confidence than other parts of the scheme. The CAA could seek to apply strong financial efficiency incentives to this aspect of the scheme through setting target costs with financial incentives and risk sharing mechanisms reflecting the level of risk and certainty associated with the cost estimates.

Ex-ante activities

- Outcomes and target costs are defined in the specification sub-programme.
- CAA could undertake a more intensive cost assessment of the sub-programme before setting a target cost
- Risks are also identified by the promoter and approved by the CAA with prescriptive regulatory treatment using notified items.
- CAA may also consider overall risk/reward profile for the sub-programme.

Plant, runway and equipment

Specification	Delivery	Outcomes
Initial target cost and outcomes developed in specification stage	Potential adjustment to target cost-based on notified items and regulatory policy	Target costs added to RAB in line with sub-programme specification and target cost
Sub-programme risk assessment undertaken by the promoter and approved by CAA to identify notified items and regulatory policy		Discretionary treatment of costs outside of risk thresholds
Promoter required to provide evidence of market testing for cost estimates		
CAA appointed expert review of sub-programme specification (for each sub-programme to identify further potential efficiency		
CAA sets final target cost and incentives for each sub-programme		

Ex-post activities

- Target costs are added to the RAB and recovered through charges.
- Potential for adjustments to target costs based on notified outcomes and regulatory policy.
- No ex-post activities required unless actual costs fall above or below risk thresholds set by CAA.
- CAA may undertake ex-post review to inform the discretionary treatment of such costs.

Financial Incentives | Regulatory Approval | Competition | Customer Bargaining | External Review | Control Mechanisms | Cost assessment

Cost assessment of these sub-programmes could be achieved through the identification of top-down and bottom up benchmarks from various sources. Costs for the runway for example could be compared against similar road type projects, whilst specific equipment costs and prices are likely to be available from various sources. For specialised items expert review of costs may be required.

Surface access sub-programme framework

The **surface access** sub-programme costs include two broad categories: those associated with directly procured projects such as changes to road alignment or supporting rail projects required as a direct part of the scheme, and wider third party surface access projects which the promoter may be required to provide contributions towards. The treatment of these types of cost will be different. Total surface access costs may cost up to 13% of the LHR – NWR scheme.

Characteristic		Dimensions of regulatory approach		
C1. Ability to separate project	High	Existing		Bespoke for project
C2. Ability to control costs	Low	Prescriptive		Discretionary
C3. Regulator's ability to define and assess efficiency	Low	Ex-ante		Ex-post
C4. Customers' ability to define and assess efficiency	Low	Low risk/reward		High risk/reward
C5. Scale of cost and risk exposure	High	Customer negotiation		Regulatory settlement
		Slow recovery of capital		Fast recovery of capital
		Non-intensive oversight		Intensive oversight

Sub-programme Business as usual (for Heathrow)

The general characteristics of the sub-programme suggest that the framework should be largely discretionary, based on ex-post cost assessment with a low level of risk and reward exposure and limited level of customer engagement and negotiation. There will be a need for relatively high levels of regulatory oversight.

For directly procured projects the promoter may be incentivised against a target cost if the level of risk is low and the CAA is confident of setting an efficient cost target. For cost contributions towards third party projects there will need to be greater oversight from the CAA to ensure that the promoter negotiates effectively and minimises its contribution subject to meeting legal and policy requirements to mitigate impacts on the wider transport network. The planning and DCO process will be a key factor in determining the level of surface access contribution the promoter is required to pay.

Surface access sub-programme mechanisms

Some surface access projects will be largely under the control of third parties such as Highways England, Network Rail and Transport for London. In some cases the promoter will only be required to negotiate a contribution towards these projects, such as the Crossrail Contribution agreed in Q6 with the Department for Transport. In other cases the promoter may be directly managing or procuring the delivery of a project such as a surface road upgrade. These two distinct elements of the sub-programme will require different regulatory mechanisms.

It may be difficult to estimate an efficient cost and apply strong efficiency incentives to the promoter as the final cost for this sub-programme will depend on negotiation with third parties and an assessment of the impact of the scheme on the local transport network which will be undertaken as part of the DCO process.

This motivates a framework which will incentivise the promoter to negotiate effectively with third parties with discretionary treatment of costs and low exposure to risk and reward. CAA oversight of this process could also be beneficial to ensure that the underlying evidence base is tested.

Mechanisms and methods

Ex-ante mechanisms

— The CAA to establish principles and regulatory policy for the treatment of surface access costs and the estimation of efficient contributions from passengers. This will help to guide the negotiation and estimation process and establish principles for 'efficient' contributions from passengers.

— The specification sub-programme will result in an initial target cost for the surface access sub-programme and an assessment of potential risks. This process should also distinguish between projects which the promoter is procuring directly, and those to which it is required to make a negotiated contribution. Regulatory mechanisms will differ for these two types of project.

— The DCO process may result in changes to the estimation of the contribution that the promoter is required to make and a new target cost. The CAA could ensure that the promoter challenges and verifies the evidence and modelling which is used as part of this process. The CAA could also appoint its own advisors to undertake this task.

— The CAA to undertake an ex-ante review of cost estimates for directly procured projects to identify the potential scope for efficiency.

— The CAA may place financial incentives on the promoter for the delivery of directly procured projects where it is confident that it can set an efficient target cost. This could take account of any potential risks for the project through the use of notified items.

Ex-post mechanisms

— IFS monitoring of high risk projects with no financial incentives to strengthen the evidence available for ex-post assessment of efficiency.

— Target costs for direct projects added to the RAB based on assumed spending profile. Project contributions added to the RAB at time incurred.

— Ex-post review of directly procured projects with focus on those with no financial incentives.

Surface access sub-programme regulation map

The surface access sub-programme will require involvement and negotiation with third parties including Transport for London, Network Rail and Highways England over the scope, costs and delivery of major surface access projects required to deliver the scheme. The promoter will be expected to make a negotiated financial contribution to many of these projects. It may also be directly responsible for the delivery of some projects. In this case, where the CAA can estimate an efficient cost it may be able to apply financial incentives.

Ex-ante activities

- CAA to develop principles and policy for the estimation of surface access cost contributions
- This should inform the specification stage and initial estimate of costs and outputs associated with each project
- The DCO/NPS process may result in changes to this forecast that will need to be taken into account
- There may also be negotiations with third parties such as TfL and DfT over the level of contributions
- CAA to undertake expert review of cost estimates
- Directly procured projects can be incentivised where the CAA can set a cost estimate

Surface Access

Specification	Delivery	Outcomes
CAA principles and policy statement for the estimation of contributions to third party surface access projects	IFS monitoring of high risk direct procurement projects with no financial incentives	Direct procurement projects added to the RAB based on target costs linked to financial incentives
Initial target cost and outcomes developed in spec. stage	CAA monitoring of promoter/3rd party negotiations and approval of contribution	Contribution projects added to RAB as costs incurred subject to efficient negotiation
Identification of risks including NPS/DCO process identified by promoter at spec. stage	Expert review of evidence and transport modelling used to estimate contribution	Expert review of non-incentivised projects with RAB adjustment for inefficiency
CAA oversight of contribution estimation/negotiation process, potential appointment of expert to review modelling evidence		
Expert review of costs (for direct projects)		
CAA sets target cost and financial incentives on directly procured projects where appropriate		

Ex-post activities

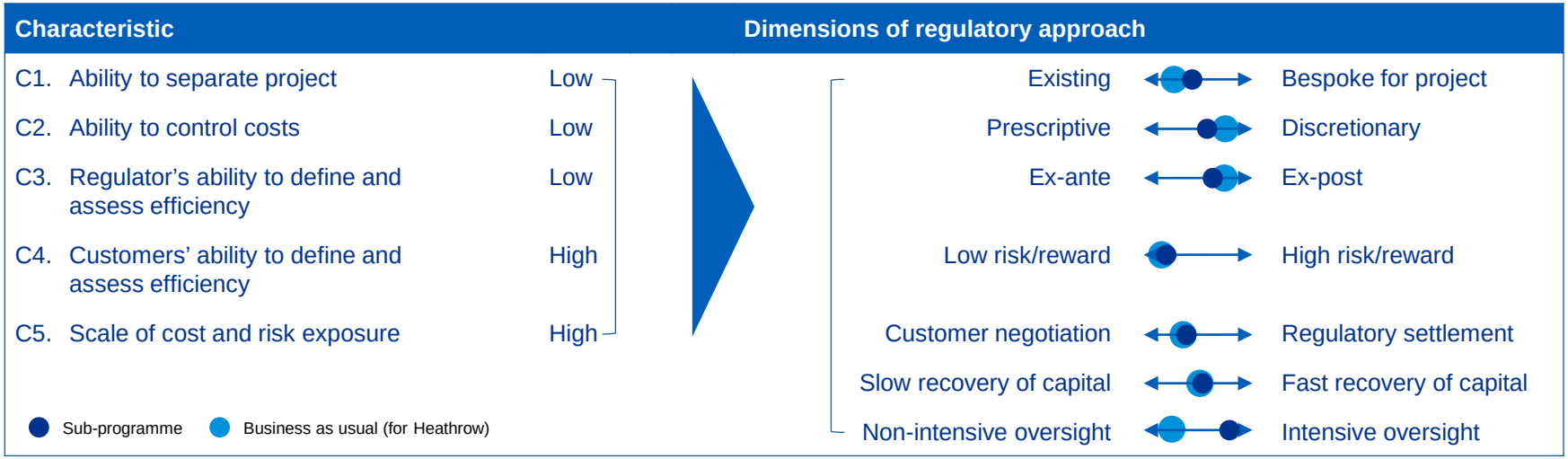
- Project contributions to third parties will be added to the RAB as they occur
- Directly procured projects may be subject to financial incentives, with only target costs added to the RAB
- Where a direct project is not incentivised, an ex-post review of the costs supported by IFS monitoring should be undertaken to identify any inefficiency

Financial Incentives
Regulatory Approval
Competition
Customer Bargaining
External Review
Control Mechanisms
Cost assessment

Cost assessment of surface access costs will differ for direct and contribution based projects. Contributions will be driven by the relative value or benefits of the project to passengers and the mitigation of negative impacts. This will require scrutiny of modelling and assumptions. Directly procured projects will generally require expert review or benchmarking to set an efficient cost.

Terminal sub-programme regulation framework

The **Terminal** sub-programme is an integral part of the overall airport and will be connected to wider assets through operational linkages (passenger transport, baggage, ground control etc.). The design of the terminal may be unique and difficult to benchmark. It will also be key for passenger and airline service quality. The design of the terminal may also evolve over time to adapt to new airline technology and requirements which may make it difficult for the promoter to control costs without reducing flexibility.



It may be difficult for the promoter to control costs and also for the regulator to define or assess the efficiency of the sub-programme as a whole. This implies that it may also be difficult to be prescriptive over the treatment of costs or apply financial incentives. Ex-ante forecasts are likely to be inaccurate due to exogenous factors or changes in scope. Any ex-ante efficiency mechanisms could lead to arbitrary over or under reward for the company, overstatement of cost and under delivery. Airlines will have a strong interest in the design and quality of the terminal and may also be able to identify efficient outcomes. For this reason they should be involved in the business planning process. The scale of the sub-programme and the potential for financial impacts also means that it will be difficult to create high risk and reward incentives for these parts of the scheme without creating potential adverse impacts on the wider project (costs of this sub-programme are around 17% of the total for LHR – NWR). This also suggests that the CAA may wish to have more intensive oversight of the project to drive efficiency through behavioural and monitoring mechanisms. Overall therefore the characteristics of the terminal project suggest that the CAA's existing cost-based regulatory framework with a range of adjustments may be appropriate.

Terminal sub-programme regulation mechanisms

It may be difficult for the promoter to fully control the costs of the terminal sub-programme due to its complexity and the potential need for changes to scope. It might also be difficult for the regulator to define or assess the efficiency of the sub-programme, in particular the outcomes and standard of quality that has been achieved.

This implies that it may also be difficult to be prescriptive over the treatment of costs or to create strong financial incentives without creating adverse impacts on this part of the scheme. In order to strengthen efficiency incentives, the CAA will need to apply or intensify oversight and monitoring mechanisms to influence the promoter's behaviour and to help identify potential risks.

Airlines and passengers will also have a strong interest in the design and quality of the terminal and may provide important input to identify efficient outcomes and scope for the sub-programme.

Mechanisms and methods

Ex-ante mechanisms

— The specification, outcomes and target cost for the terminal sub-programme will be determined in the specification stage, and updated following the DCO process. This will result in a specification and target cost for the overall terminal sub-programme.

— The specification stage will also identify key risks and contingencies such as changing technology or future aircraft requirements. The target cost may need to be changed as a result of changes in scope.

— The promoter will undertake regular engagement with airlines and passengers over the design and progression of the terminal at key points. Airlines may request changes to the scope of the project to accommodate future changes in requirements for the terminal design. The promoter may request changes in the scope of the project to account for unforeseen risks. This process could be based on the existing core and development capex mechanism.

— The CAA would provide oversight of this process to ensure that all passengers interests are reflected in the decision about the terminal design. The CAA may take a discretionary approach to changes in project costs, for example taking into account if the risk were identified at the specification stage and the impact on the overall project cost.

— Changes to the specification of the terminal would result in changes to the target cost.

— The CAA and airlines may also propose output incentive metrics for the projects including key project timescales and triggers. This could include issues such as levels of service quality achieved, effective operational transition, minimisation of delays and other operational factors over the initial period of operation.

Oversight mechanisms

— The CAA will have oversight of the progress of key projects through an enhanced IFS role. This could include the oversight and assessment of project governance, procurement and general project management activities.

— The promoter to notify the IFS/CAA of any outsourced project where competition has been limited (e.g. less than two bidders). IFS will review promoter's approach with range of potential outcomes such as an intensified cost assessment process to encourage efficiency.

Ex-post mechanisms

— The CAA to undertake an ex-post cost assessment based on expert review of costs drawing on the inputs to the ex-ante cost assessment including the reconciliation with the AC estimates, the identification of key risks and contingency and evidence gathered by the IFS. Any inefficiency identified could be removed or excluded from the RAB.

— Complementary assessment of project outcomes relative to specification and identification of any changes in scope.

Terminal sub-programme regulation map

The terminal sub-programme may be the most complex part of the scheme with a wide range of inter-linkages with the wider airport and impacts on passenger and airline service quality. It may also be subject to a range of changes in project scope. This will make it difficult for the CAA to create strong efficiency incentives and motivates a framework with weaker financial incentives, but high levels of regulatory oversight through the development of the Independent Fund Surveyor role.

Ex-ante activities

- Terminal specification and cost envelope is developed in the specification sub-programme with consultation with passengers, airlines and CAA.
- Key risks also identified.
- The cost and specification of the sub-programme may need to be altered as the scheme progresses. This can be managed through the core and development capex process.

Terminal

Specification	Delivery	Outcomes
Initial target cost and outcomes developed in specification stage	Engagement with CAA and airlines at key points of programme or risk occurrence	Ex-post cost assessment based on expert review of outcomes and IFS evidence
Sub-programme risk assessment undertaken by the promoter and approved by CAA to identify high risk issues	Changes in scope and target cost controlled through core and development capex process	Target cost added to RAB with discretionary adjustments for efficient changes in scope
Airlines and CAA to identify outcome incentives for the terminal sub-programme (date for completion, service quality etc.)	Triggers for defined project outcomes	Bonuses and penalties applied for outcome incentives
CAA to set financial incentives linked to identified outcomes	Enhanced IFS role – Intensified focus on high risk projects, review of procurement, project management and other issues. More intensive focus on high risk projects (i.e. sole source)	

Ex-post activities

- Ex-post cost assessment will be key to driving efficiency behaviour.
- Increasing the odds of identifying inefficiency is key. This requires an intensification of the IFS role, with a focus on high risk projects.
- The CAA can adjust the RAB to take account of changes in scope and identified inefficiency based on the cost assessment.
- Output incentives can also be linked to RAB treatment.

Financial Incentives **Regulatory Approval** **Competition** **Customer Bargaining** **External Review** **Control Mechanisms** **Cost assessment**

Cost assessment for the terminal sub-programme will require a breakdown of the overall cost estimate into key projects with a specification and cost estimate for each. For some projects it may be possible to obtain top-down or bottom up benchmarks. Many projects will be bespoke and difficult to assess requiring expert review of the promoter's business case and estimates.

Project level mechanisms and methods

As part of the sub-programme focussed regulatory framework, the CAA could also specifically seek to identify major projects which could be targeted with high power incentive mechanisms. This could be achieved based on an assessment of the characteristics previously described at a project level.

For example the TTS system is likely to be complex and subject to a range of uncertainties which will make it difficult to estimate an efficient cost and imply a more discretionary treatment.

In contrast piers, car parks, control posts and some other projects may be more straightforward to assess enabling an incentive-based approach to be applied. These projects could be directly incentivised against a target cost based on benchmarks of similar projects.

Project level mechanisms and methods would also enable greater flexibility in the timing of cost estimates and assessment processes to align with the design progress of each project.

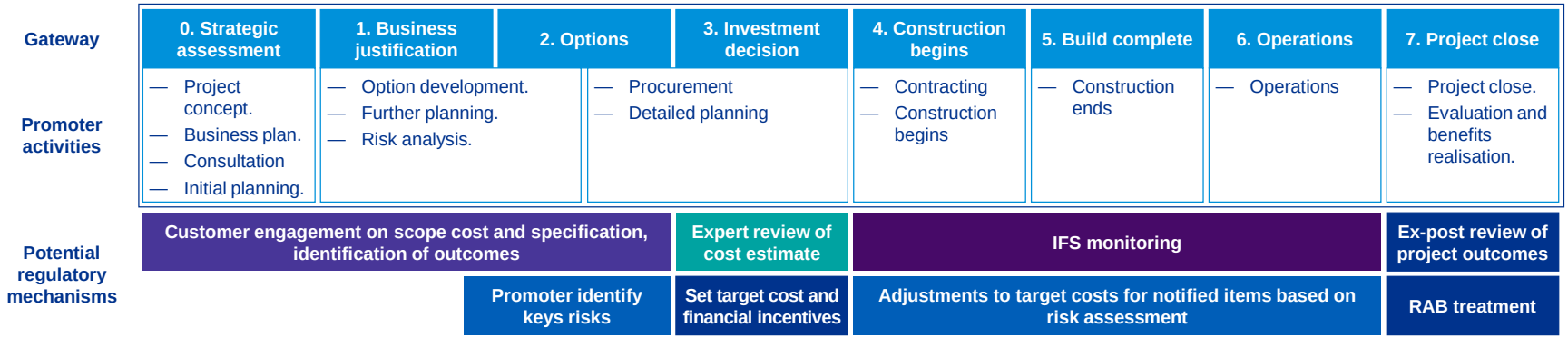
Generally each project will progress through a set of defined project management decision 'gateways' moving from conceptual design (0-2), to scheme design (2-4) and scheme selection and detailed design (3), procurement and construction (4-5) and operations (6-7).

The cost estimates, timing and outcomes of each project will evolve along this process as shown in the diagram below. In some cases projects will already have progressed some way through this process.

At each stage the CAA could seek to apply different regulatory methods and mechanisms to the project as shown below. There will be a key decision point at which a single option is selected, after which cost forecasts can be set with a high degree of confidence based on market testing (usually gateway 3). This stage is a key regulatory decision point at which enough information is generally available to assess the viability of the project, identify key risks and costs, and attach regulatory mechanisms.

At this stage, in addition to estimating a target cost, the CAA could decide whether or not to apply further efficiency mechanisms such as a cap and collar 'deadband' with prescriptive treatment for notified items. Although in practice the promoter may have limited scope to drive efficiency savings at this point.

To streamline the process the CAA could set out a limited range of options for the regulatory treatment of major projects at the outset and notify the promoter of its selection once each project reaches Gateway 3.



Implementation of the sub-programme framework

In addition to the mechanisms and methods specifically applied to each sub-programme, there will also be a range of overarching programme based regulatory issues and mechanisms which may need to be addressed by the CAA and stakeholders. This may include the following:

- Stakeholder consultation on the overall regulatory framework for the scheme
- Regulatory segmentation of the scheme for the application of the sub-programme framework
- Defining regulatory principles for cost allocation between sub-programmes
- Enhancement or intensification of the IFS role
- Reconciliation of new and existing regulatory frameworks
- Development of shortlist of project-based mechanisms and incentive options
- Process for monitoring of scheme actual spend, budget and forecasts
- Process for monitoring of scheme risks
- Development of regulatory options to intervene and respond to cost escalation
- Contingency planning
- Defined scope variation mechanism (development of core and development capex)
- Review of CAA organisation technical and resource requirements
- Ongoing consultation with airlines and passengers

Stakeholder consultation on the overall regulatory framework

It will be important to consult stakeholders on the CAA's overall regulatory framework for the scheme, the methods and mechanisms it intends to apply and the requirements it will place on stakeholders and the promoter in particular.

This will help to test and refine the approach, highlight key issues which need to be addressed and help to identify the overall regulatory work programme. It will also help stakeholders to prepare for engagement with the CAA under the new framework. This will be important where the CAA is expecting to rely on consultation with airlines for example.

The framework consultation could set out a single proposal for the regulatory framework based on the sub-programme approach, or a range of options for stakeholders to consider, for example with different levels of sub-programme groupings or comparing the relative benefits of the approach against the existing cost-based framework for Heathrow.

Regulatory segmentation of the scheme

Based on the promoter's updated business plan, project characteristics, assessment criteria and the promoter's own preferences the CAA could identify an appropriate regulatory segmentation of scheme costs in order to apply the sub-programme-based framework.

We have provided an indicative segmentation in the previous slides, but alternatives with greater or lesser levels of segmentation could also be applied. For example the scheme could be segmented into sub-programmes based on the AC categorisation or simply based on categories for high and low risk sub-programmes or projects.

Implementation of the sub-programme framework (cont.)

The promoter could be required to provide a suggested sub-programme breakdown and identify the sub-programmes or projects it regards as most and least suitable for incentive-based mechanisms. This could be facilitated by requiring the promoter to identify a minimum proportion of scheme costs to be treated under an incentive-based framework.

This may help to draw out areas of the scheme with greater uncertainty and risks, which may need to be addressed through regulatory policy such as the identification of key risks and modifications to the scheme cost envelope.

Setting regulatory principles for cost allocation

The implementation of the sub-programme framework could create incentives for the promoter to alter its cost allocation processes. In order to mitigate this risk the CAA could set out principles for cost allocation and commit to an ex-post review of the promoter's allocation processes at the end of each regulatory period.

Enhancement of IFS role

The role of the IFS could be expanded or intensified to provide stronger oversight of projects or activities which might have weaker efficiency incentives in the regulatory framework. This could involve for example an expansion of the scope and activities of the role such as oversight of the procurement and risk analysis process and/or more intensive scrutiny across a wider range of projects.

Where the promoter is exposed to financial risk there may be less need for scrutiny by the IFS. The CAA could consult stakeholders on how the role of the IFS could be enhanced and integrated with the wider incentive mechanisms.

Reconciliation with existing regulatory framework

It will be necessary to reconcile the regulatory framework for the runway scheme with the existing framework for the existing airport assets. This will primarily require determining how, when and with what frequency regulatory activities such as cost assessments and price controls are undertaken and the consequent adjustments to the RAB and landing charges.

The overall expansion programme could take around 10 years to complete. This means that the costs of the project could span two or more control periods. The regulatory process for each sub-programme or project (cost estimation and assessment) should be aligned with the construction phasing as closely as possible. The review of costs and outputs should be undertaken as soon as practical once a project element is complete.

The CAA could then either choose to role approved costs and financial incentive values into (or out of) the RAB in the same year with an immediate impact on charges, or to make all adjustments at the time of the wider regulatory review with appropriate adjustments for the delayed timing of cost recovery. The latter approach would reduce the regulatory burden but may be more likely to create financeability challenges for the promoter if it results in a significant delay between costs being incurred and revenue recovery. It might also result in large changes in charges between regulatory periods.

Shortlist of project incentive options

Under the sub-programme framework, the CAA could seek to apply efficiency mechanisms and incentives in a staggered approach to align with projects approaching gateway three once cost estimates and specifications have been well developed.

Implementation of the sub-programme framework (cont.)

A potential challenge to this approach is that it may not be clear to the promoter what level of risk or reward it will be exposed to on a particular project. This might have implications for the promoters incentives, for example influencing the approach to cost estimation and procurement (e.g. by encouraging cost overstatement and a risk averse approach to procurement which may not be in the interests of passengers).

To mitigate this risk the CAA could set out a defined shortlist and range of mechanisms and incentives which could be applied to sub-programmes or projects. This would provide the promoter with an understanding of its potential risk exposure.

For example the CAA could set out a principle that cap and collar dead bands used to incentivise cost efficiency will be symmetrical and no more that ±20% of the target cost of the project. The level of risk exposure applied to a project or sub-programme would account for wider issues such as uncertainty, the potential for scope change and the potential risks to the financeability of the project.

Monitoring of scheme actual spend, budget and forecasts

The promoter could be required to provide ongoing monitoring of scheme costs incurred against the budget and target costs set at the specification stage. This could also include an updated cost forecast for each sub-programme and at the overall scheme level. This monitoring could be used to assess the likelihood of cost escalation and the need for the CAA to intervene with further efficiency mechanisms.

Monitoring of scheme risks

As part of the specification stage the promoter will be required to develop a risk register identifying key risks and uncertainties for the scheme. The impact of these risks needs to be considered and where appropriate linked to the scheme cost envelope through a defined regulatory policy.

The promoter could be required to maintain a live risk register for each sub-programme and the overall scheme and to undertake ongoing assessments to ensure that all significant risks are identified and mitigated. Where the promoter identifies a significant new uncontrollable risk it could request the CAA to define an appropriate regulatory treatment.

Regulatory options to respond to cost escalation

Where monitoring of spend forecasts and risks suggests that there is likely to be cost escalation beyond the scheme cost envelope, the CAA could seek to intervene through additional regulatory mechanisms. This could involve a range of options including for example the appointment of a Project Representative or requirement for the promoter to undertake a cost saving exercise to bring the costs of the project back within the envelope. The CAA could consider wider potential options for intervention.

Contingency planning

The sub-programme framework could potentially place a high level of risk on the promoter. These risks could occur at the sub-programme level through specific mechanisms, or at the overall scheme level through the cost envelope and risk layers. The CAA may need to consider what course of action it could take in response to particular cost escalation outcomes.

For example, significant cost escalation above the scheme cost envelope and risk layers could ultimately threaten the viability of the promoter and the delivery of the project. In this event the CAA would need to consider a course of action to protect the interests of passengers.

Implementation of the sub-programme framework (cont.)

Pre-defined scope variation mechanisms/process

It is likely that over the course of the scheme's construction there will be some changes in scope requirements. This could relate to the development of new technology, new aircraft or changing passenger and airline preferences. It may be beneficial for the CAA to define a process or mechanism to manage changes in scope and take account of these changes on the regulatory framework and cost envelope.

We note that the CAA already has a variation mechanism enabled through the distinction between core and development capex and associated governance processes. This process may need to be amended to reflect the greater potential complication of the sub-programme framework. The key issue is that changes in scheme scope would need to be reflected in the full range of regulatory mechanisms applied to specific sub-programmes.

The implications of changes in scope will tend to be most significant where they relate to a sub-programme where the promoter faces stronger financial incentives linked to a target costs and outcome specification.

Review of CAA organisation and requirements

The sub-programme framework may significantly increase the complexity of the regulatory process and the range of activities that the CAA could be required to become involved in (cost estimation and analysis and treatment of risks for example). The extent of this additional complexity will be related to the level of detail in the regulatory segmentation of the scheme and the number and range of mechanisms applied overall.

The CAA may need to consider its existing capacity and capability and also its ability to deliver the framework effectively. This could include for example the development of a detailed work plan and assessment of work load and level of internal and external resources required.

Ongoing consultation with airlines and passengers

The specification stage will be the main opportunity to take account of passengers and airline views on the outcomes and design of the scheme. This stage will involve intensive engagement between the promoter, airlines and the CAA to determine the efficient scope of the project, define key outcomes to be delivered by the scheme, set target costs and an overall cost envelope and develop a regulatory framework.

Once this stage is complete there will continue to be a need to consult with airlines and passengers over the scheme, although the scope of this consultation may need to be restricted to areas where changes in scope are feasible and beneficial to passengers (the terminal design for example may benefit from ongoing consultation with passengers). Where the promoter is being incentivised against a target cost and specification it may be difficult or costly to change scope for example.

The CAA could consider how airlines and passengers views will be taken into account by the promoter after the specification stage by placing a requirement on the promoter to undertake further consultations at key points throughout the delivery of the scheme. The scope of these consultations may need to be targeted at specific issues.

Implementation mechanisms map

The sub-programme framework will add some complexity to the regulatory framework. In addition to the mechanisms being applied to the individual sub-programmes, it will be necessary to undertake a wider range of activities to ensure that the framework is developed and implemented effectively. This will include consulting stakeholders on the overall framework to be adopted, defining the regulatory segmentation of the scheme, ongoing cost and risk monitoring and developing regulatory options to respond to cost escalation.

- Consultation on the proposed regulatory framework will be key to refining the framework and identifying an appropriate regulatory segmentation.
- There may be benefits from enhancing or intensifying the IFS role.
- It will be necessary to develop a regulatory segmentation of the scheme. This can be informed by the characteristics of the sub-programmes and projects within the scheme.

Framework implementation

Preparation

- Consultation on preferred regulatory framework
- Setting principles for cost allocation (between sub-programmes)
- Enhancement of IFS role
- Development of 'shortlist' of project incentive options
- Regulatory segmentation of the scheme into defined sub-programmes and projects and assessment of overall risk and reward exposure for the promoter

Ongoing mechanisms

- Requirement for the promoter to provide ongoing monitoring of cost forecasts
- Requirement for the promoter to provide ongoing monitoring of risks and update of risk register
- Developing regulatory options to respond to cost escalation in the event that cost forecasts exceed the envelope
- Reconciliation of scheme with existing regulatory framework including time periods for review and RAB changes
- Scope variation mechanisms (Core and development capex process)
- Review of CAA organisation and requirements against framework work programme
- Contingency and scenario planning to prepare for potential risks and outcomes (such as cost escalation and promoter failure)
- Ongoing consultation with airlines and passengers

- The promoter may be required to provide regular updates on actual spend and cost forecasts against the scheme cost envelope.
- Where the promoters cost forecasts indicate that the scheme will exceed the cost envelope the CAA could decide to apply further mechanisms.
- This could involve more intensive monitoring of the promoters activities through the appointment of a project representative.

Financial Incentives | **Regulatory Approval** | **Competition** | **Customer Bargaining** | **External Review** | **Control Mechanisms** | **Cost assessment**

The promoter will have responsibility for undertaking ongoing monitoring of costs (both actual and forecast) and risks and provide regular updates to the CAA. Cost forecasts will be compared against the cost envelope to identify potential cost escalation. This will create incentives for the promoter to manage overall costs and provides the CAA with information on project progress.

Enhanced IFS role

Where projects are not financially incentivised against a target cost, the CAA will be reliant on ex-post review of the promoters activities and conduct to identify inefficient costs. This places a burden of proof on the CAA to demonstrate that the decisions and actions on a particular project have been inefficient. To overcome this burden the CAA has developed the IFS mechanism to monitor the performance of the promoter on key projects where stakeholders desire assurance. The scale of the runway scheme could mean that there may be value from enhancing or intensifying the IFS role to strengthen efficiency incentives where financial incentives are not feasible. This could involve seeking a wider range of reviews over the programme or project to assess the scope for efficiency. A potential expanded scope of the IFS role to fully explore the scope for efficiency on a project is provided below.

Expanded role of IFS	Scope of review
Financial review	— Review of financial assumptions and forecasts for major projects
Business plan review	— Assessment of quality and accuracy of the business plan and validity of assumptions
Management review	— Review of organisation, key people and competency, review of governance, management and implementation plan
Risk and value review	— Assessment of quality and thoroughness of risk assessment and impact assessment
Design review	— Review of project design, assessment of option, competency of individuals
Procurement review	— Review of procurement process, management of process, quality of information and bids
Scope management review	— Review of changes from initial design to final delivery, control of process
Time management review	— Assessment of project timings against forecasts and assumptions, investigation of causes for delay
Cost management review	— Review of cost management processes
Contract administration and disputes	— Review of contract management and disputes with contractors

Enhanced IFS role (cont.)

Financial review	Business plan review	Management review	Risk and value review	Design review
— Independent report and analysis of project forecast final cost and revenues. — Deep dive financial analysis into high risk/value contracts. — Identification of major risks/threats to outturn. — Identify specific failures, causes and responsibilities in financial management, forecasting, cost control. — Root cause analysis of fundamental issues impacting outturn.	— Business Plan. Was it a competent and adequate basis for investment? — Validity of fundamental assumptions in the plan. — Business case versus actual: are deviations properly validated, justified and approved against business plan criteria? — Fundamental issues, consequences, who is responsible. — Recommendations for corrective action.	— Review of organisation, key people, performance and competency. — Review of adequacy of execution plan and strategy, identification of shortcomings. — Specific issues and failures in controls, governance and decision making, and who is responsible. — What has gone wrong and essential management action to rectify.	— Deep dive into high risk/high value contracts-identify big ticket risks and whether competently managed. — Are full costs of risks/failures properly recovered from those responsible. — Are the real risks really identified and managed? — Are value management principles effectively and properly applied, implications of failures.	— Deep dive review into design status and competency of design management. — Key issues, failures, consequences and responsibility. — Discover and investigate major design failures, consequences and liabilities. — Who was responsible, have they been held to account? — How to prevent future failures.

Enhanced IFS role (cont.)

Procurement	Scope management review	Time management review	Cost management review	Contract admin and disputes
— Review of procurement processes. — Design of tender. — No. of bidders secured. — Range of procurement options considered and rationale for final selection (fixed prices, time and materials/target price. — Identification of potential economies of scale. — Control of variance and scope. — Quality and evidence of assessment process. — Governance	— Deep dive into scope management and change control. — Specific causes of scope growth and consequences. — Fundamental impacts on project cost and time. — What is the true cost and implications of major scope growth. — Who is responsible, have they been held to account. — Solution and recommendation for major scope growth issues.	— Deep dive into schedule and forecast time to complete. — Fundamental issues causing time delays and who is responsible. — Are contractors' being properly managed and held accountable? — Time consequences of major scope growth.	— Deep dive into high risk/value contracts. — Analysis of current financial status. — Is cost control implemented competently, highlight specific issues and who is responsible. — Red flag suspected conflicts and suspected fraudulent activity.	— Deep dive into high risk/value contracts. — Review contract terms for clarity and risk. — Review claims and disputes, assess liability and risk. — Assess competency in management, red flag conflicts and suspected frauds.

Assessment of sub-programme framework

The sub-programme/project-based approach to the regulation of the new runway capacity scheme may provide a number of advantages over the more traditional programme focussed approach that has been applied by the CAA. It could also have a number of drawbacks primarily related to its potential complexity and greater implementation risk for the promoter and CAA. We highlight some of the key advantages and disadvantages of the approach below.

Advantages

- Allows the regulatory framework to be adapted to the characteristics of individual sub-programmes and projects enabling a greater range of mechanisms and methods to be applied to better suit the economic characteristics of the overall scheme.
- Enables the regulator to focus regulatory scrutiny and oversight on elements of the scheme where cost efficiency is likely to be a more significant challenge.
- Allows the timing of incentive definition and cost assessment to be aligned with the project management timeline and development of more accurate cost forecasts.
- Enables stronger efficiency incentives for parts of the scheme whilst retaining a level of discretion to deal with projects or sub-programmes which are subject to a higher level of risk uncertainty or changes in scope.
- Exposes the promoter to a level of cost risk/reward which may help to motivate general improvements in efficiency. The overall risk and reward exposure could also be tailored based on an shortlist defined by the CAA to mitigate financeability issues.

Disadvantages

- Depending on the level of segmentation the approach may significantly increase the regulatory burden through the number of mechanisms and processes that will need to be applied.
- May create adverse incentives for cost allocation, requiring additional regulatory scrutiny and upfront agreement of allocation principles.
- May create adverse incentives for cost over statement for projects where the promoter anticipates high power financial incentives will be applied.
- Approach requires a range of wider implementation work including consultation on the framework design, project segmentation and principles for cost allocation.
- May create complexity around the interfaces between different sub-programmes where the regulatory framework is different. The programme critical path may cross between different sub-programmes that are covered by different regulatory regimes and incentives for example.
- Some sub-programmes may be made up of diverse projects limiting the ability of the CAA to apply effective incentives for cost efficiency.
- The framework requires the CAA to have confidence in setting ex-ante target costs for a range of complex projects and identifying potential risks and their treatment through notified items.

On balance the sub-programme framework may provide a number of advantages over the CAA's existing regulatory approach and alternatives programme-focussed regulatory models that could be applied. These might come at the expense of the development of a more complex regulatory framework which will also create a range of adverse incentives which would need to be managed by the CAA. The sub-programme approach will also require a range of over-arching work streams to enable the design, management and implementation of the framework which will also create additional complexity and workload for the CAA and stakeholders.

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Section 5.4 Conclusions

Conclusions

Choosing methods and mechanisms

There are a range of incentive mechanisms and cost assessment methods that could be applied to the new runway scheme. A key challenge for the CAA is to determine which of these should be applied, at what level, intensity and time given the economic characteristics of the scheme and its sub-components.

In order to make this decision the CAA should consider the wider strategic aspects of the overall regulatory programme, stakeholders appetite and capacity for risk and reward, innovation and complexity, the potential regulatory burden, and potential wider implications for financeability and cost of capital which might affect overall costs. These issues go beyond the scope of this study, but are important in coming to a conclusion about the most appropriate regulatory mechanisms and methods to apply to the scheme.

Regulatory mechanisms and cost assessment methods cannot be considered in isolation and operate as part of a wider regulatory framework, which should take account of all of these factors. For this reason we have sought to provide an overview of comparative frameworks applied in other regulated sectors and identified the rationale for the approaches that have been developed based on economic characteristics.

A key recommendation from our study is that the CAA should consider what the overall regulatory framework for the scheme should be, its foundation (based on monitoring, costs, incentives, outputs or competition) and design across ***the seven framework dimensions*** we have identified. This will help to guide the overall development of the efficiency mechanisms and methods applied to the scheme.

In making this assessment the CAA might be guided by the ***five project economic characteristics*** we have identified which influence the viability of different regulatory approaches.

This includes the ability to segment the costs of the scheme from existing assets, the ability of the promoter to control costs, the ability of the regulator to assess efficiency, the ability for customers to assess efficiency and the overall financial headroom for risk exposure. These characteristics can be considered both at an overall scheme level or by individual sub-programmes and project components.

Options for the framework

Based on our assessment of the economic characteristics of the new runway scheme as a whole, we have identified ***three broad framework approaches*** which could be viable:

1. **Cost-based framework** applied at a programme level, based on development of the existing framework for Heathrow including greater oversight of the promoter's activities and more intensive ex-post cost assessment to strengthen incentives.
2. **Incentive-based framework** applied at a programme level with financial incentives and some level of exposure to risk and reward for the promoter through the incorporation of a cap and collar dead band. This framework would need to be supported by intensive ex-ante cost assessment and identification of major risks.
3. **Sub-programme/project-based framework** which applies a variety of mechanisms and methods across the scheme based on specific economic characteristics. This could be supported by the application of an overall cost envelope for the scheme to create overall incentives for efficiency and accurate cost forecasting.

Conclusions (cont.)

The cost-based framework would be similar to the existing framework for Heathrow and is therefore likely to be viable with relatively limited wider implications. This framework incorporates several existing efficiency mechanisms and cost assessment methods and has been specifically developed to account for the differentiated and evolving nature of airport capital projects and the high level of information asymmetry between the CAA and the promoter.

This framework could be developed further through applying more intensive ex-post cost assessment mechanisms, and an expanded or intensified role for the IFS to increase the likelihood of identifying inefficiency for ex-post treatment. It may also benefit from changes to the customer consultation process to ensure that it is targeted at passenger focussed elements of the scheme and future passengers' views are taken into account in the consultation process.

An incentive-based frameworks would require an intensive phase of work by the CAA to establish a comprehensive outcome specification for the scheme at the outset. This frameworks would also require a highly intensive ex-ante cost assessment process to ensure that the target cost is set at an efficient level, taking account of significant risks and uncertainties where they can be identified.

The natural evolution of the scheme and potential risks and uncertainties, will mean that there would need to be a large number of risk sharing and error correction mechanisms within the incentive-based framework which would result in a high level of complexity. It is also possible that the scheme would experience ongoing changes in scope and target cost to reflect changes in technical requirements (for example to account for new aircraft types and technology). This would need to be accommodated through a scope change mechanism.

The incentive framework could also be designed to limit the overall risk/reward exposure of the promoter to an appropriate level – given the potential financeability risks of the project – through the use of dead-bands and cap and collar thresholds.

The sub-programme regulatory framework poses a variety of challenges including greater complexity and workload relative to the programme-focussed options. This would include novel issues such as the segmentation of the scheme costs for different regulatory treatment. This framework may also tend to create incentives for cost over-statement and the manipulation of the cost allocation processes if the promoter expects financial incentives to be applied

Despite this the sub-programme framework may offer a number of advantages by enabling greater flexibility and refinement in the application of cost efficiency mechanisms and methods throughout the scheme. The level of segmentation could also be tailored to reflect stakeholders appetite for additional complexity and workload and the variation of the schemes economic characteristics. The application of an overall cost envelope with risk layers for the promoter would also create incentives for the promoter to estimate and manage the overall costs of the scheme effectively.

We have illustrated an example of this approach in our report based on the AC cost estimates and segmentation of the scheme. The CAA could also consider greater or lessor levels of segmentation and different categories of cost.

Overall, our assessment is that both the cost-based and sub-programme approaches are likely to be viable and effective options for the regulation of the scheme. The sub-programme approach could have superior incentive effects but would have major implications for the complexity of the regulatory framework which would need to be considered carefully by the CAA. A programme focused incentive framework is likely to be difficult to implement due to the challenges involved in defining scheme outcomes and efficient costs.

The cost-based programme focused approach arguably has weak efficiency incentives but is well understood, relatively straightforward to implement and can deal with the uncertainty and changes in scope which could occur on the scheme. The sub-programme approach could effectively combine the strengths of the cost and incentive frameworks by creating stronger incentives for some parts of the scheme whilst retaining flexibility and discretion where appropriate. These benefits come at the expense of greater complexity, workload and risk for the CAA and stakeholders.

Conclusions (cont.)

On balance we consider that the sub-programme framework could be the most effective approach for the regulation of the scheme but note that there are a range of wider issues and challenges that the CAA would need to address in order to implement this framework effectively. This includes consulting stakeholders on the approach, setting out principles for cost allocation and identifying an appropriate level of segmentation, setting an appropriate overall contingency and cost envelope for the scheme and identifying an appropriate overall level of risk and reward exposure for the promoter. The CAA would also need to consider implications for its internal organisation and workload including consultancy spending, headcount and cost assessment capacity for example.

The ability to assess an efficient ex-ante cost for individual sub-programmes or projects is a key requirement for the framework. This may be a challenge but is likely to be feasible for at least some elements of the scheme.

An illustration of the sub-programme regulatory framework

We have developed a high level illustrative programme for the regulation of the scheme based on the sub-programme approach. We have used the AC cost forecasts and segmentation to provide an illustration of how the sub-programme approach could be implemented and the range of mechanisms and methods that could be applied by the CAA under this framework.

We have assessed the economic characteristics of each sub-programme and grouped them into regulatory segments. This has resulted in six segments with different mechanisms and methods for each plus a range of overarching mechanisms and activities which would need to be undertaken to implement the framework. The CAA could consider a higher or lower level of segmentation.

The specification sub-programme is a key part of the regulatory framework and is likely to provide opportunities to identify 'win-win' efficiencies through refining the scope of the scheme, whilst also facilitating a discussion over the most appropriate cost-quality trade-off. This sub-programme will also be key to identifying an appropriate regulatory segmentation and the identification of elements of the scheme where financial incentives could be applied.

The mechanisms and methods applied to each segment are differentiated reflecting the economic characteristics of the sub-programme, but generally we suggest that each segment is subject to negotiation with customers at the specification stage to define outcomes and estimate costs.

Costs may be further assessed by the CAA ex-ante based on various assessment methods including a reconciliation with AC forecasts, the identification of key cost drivers, benchmarking and expert review. Risks and uncertainties should also be identified by the promoter for each segment to enable the CAA to develop a regulatory policy. This would normally require the CAA to specify how the target cost and cost envelope would change in the event that a specified risk occurs.

For some regulatory segments such as the runway, the CAA may be able to identify a target cost against which the promoter could be incentivised through a cap and collar 'dead band' or thresholds set at different levels to reflect the appropriate strength of incentive as appropriate. Where actual costs fall outside of this 'dead band' the CAA could undertake an ex-post review to determine the reason for under or out-performance and determine an appropriate regulatory treatment of costs.

The risk assessment for each sub-programme could result in a number of 'notified items' which would need to be monitored as the scheme progresses. A change in assumption associated with a notified item would then result in a prescriptive change in the target cost for the element of the scheme.

For other regulatory segments such as the Terminal – the CAA may decide that it is not appropriate to set financial incentives as the risks, uncertainties and potential changes in scope are likely to be too great. However there may be opportunities for stronger incentives at the project level.

Conclusions (cont.)

In some cases it may also be possible for the CAA to identify appropriate output incentives. These might be linked with the successful delivery of projects or sub-programmes by a given deadline (i.e. Triggers), but wider output metrics could also be identified in some cases supported by consultation with airlines – such as the achievement of operational outcomes for service quality, security flow rates and other factors.

Some of the sub-programmes and projects are non-customer facing (e.g. plant and land preparation projects). In these cases there may be limited benefits from customer negotiation over the design of the project. In others such as the terminal sub-programme customer consultation in planning and design will continue to be useful for enhancing the outcomes and design of the scheme and should be undertaken at an early stage by the promoter. Ongoing opportunities for customer engagement as the scheme progresses should also be provided.

Where sub-programmes are not subject to financial incentives there may be a need for more intensive oversight by the CAA to increase the effectiveness of ex-post financial incentives. This could be achieved through several mechanisms.

The role of the IFS could be expanded or intensified to increase the likelihood of identifying inefficient costs. For example the IFS could provide active investigation of specific projects where the promoter's incentives for efficiency are thought to be weak. This could include a review of areas of the promoters project management processes and activities such as the design, option development, procurement, risk management, cost and contract control activities for specific projects.

The CAA could also set out a set of principles for project procurement to ensure that the promoter achieves value for money. For example the CAA could require the promoter to seek approval, or notification of any project procurement which does not meet a minimum standard (such as securing a minimum of two bidders).

In addition to these sub-programme focused mechanisms, the CAA could also set an overall cost envelope for the scheme which would directly expose the promoter to any cost escalation beyond the envelope.

This envelope could incorporate a contingency allowance to account for major risks and uncertainties. The CAA could also apply 'risk layers' to optimise the promoters risk exposure at different levels of cost escalation to manage impacts on financeability. The cost envelope could be linked to the promoters original cost estimate for the AC process for example, taking account of cost savings achieved in the specification stage.

The diversity of projects within some sub-programme may warrant further segmentation at a project level to identify projects which can be targeted with specific efficiency mechanisms and financial incentives. This may also enable the CAA to align the framework to the promoter's project management process and apply mechanisms at appropriate points when greater information on costs and outcome specification is available.

Implementation of the programme

The mechanisms and methods described in the sub-programme approach are focused on individual parts of the scheme. In order to implement the programme the CAA will also need to undertake programme-based work streams and develop mechanisms to account for wider issues. In some cases these work streams will also be important for encouraging efficient behaviour.

We have highlighted some of the key tasks and work streams that would need to be undertaken to implement the regulatory framework as follows:

— **Undertake consultation with stakeholders over the regulatory framework**, including the available options and CAA's preferred approach. This could include an illustration of the sub-programme framework comparing the benefits and drawbacks relative to the CAA's existing framework.

— **Require the promoter to update the business plan and cost forecasts for the scheme** and provide an initial scheme cost segmentation, bottom up output specification, identification of risks and reconciliation with the AC cost estimate. This will provide a starting point to consider the potential segmentation and regulatory framework for the scheme.

Conclusions (cont.)

- **Require the promoter to undertake a consultation with passengers and airlines on the scheme outcomes and design options** (the specification stage). This should include assessing the outcome and scope of the scheme and identifying options for major cost reduction, of for example 10% and 20% of the cost envelope. This will be a key opportunity to identify cost savings and define the desired outcomes and trade-offs for the scheme.
- **Develop a sub-programme and project-based segmentation of the scheme**-based on an assessment of the promoter's updated business plan, scheme breakdown and the identification and assessment of project characteristics. This report provides an indicative segmentation based on the AC reports. The CAA could consider alternatives with greater or lessor levels of segmentation reflecting the need for stronger efficiency incentives and capacity for additional complexity and workload.
- **Develop mechanisms and methods for each sub-programme** based on the project economic characteristics and overall consideration of the strength of incentives, risk and regulatory complexity. This could involve a range of different approaches being applied to the scheme including the application of financial incentives where the CAA is confident of setting an efficient target cost, identifying risks and accommodating changes in efficient scope.
- **Develop principles for cost allocation** to be adhered to by the promoter to ensure that the scheme segmentation and separate regulatory treatment is effective, and commit to an ex-post review of the promoters adherence to these principles.
- **Consider how the scheme framework will be reconciled with the framework for the existing assets**, including the timing and frequency of cost assessments and RAB adjustments and linkages between the scheme and existing regulatory processes.
- **Develop a 'shortlist' of options for the regulatory treatment of projects** and sub-programmes to give the promoter clarity on the range of risk and reward it could be exposed to on any particular project.
- **Consider the potential expansion and/or intensification of the role of the IFS** including potential oversight of procurement and project management processes for example and the types of project where oversight is likely to be most beneficial. This could require a review of existing IFS outputs.
- **Estimate an overall cost envelope for the scheme**. This could provide a contingency allowance to account for risks and uncertainties and define risk layers to ensure that the promoter is exposed to cost escalation beyond the envelope. This could be linked to the promoters original cost forecasts and AC estimates for example.
- **Consider the overall level of risk/reward for the scheme** and the proportion of cost which could be subject to financial incentives. There may be practical limits to the level of risk exposure that can be applied to the promoter. There may also be limits to the level of cost escalation that can be recovered from passengers through charges.
- **Place a requirement on the promoter to provide a regular update of scheme related expenditure against budget/target costs**, and forecast cost to completion for the overall scheme. Require the promoter to give notification where scheme costs are expected to exceed the cost envelope.
- **Place a requirement on the promoter to undertake a risk assessment as part of the development and update of the business plan and specification stage**. This will identify significant risks within each segment of the scheme. The CAA may provide a prescriptive regulatory treatment for those risks. The promoter could also be required to maintain a risk register and give notification when new risks are identified during delivery.
- **Develop options for intervention in the event that the scheme costs are forecast to exceed the cost envelope**. This could involve a range of contingent mechanisms such as direct intervention in the management of the project through the appointment of a Project Representative, a requirement for the promoter to identify cost savings or a review of the promoters activities and the reasons for cost escalation.

Conclusions (cont.)

- **Undertake contingency planning for potential scheme outcomes.** Significant cost escalation above the scheme cost envelope and risk layers could ultimately threaten the viability of the promoter and the delivery of the scheme. In this event the CAA would need to consider a course of action to protect the interest of passengers.
- **Develop a mechanism to enable ongoing changes in project scope** where mutually agreed between the promoter, airlines and the CAA. This mechanism could be based on the existing core and development capex mechanism, but would also need to account for the impact of scope changes on new regulatory mechanisms, target costs and the overall scheme cost envelope The CAA may also need to ensure that future airlines and passengers interests are represented in this process.
- **Develop an overall regulatory work plan** taking account of the level of segmentation and nature of the mechanisms and methods applied in each sub-programme. Based on this work-programme **consider the overall requirements for the CAA** to deliver the framework effectively. This will involve an assessment of headcount, technical skills and the range and type of consultancy expertise that would be required. Under the sub-programme framework there is likely to be a need for greater expertise and support in cost assessment for example.
- **Consider the need for ongoing consultation** of airlines and passengers by the promoter and the main opportunities for this through the duration of scheme delivery. The main opportunity for consultation will occur in the specification stage. Some parts of the scheme will benefit from ongoing engagement with stakeholders, on the other hand once the outcome specification and target costs/envelope for the scheme is set it may be difficult to facilitate changes.

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Appendix 1
Airport expansion schemes

Introduction to Appendix 1

This Appendix provides an overview of the three schemes that have been shortlisted by the Airports Commission. Our assessment of their economic characteristics and key risks has been directly informed by this information. For each option we provide a brief summary, highlight key risks 'hotspots' and describe a high level programme chart.

The appendix includes:

— Description of three expansion schemes.

— Heathrow: Risk hotspots.

— Gatwick: Risk hotspots.

— Heathrow North West Runway High Level Programme.

— Heathrow Extended Northern Runway High Level Programme.

— Gatwick Second Runway High Level Programme

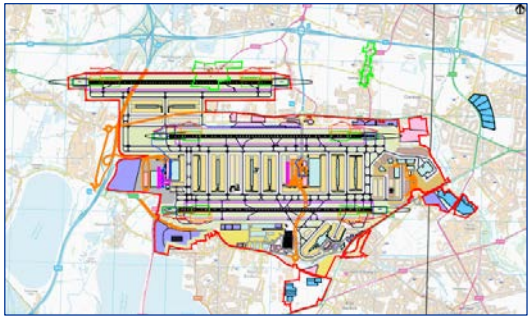
— Capex composition.

— LHR-NWR – Assessment of need scenario costs.

— LHR-ENR – Assessment of need scenario costs.

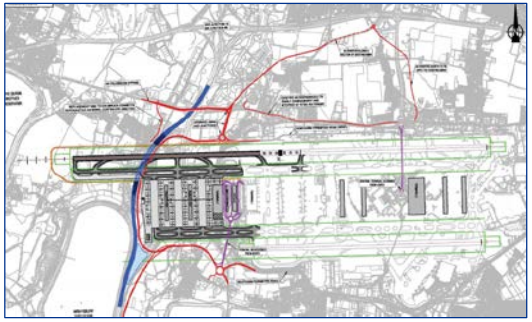
— LGW-SR – Assessment of need scenario costs.

Three expansion schemes



Heathrow North West Runway

The Heathrow North-West scheme proposes an entirely separate runway located to the North West of the current Heathrow facility. This runway is 3,500m long and about 2 miles north of the current north runway. The Airports Commission stated this scheme delivers more substantial economic and strategic benefits than any of the other shortlisted schemes, strengthening connectivity for passengers and freight users and boosting the productivity of the UK economy.



Heathrow Extended Northern Runway

The extended Northern runway design was developed by Heathrow Hub Limited. It proposes to extend Heathrow's currently Northern Runway to a total length of 6,800m. Within this would be the creation of a central buffer zone to create two in-line runways, allowing for aircraft to land on one and take off on the other at any given time. The benefits of this option include moving the noise footprint to the west, reduced costs relative to the NWR option and less impact on local communities. The runway scheme would also require the rerouting of the M25.

Gatwick Second Runway

Gatwick submitted a scheme design for a new 3.4km runway located 1,045m to the south of the existing runway. The distance between the runways would enable independent operation (i.e. they can be used for either arrivals or departures.)

The runway would be served by an additional terminal building, with Gatwick estimating an overall capacity 90 million passengers by 2050. In addition Gatwick proposes new cargo and aircraft maintenance facilities, new hotels, new Gatwick Gateway, new automated people mover, diversion of River Mole and Crawter's Brook and A23 diversion.

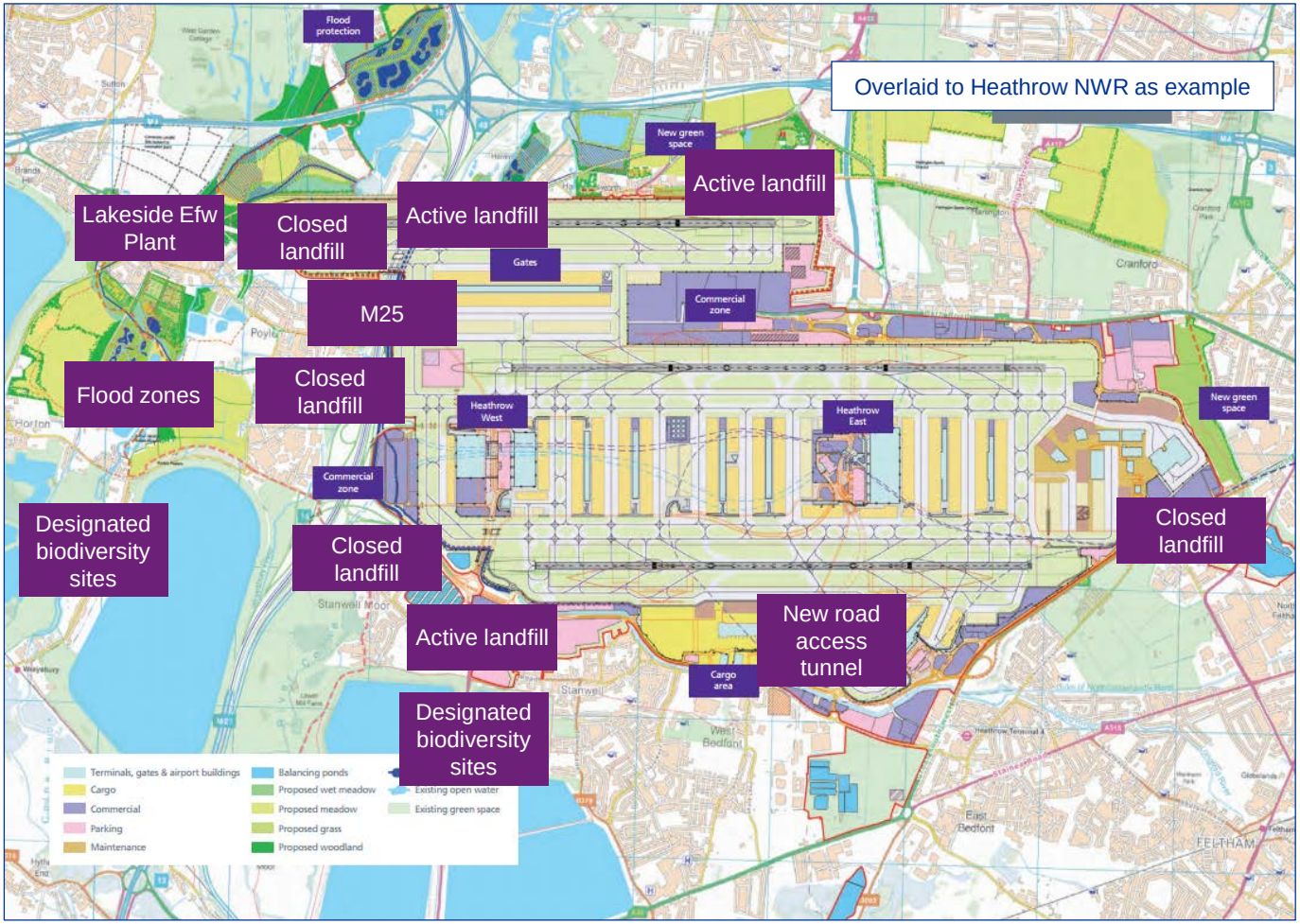
Heathrow: Risk hotspots

General risk

- Land acquisitions
- Supply chain capacity c/w other UK and worldwide mega-projects
- Securing planning permission
- Compensation to noise impacted communities

Heathrow specific risk

- M25 tunnel
- Flood risks
- Noise affected populations
- European rules on air quality
- Runway concept (ENR)
- Transfer scheme (ENR)
- Replacement of energy from waste plant (NWR)
- Housing (NWR)



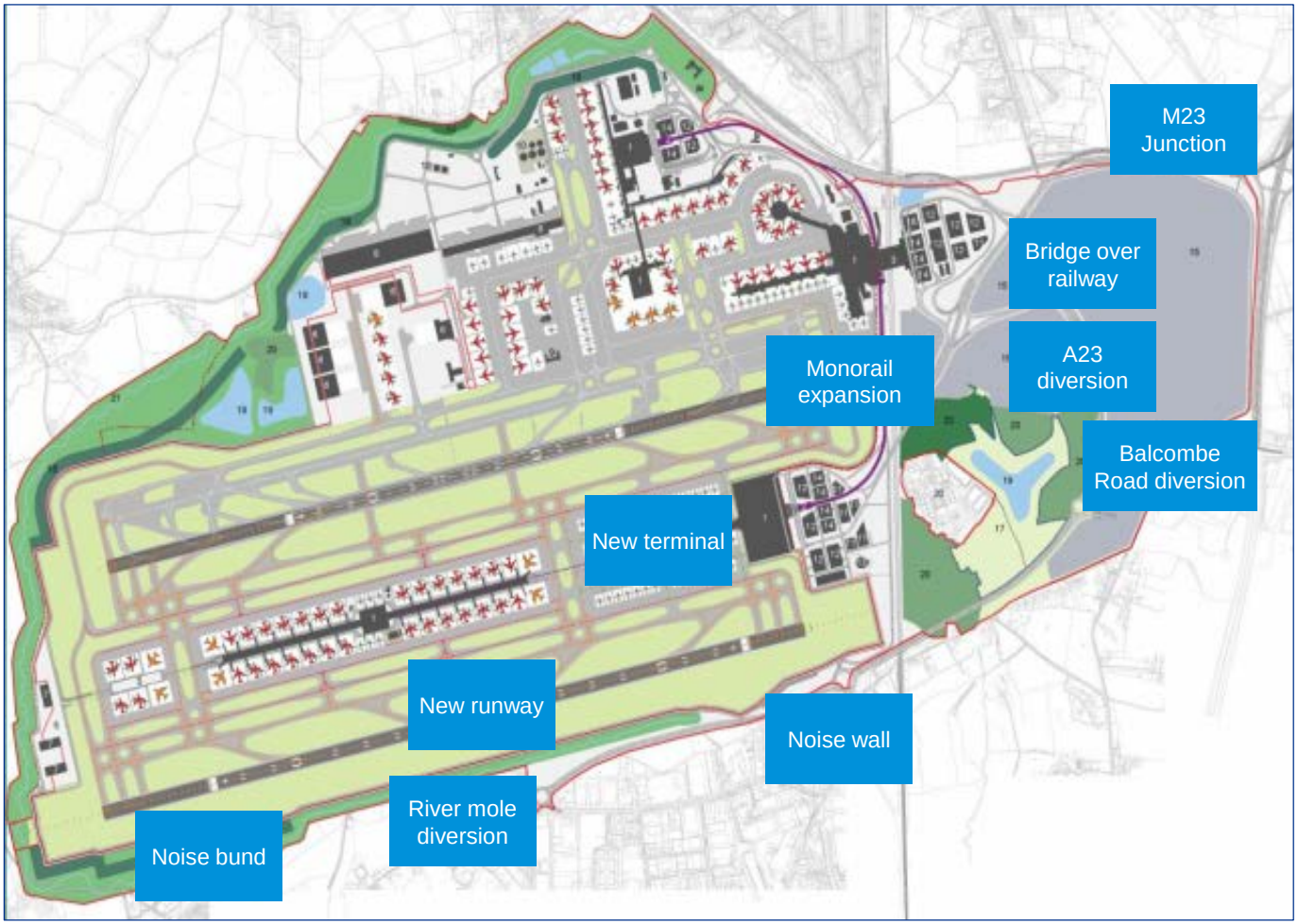
Gatwick: Risk hotspots

General risk

- Land acquisitions
- Supply chain capacity c/w other UK and worldwide mega-projects
- Securing planning permission
- Compensation to noise impacted communities

Gatwick specific risk

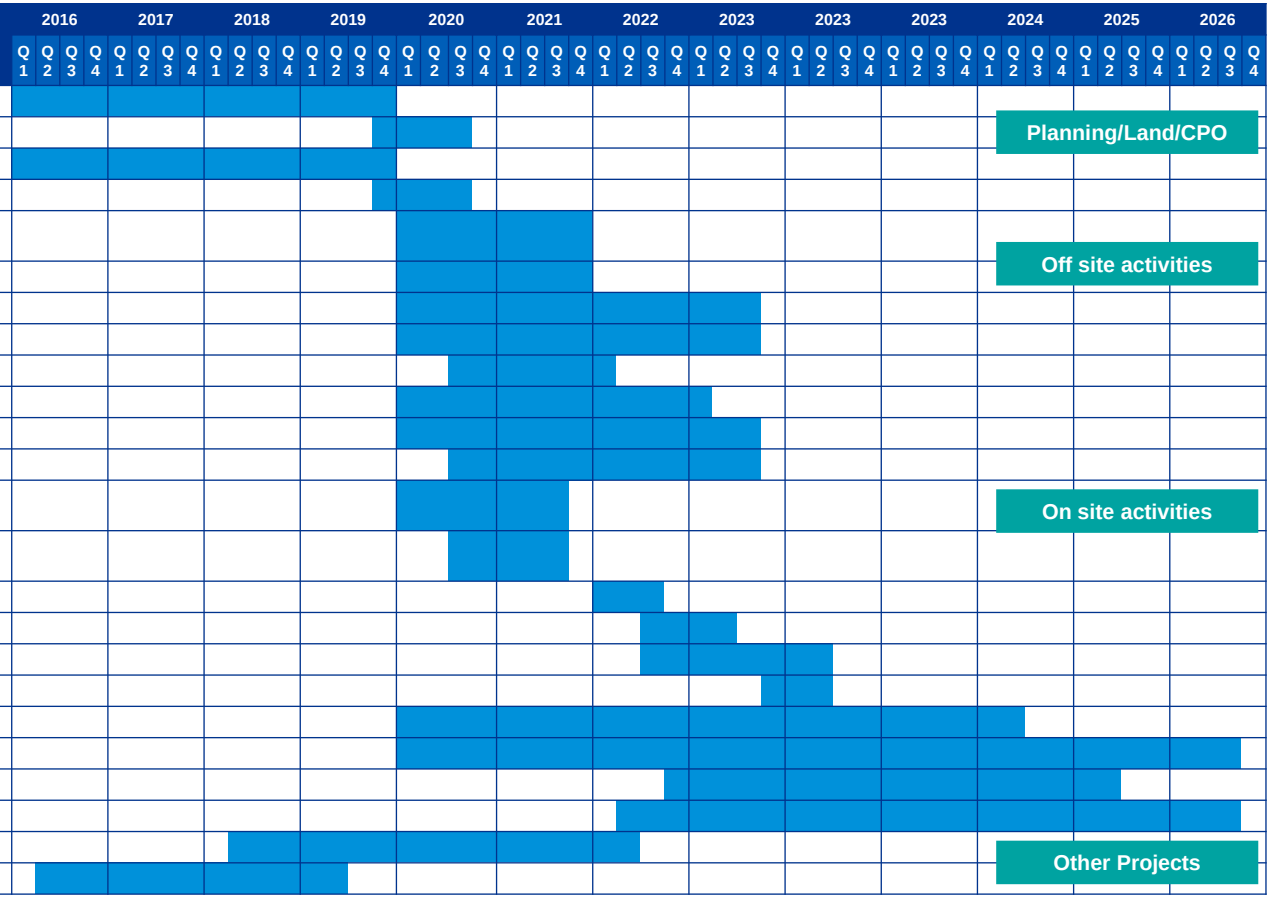
- A23 diversion
- Rail crossing bridge
- River mole diversion
- Flood risk



Appendix 1 – Airport expansion schemes

LHR-NWR high level programme

Activity	Start	Finish
Planning and Outline Design	05-Jan-16	20-Dec-19
Discharge Conditions	25-Oct-19	29-Jul-20
Land Acquisition	05-Jan-16	20-Dec-19
CPO	25-Oct-19	29-Jul-20
Construction of new Hotels/Immigration Centre	05-Jan-20	24-Dec-21
Construction of new Waterside	05-Jan-20	24-Dec-21
Construction of Waste/Energy Plant	05-Jan-20	26-Jul-23
Construction of M25 tunnels and diversion	05-Jan-20	25-Jul-23
Construction of Poyle bypass	30-Jul-20	03-Feb-22
River diversions, structures, flood storage	06-Jan-20	10-Jan-23
Enviromental mitigations	06-Jan-20	05-Oct-23
A4 Diversion	03-Jul-20	21-Oct-23
Enabling works in areas not requiring CPO or asset relocation	06-Jan-20	29-Aug-21
Enabling works in areas requiring CPO but asset relocation not required	30-Jul-20	09-Aug-21
Demolition of hotels/immigration centre	10-Jan-22	20-Sep-22
Demolition of Waterside	27-Jul-22	08-May-23
Demolition of Waste/Energy plant	27-Jul-23	26-Apr-24
Demolition of A4	01-Nov-23	03-May-24
Earthworks/Remediation	06-Jan-20	22-Apr-24
Site Wide Infrastructure	06-Jan-20	29-Jul-26
Third Runway	07-Oct-22	27-Jun-25
TTS and baggage systems	13-May-21	02-Sep-26
WRATH construction	16-May-18	24-Jun-21
Construction of Over Head Line diversion	06-Jun-16	31-May-19



Source: Heathrow, Airports Commission Initial Assessments – Consultation, A3 Appendices, February 2015.

Appendix 1 – Airport expansion schemes

LHR-ENR high level programme

Activity	Start End	End Date	2015				2016				2017				2018				2019				2020				2021				2022				2023			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Heathrow ENR Phase 1	**01-Jul-15**	**31-Mar-23**																																				
Davies Commission reports	01-Jul-15																																					
Government Determines Policy	01-Jul-15	31-Dec-15																																				
Planning and Permitting	**01-Jul-15**	**03-Jul-18**																																				
Preliminary Design	01-Jul-15	30-Dec-16																																				
Enviromental Statement	01-Jul-15	30-Dec-16																																				
Planning (DCO)	02-Jan-17	03-Jul-18																																				
Compulsory Purchase	02-Jan-17	03-Jul-18																																				
Other Orders	02-Jan-17	03-Jul-18																																				
Design Development and Procurement	**02-Jan-17**	**25-Sep-18**																																				
Design Development	02-Jan-17	20-Dec-17																																				
Approval	01-Jan-18	26-Feb-18																																				
Procurement	27-Feb-18	26-Sep-18																																				
Construction and Commissioning	**25-Sep-18**	**31-Mar-23**																																				
Construction	25-Sep-18	20-Sep-22																																				
Commissioning	03-Oct-22	31-Mar-23																																				

Assumes outcome of commission is sufficiently clear to progress

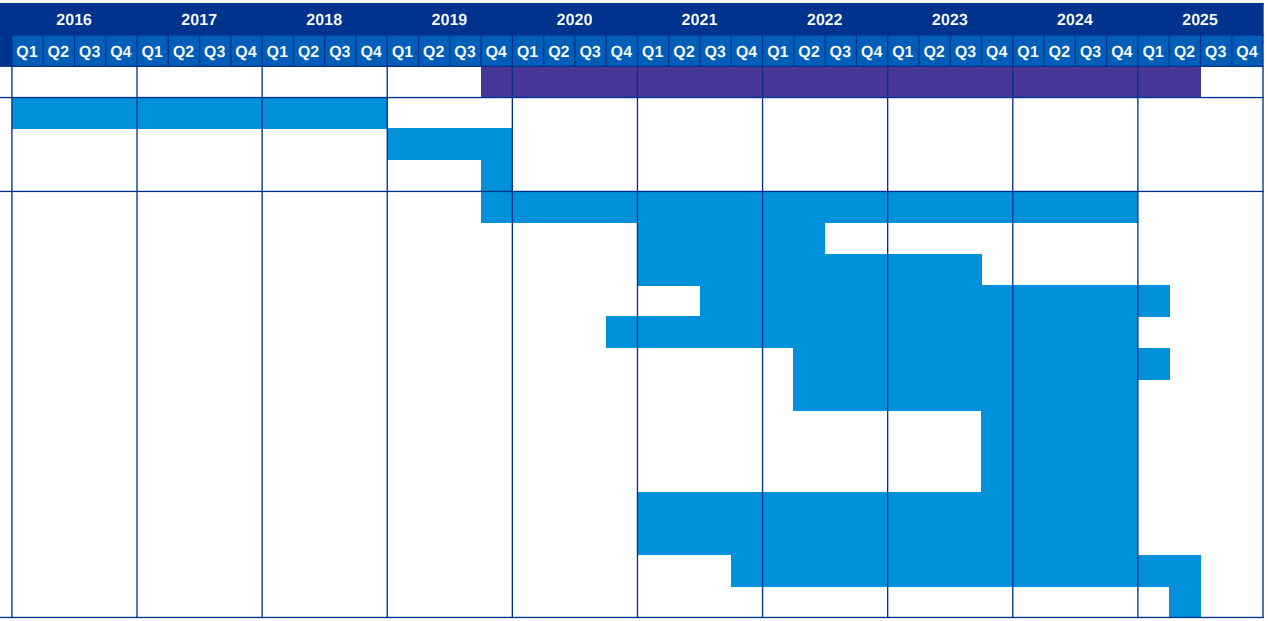
Design and procurement at risk

Source: Heathrow Hub, Submission to Airports Commission – Long Term Options, July 2013.

Appendix 1 – Airport expansion schemes

LGW-SR high level programme

Activity	Start End	End Date
Gatwick R2 Phase 1	**09-Dec-19**	**30-May-25**
Preparation and DCO application		
Government Review of DCO		
DCO Approval	09-Dec-19	
Enabling works	09-Dec-19	16-Dec-24
River Diversion Works	04-Mar-21	11-Apr-22
Earthworks	04-Mar-21	25-Sep-23
Airfield	09-Sep-22	20-Feb-25
Airside Facilities	01-Oct-20	22-Oct-24
Midfield Terminal and Piers	20-Apr-22	24-Mar-25
Surface Access	20-Apr-22	30-Oct-24
MSCP and Access Roads – Midfield Terminal	06-Nov-23	05-Nov-24
South Terminal Improvements	05-Oct-23	20-Dec-24
Utilities	04-Mar-21	11-Dec-24
Energy Centre	04-Mar-21	07-Mar-24
Operational Commissioning	01-Oct-20	30-May-25
Operational Handover	30-Apr-25	30-May-25

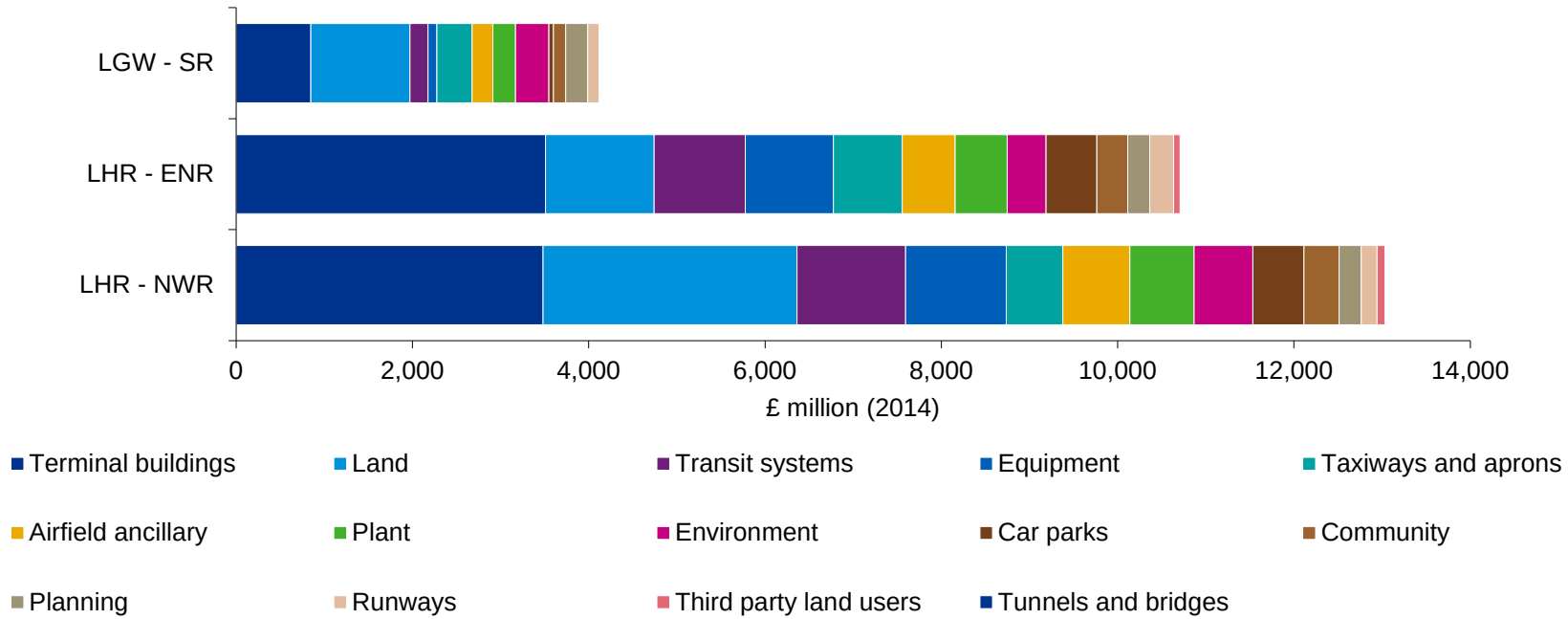


Source: Gatwick Airport, Bechtel – Project Execution Plan, January 2015.

Scheme capex composition

There are major differences in the overall costs and cost composition of the three schemes. The LHRNWR project is the highest cost at around £13 billion relative to around £5 billion for LGW2R (not including surface access and contingency costs). The largest elements of the scheme cost are land, terminal buildings, taxiways and aprons and transit systems.

Airports Commission estimates of scheme cost



Source: Scheme capex excludes adjustments for optimism bias and risk.

LHR-NWR – Assessment of need scenario costs

£m, 2014 prices			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Total	%	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Airport infrastructure																								
Planning	250	*1%*	50	50	50	50	50																	
Terminal buildings	3,482	*17%*									266	665	972	962	370	247								
Plant	729	*4%*						17	34	69	98	143	159	141	41	27								
Tunnels and bridges	0	*0%*																						
Transit systems	1,232	*6%*						6	13	25	112	241	334	320	109	72								
Runways	180	*1%*						9	18	36	36	36	27	18										
Taxiways and aprons	642	*3%*						20	41	82	82	82	73	87	105	70								
Equipment	1,143	*6%*									59	147	233	287	250	167								
Land	2,880	*14%*						144	288	576	576	576	432	288										
Airfield ancillary	758	*4%*						34	68	136	140	146	117	87	18	12								
Car parks	577	*3%*									14	36	58	83	86	84	60	40	30	4	13	26	26	17
Third party land users	91	*0%*						5	9	18	18	18	14	9										
Environment	669	*3%*						33	67	134	134	134	100	67										
Community	400	*2%*						20	40	80	80	80	60	40										
Optimism bias	2,301	*11%*						52	104	208	291	415	464	430	176	122	11	7	5	1	2	5	5	3
Risk	2,558	*12%*						58	116	231	323	461	516	478	196	136	12	8	6	1	3	5	5	3
Total – Airport	17,892	*87%*	50	50	50	50	50	398	798	1,595	2,229	3,180	3,559	3,297	1,351	937	83	55	41	6	18	36	36	23
Cumulative – Airport			50	100	150	200	250	648	1,446	3,041	5,270	8450	12009	15306	16,657	17,594	17,677	17,732	17,773	17,779	17,797	17,833	17,869	17,892
Non-airport infrastructure																								
Roads	2,234	*11%*								23	156	616	850	590										
Rail	488	*2%*									163	163	163											
Total – RR	2,722	*13%*								23	318	779	1,012	590										
Cumulative – RR										23	341	1,120	2,132	2,722										
Total – ALL	20,614	*100%*	50	50	50	50	50	398	798	1,618	2,547	3,959	4,571	3,887	1,351	937	83	55	41	6	18	36	36	23
Cumulative – All			50	100	150	200	250	648	1,446	3,064	5,611	9,570	14,141	18028	19,379	20,316	20,399	20,454	20,495	20,501	20,519	20,555	20,591	20,614
Cumulative – All %			*0%*	*0%*	*1%*	*1%*	*1%*	*3%*	*7%*	*15%*	*27%*	*46%*	*69%*	*87%*	*94%*	*99%*	*99%*	*99%*	*99%*	*99%*	*100%*	*100%*	*100%*	*100%*

LHR-ENR – Assessment of need scenario costs

£m, 2014 prices			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Total	**%**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Airport infrastructure																								
Planning	250	*1%*	50	50	50	50	50																	
Terminal buildings	3,509	*17%*									269	672	982	971	369	246								
Plant	590	*3%*									50	125	179	168	41	27								
Tunnels and bridges	0	*0%*																						
Transit systems	1,034	*5%*						3	5	11	78	179	259	269	138	92								
Runways	269	*1%*						13	27	54	54	54	40	27										
Taxiways and aprons	781	*4%*						31	61	123	132	145	127	104	35	23								
Equipment	998	*5%*									47	117	190	246	239	159								
Land	1,234	*6%*						62	123	247	247	247	185	123										
Airfield ancillary	600	*3%*						30	60	120	120	120	90	60										
Car parks	578	*3%*									15	36	58	83	86	84	60	40	30	4	13	26	26	17
Third party land users	74	*0%*						4	7	15	15	15	11	7										
Environment	440	*2%*						22	44	88	88	88	66	44										
Community	351	*2%*						18	35	70	70	70	53	35										
Optimism bias	1,882	*9%*						33	65	131	213	336	403	385	163	114	11	7	5	1	2	5	5	3
Risk	2,091	*10%*						36	73	145	237	374	448	427	182	126	12	8	6	1	3	5	5	3
Total – Airport	14,681	*71%*	50	50	50	50	50	252	500	1,004	1,635	2,578	3,091	2,949	1,253	871	83	55	41	6	18	36	36	23
Cumulative – Airport		*0%*	50	100	150	200	250	502	1,002	2,006	3,641	6,219	9,310	12,259	13,512	14,383	14,466	14,521	14,562	14,568	14,586	14,622	14,658	14,681
Non-airport infrastructure																								
Roads	2,235	*11%*								23	156	616	850	590										
Rail	488	*2%*								163	163	163												
Total – RR	2,722	*13%*								185	318	779	850	590										
Cumulative – RR										185	503	1,282	2,132	2,722										
Total – ALL	17,403	*84%*	50	50	50	50	50	252	500	1,189	1,953	3,357	3,941	3,539	1,253	871	83	55	41	6	18	36	36	23
Cumulative – All			50	100	150	200	250	502	1,002	2,191	4,144	7,501	11,442	14,981	16,234	17,105	17,188	17,243	17,284	17,290	17,308	17,344	17,380	17,403
Cumulative – All %			*0%*	*1%*	*1%*	*1%*	*1%*	*3%*	*6%*	*13%*	*24%*	*43%*	*66%*	*86%*	*93%*	*98%*	*99%*	*99%*	*99%*	*99%*	*99%*	*100%*	*100%*	*100%*

LGW-SR – Assessment of need scenario costs

£m, 2014 prices			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Total	%	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Airport infrastructure																								
Planning	250	*1%*	50	50	50	50	50																	
Terminal buildings	848	*4%*											42	127	170	212	170	127						
Plant	255	*1%*						8	24	32	40	32	29	14	19	24	19	14						
Tunnels and bridges	0	*0%*																						
Transit systems	203	*1%*											10	30	41	51	41	30						
Runways	126	*1%*						6	19	25	32	25	19											
Taxiways and aprons	400	*2%*						15	45	60	75	60	50	15	20	25	20	15						
Equipment	100	*0%*						0	1	1	1	1	6	14	19	24	19	14						
Land	1,125	*5%*						56	169	225	281	225	169											
Airfield ancillary	237	*1%*						8	24	31	39	31	28	12	16	20	16	12						
Car parks	52	*0%*											3	8	10	13	10	8						
Third party land users	10	*0%*						0	1	1	1	1	1	1	1	1	1	1						
Environment	380	*2%*						19	57	76	95	76	57											
Community	140	*1%*						7	21	28	35	28	21											
Optimism bias	697	*3%*						22	65	86	108	86	78	40	53	66	53	40						
Risk	775	*4%*						24	72	96	120	96	87	44	59	74	59	44						
Total – Airport	5,598	*27%*	50	50	50	50	50	165	498	661	827	661	600	305	408	510	408	305	0	0	0	0	0	0
Cumulative – Airport			50	100	150	200	250	415	913	1,574	2,401	3,062	3,662	3,967	4,375	4,885	5,293	5,598	5,598	5,598	5,598	5,598	5,598	5,598
Non-airport infrastructure																								
Roads	510	*2%*										126	126				129	129						
Rail	0	*0%*																						
Total – RR	510	*2%*					0	0	0	0	0	126	126	0	0	0	129	129						
Cumulative – RR							0	0	0	0	0	126	253	253	253	253	381	510						
Total – ALL	6,108	*30%*	50	50	50	50	50	165	498	661	827	787	726	305	408	510	537	434	0	0	0	0	0	0
Cumulative – All			50	100	150	200	250	415	913	1,574	2,401	3,188	3,915	4,220	4,628	5,138	5,674	6,108	6,108	6,108	6,108	6,108	6,108	6,108
Cumulative – All %			*1%*	*2%*	*2%*	*3%*	*4%*	*7%*	*15%*	*26%*	*39%*	*52%*	*64%*	*69%*	*76%*	*84%*	*93%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

High costs elements of scheme capex

For each of the schemes we have set out the five most significant cost elements as recorded at a sub-programme level and their associated activities. These costs are based on the Airports Commission costs forecast reports.

Across all the options Terminals, Piers & Satellites and Project/Design Team Fees are all significant cost elements. In addition for both LHR projects the baggage handling system and for LHR NWR and LGW 2R the purchase of land will be highly important. Other high cost elements are advanced enabling works, clearing site and preparation at LHR ENR and Taxiways & Aprons at LGW 2R. The scale of these projects means that they are likely to be particularly important for the overall costs of the scheme.

	Sub Project	Activities associated	£ (2014)
LGW 2R	Terminals	New terminal, new terminal – Fit out, remote pier	£1,064m
	Project/Design Team Fees	Project/Design team fees	£848m
	Land Purchase	PCE, based on advisors estimates	£846m
	Piers & Satellites	Contact pier, remote pier	£839m
	Taxiways & Aprons	Taxiways, end around taxiway (EAT's) western end, head of stand roads and footway, rapid exit taxiway, runway crossing, apron to new aircraft maintenance units, Code C taxi lanes, Code E taxi lanes, GSE parking areas	£522m
LHR NWR	Purchase of Land & Existing Infrastructure	Residential property compulsory purchase, commercial property compulsory purchase, land purchase	£2,226m
	Project/Design Team Fees	Project/Design team fees	£1,668m
	Piers & Satellites	Satellite substructure, superstructure, fit out, T2E satellite	£1,560m
	Terminals	T6; substructure, superstructure, fit out	£1,559m
	Baggage Handling Systems	Baggage equipment terminal, baggage equipment satellite	£730m

Note: Optimism bias and risk adjustment not included.
Source: Jacobs, 2015.

High cost elements at LHR NWR

In order to establish a more complete view of scheme capex we have also reviewed and highlighted all sub-projects proposed by LHR NWR with an estimated cost over £150 million and set them out below. Each of these elements of cost could be reviewed and assessed using different methods.

Sub Project	Activities associated	£ (2014)	Percent of Scheme Capex
Purchase of Land & Existing Infrastructure	Residential property compulsory purchase, Commercial property compulsory purchase, Land purchase	£2,226m	*13%*
Project/Design Team Fees	Project/Design team fees	£1,668m	*9%*
Piers & Satellites	Satellite substructure, superstructure, fit out, T2E Satellite	£1,560m	*9%*
Terminals	T6; substructure, superstructure, fit out	£1,559m	*9%*
Baggage Handling Systems	Baggage equipment terminal, baggage equipment satellite	£730m	*4%*
TTS Station/Deport	Stations, stations fit out, maintenance base structure, maintenance base fit out	£540m	*3%*
Car Parks	Surface & Multi Storey Parking	£500m	*3%*
TTS Tunnels	Tunnels civils, fit out and additional cars	£412m	*2%*
Community impacts	Noise insulation and compensation, community infrastructure levy and other	£348m	*2%*
Access Roads	Airside roads and tunnels	£333m	*2%*
Taxiways & Aprons	Taxiways and taxi lanes	£314m	*2%*
Baggage Tunnels	Tunnel civils and fit out	£251m	*1%*
Decants/Demolitions	Site clearance and decants/demolitions	£239m	*1%*
Fixed links, VCC, Rotunda/Nodes. PCA and Airbridges	VCC, airbridge, PCA, nodes and fixed links to new stands	£210m	*1%*
Stands	Code C/D stands, contact stands to satellites and remote stands	£199m	*1%*
Utilities	Utilities	£172m	*1%*
Enabling works	Earthworks, site levelling and soil remediation/stabilisation	£155m	*1%*

KPMG

Appendix 2
Efficiency mechanism case studies

Introduction to Appendix 2

In this appendix we describe nine case studies of regulatory efficiency mechanisms. The case studies referred to in the main body of the text include:

- Thameslink, Project Representative
- Xoserve, Funding Governance and Ownership
- Crossrail, Project Governance
- Ofwat, Customer Challenge Group
- Phoenix Gas, Ex ante incentives
- Thames Tideway Tunnel, Risk sharing
- ORR, Enhancement Cost Adjustment Mechanism
- Channel Tunnel, Competition
- Thames Tideway Tunnel, Contract incentive mechanisms

Thameslink, Project Representative

The Department for Transport (DfT) became the sponsor of the Thameslink programme in 2005, taking over from the Strategic Rail Authority, and Network Rail is the main delivery body.

A specific 'regulatory protocol' defines how they work together to implement the capital programme. This is a departure from the usual arrangements for Network Rail's infrastructure programmes, where the Office of Rail Regulation is responsible for regulating efficiency and safety. The protocol gives the DfT a more direct monitoring role, designed to reduce its exposure to the risk of the programme overrunning.

The DfT expanded the programme management role of the Thameslink systems integration team, and established an 'interface steering group' to address interfaces between the infrastructure and other department-led programmes.

The Thameslink programme board meets every month and includes all stakeholders. The board has no formal powers and its role is predominantly to provide advice, coordination and ensure all parties are up to date.

Thameslink has appointed external consultants to review cost estimates but this did not include any assessment of project management.

Crossrail adopted a different approach to project governance by appointing a Project Representative: an independent body within the company delivery structure which attends all meeting on behalf of the DfT. The project representative provide a monitoring role to ensure that the DfT is well informed about the overall progress of the scheme.

Focus on project representatives

The National Audit Office has commented on the role of the P-REP in challenging costs: 'There was strong internal and external challenge to Crossrail Limited from the Project Representative, a team of senior engineers that reviews and challenges Crossrail Limited's work on behalf of sponsors, and from the Major Projects Review Group in the Cabinet Office.'

— The Project Representative reviews and provides commentary on Crossrail Limited's regular progress reports, as well as carrying out focused reviews of particular aspects of the programme.

— These reports help the Department and Transport for London to engage with and challenge Crossrail Limited effectively.

Similarly their review of rail infrastructure projects notes that 'The Department's appointment of a 'project representative' team of experts with experience of managing major programmes on High Speed 1, Crossrail and High Speed 2 has provided sponsors with independent assurance about progress, risk management and delivery capability.'

https://www.nao.org.uk/wp-content/uploads/2014/10/Lessons-from-major-rail-infrastructure-programmes.pdf

https://www.nao.org.uk/wp-content/uploads/2014/01/Crossrail-summary.pdf

Xoserve, Funding Governance and Ownership

Xoserve is the central service provider (CSP) for the UK gas industry. Its role includes providing customer data and information, allocation of energy and information and enquiry services, and managing the change of supply process for the five gas distribution networks and National Grid's UK Transmission business. The company provides a case study of two types of regulatory efficiency mechanism:

- Regulatory intervention in the funding, governance and ownership of regulated companies and
- the use of independent project management and assurance bodies to ensure the efficient delivery of a project.

In 2013 Ofgem undertook a review of the funding, governance and ownership (FGO) of the company and decided that a full co-operative governance model should be established in order to make the company more responsive and flexible to the changing requirements of the industry. This decision means that Gas transporters and shippers would be required to jointly participate in Xoserve's governance and fund its activities.

Ofgem considered various options for the FGO framework and concluded that there should be several changes including changes to the Uniform Network Code to identify and define business requirements, and changes to the Gas Transporters licences. The GTs would continue to own and run the CSP but there would be changes to cost allocation processes.

These recommendations were required to be implemented by industry, with oversight by Ofgem through a programme overview board (POB). The POB has open membership and has been set up to address five specific areas of implementation including the delivery of obligations and contracts, Xoserve corporate governance, Central Data Services governance, Xoserve business planning and budgeting and charging and cost allocation.

Xoserve is also responsible for the delivery of project Nexus – The replacement of the UK Link system for energy settlements, supply point administration and other functions in the GB gas market. This project will enable the use of information from smart and advanced meters to enable more accurate invoicing and smart metering.

Following delays to the original project timetable (completion expected in October 2015) – and the complications of the projects FGO – Ofgem took several steps to strengthen the governance, management and assurance of the project including:

- Setting up a new industry steering group with the mandate to make decisions or recommendations on Project Nexus implementation issues.
- Procuring a project management and assurance manager (P-REP) to provide independent advice, management and assurance on the delivery of Project Nexus.

The steering group represents a cross section of industry including Ofgem and independent shippers and gas transporters. The P-REP role includes conducting an assessment of Xoserve's plans, using those plans to create a wider cross-industry plan incorporating stakeholders deliverables and dependencies in order to meet the project deadline, developing a framework for determining whether each of the milestones has been met and the potential impact on the project deadline, ongoing project assurance and recommendations for remedial actions and providing an assessment of alternative implementation options.

Crossrail, Project Governance

Crossrail is Europe's largest construction project with over 10,000 people working across more than 40 construction sites. The total funding envelope available is £14.8 billion, underwritten by DfT and TfL, with contributions from Network Rail, Heathrow Airport Limited, City of London Corporation, Canary Wharf Group, and Berkeley Homes.

Corporate governance: The project's corporate governance structure has been especially important in delivery as it has required the collaboration of central government, London government and local government as well as a large and diverse community of stakeholders and industry partners. These wider stakeholders and industry partners do not have direct ownership or control over the project but did contribute through various forums and non-contractual boards.

In relation to the project's main sponsors; DfT and TfL. A central part of successful delivery of the project was aligning the interests of the two organisations through a Sponsors Agreement that was negotiated and agreed in 2008. This set out the management, ownership and governance of the project. This involved the creation of a Joint Sponsor Board (JSB), comprising of two members from each organisation and a Non-Executive Director.

An important distinction was then made between the JSB and the delivery body, an SPV (CRL). The delivery body was set up in order to ensure the project was developed as per the sponsors requirements as set out in the Crossrail Project Development Agreement. This included development, design, procurement, construction, commissioning, integration and completion of a railway system capable of operating the specified services. The separation of the sponsors and delivery team maintained clear accountability, allowed skills to be put to use in the appropriate place and enabled the ring-fencing of overall budget.

Risk: Cost and funding risk is ultimately held by the sponsors who own the business case and are accountable for specifying specific outcomes. CRL as the delivery agent was accountable for designing and delivering the infrastructure, within funding limits.

Earned autonomy and review point process: A specific feature of the project is that CRL is granted more authority as the project progresses, whereby as confidence grew in the delivery plan and cost outcomes more autonomy was transferred to CRL by the sponsors. This was formalised through the development agreement which set out four specific review points.

A review of the project governance arrangements suggests that all parties thought this was valuable and worthwhile but it was noted it took a significant amount of time and focus. In addition there was clear, high quality monthly and semi-annual reports on progress, which focus on the main issues of interest for sponsors.

Incentives and intervention points: The delivery team was incentivised through: upside and downside risk sharing mechanisms, personal incentivisation of Executive management to deliver to identified KPIs, consequences of breaching intervention points linked to the use of contingency powers (including ability for senior staff to be dismissed) and reputation of CRL Board and Management. Overall it should noted the focus of the incentives was to on ensure timely delivery rather than the lowest cost possible.

Sponsors had a series of intervention point where action could be taken if the project was expected to cost more than the P50 estimate. Inventions included requesting CRL to submit remediation plans to TfL, TfL stepping in with a £600 million contingency fund and replacing Directors and Senior Executives and DfT intervention.

Ofwat, Customer Challenge Group

The Ofwat Customer Challenge Groups (CCG) are a core part of the customer engagement mechanisms:

Each company will have in place, and support, an independent CCG.

CCGs will be responsible for providing independent challenge to companies and independent assurance to Ofwat on:

— The quality of a company's customer engagement

— The degree to which the results of this engagement are driving decision making and are reflected in the company's plan

Ofwat will provide information in advance to help them prepare for the regulatory settlement e.g. expected range for the cost of capital.

Pros/cons

— CCG role is not to ratify the companies plan but to comment on it and challenge the process that results.

— Allows views from a range of informed stakeholders e.g. local business forum, Age UK, environmental groups.

— Challenging and questioning role during the initial development of the plan e.g. how are customer needs being assessed and planned for?

— Change in expectations on the CCG role limited their effectiveness

— No direct regulatory power: there is no discrete mechanism by which their feedback is incorporated within the regulatory determination.

— However Ofwat has said it will strengthen the role of the CCGS next time.

http://www.Ofwat.gov.uk/regulated-companies/price-review/2019-price-review/customer-challenge-groups/

http://www.Ofwat.gov.uk/wp-content/uploads/2016/06/3-Feb-CCG-workshop-final-slides-for-website.pdf

Customer Challenge groups will have a strengthen role in the 2019 price review:

Ofwat view customer engagement and outcomes as one of the 2014 price review's key successes.

Ofwat expects companies to continue to be responsible for engaging directly with their customers as they are best placed to develop a genuine understanding of their customers' needs and requirements. And to use this information to develop robust, customer-focused business plans and provide excellent levels of service to all customers.

Ofwat expects companies to deliver further improvements to the quality of their customer engagement at the 2019 price review and will consider this when assessing business plan quality as part of our risk-based review.

PR19: Proposed role of the CCGs – Building on the success at PR14

Facilitating more collaboration between CCG chairs to share information, knowledge and good practice

↓

Provide more clarity on scope of issues to be addressed by CCGs (including more guidance on what should be covered by the CCG reports) and timetable of deliverables

↓

Greater focus on transparency of governance and funding processes for CCGs

↓

Publishing information and expectations (e.g. cost of capital, common versus bespoke outcomes, role of comparative information) earlier on in the price control process

Phoenix Gas, programme ex-ante incentives

- Phoenix Gas has been regulated by the Northern Ireland Authority for Utility Regulation (UREGNI) since 1996, when it was given a 20-year licence to convey gas and supply gas in the licenced area based on a mandatory development plan.
- **Incentives:** The licence provided strong incentives to outperform the ex-ante settlement in terms of both roll out of the network and capex/opex spend. This was recognised through allowing Phoenix Gas to retain 100% of outperformance as long as the mandatory development plan was met.
- Over or under performance by Phoenix Gas was reflected in the forward-looking cost forecast at each price control review. The aim of this was to incentivise Phoenix Gas to achieve efficiencies, which would then be reflected in lower prices for consumers in the following price control.
- **Revenue recovery:** At the beginning of the licence the revenue recovery was profiled over a 20-year period to reflect the fact that it would take time for the market to be become sustainable. Specifically the licence included formulae to capitalise negative cash flows due to lower than forecast demand to be recovered later in the 20-year period, through higher conveyance charges.
- Under-recovered revenues were subject to a lower rate of interest to discourage unnecessary under-recovery. The licence stipulated the use of price control reviews to reset price caps based on revised cost and volume forecasts over the 20-year period.
- **Reforms to licence:** In 2007, after negotiations between UREGNI and Phoenix Gas, changes were made to the licence, including the extension of the cost recovery period from 20 to 50 years, the introduction of a price control based explicitly on a regulated asset value (RAV) and the determination of an opening asset value (OAV), establishment of a depreciation profile and a reduction in the rate of return from 8.5 to 7.5%,
- **Project Characteristics:** In explaining the rationale behind the regulatory approach it is useful to consider the specific economic characteristics related to the Northern Irish gas market at the time of the licence, key aspects include;
  - Creation of greenfield network and subsequent market whereby the challenges differ from those found in mature utility markets.
  - Recognition by all parties that investment would not be able to be recouped for a number of years.
  - A mandatory development plan and required distribution channels to be set up.
  - Uncertainty regarding the willingness of customers to switch to natural gas.
  - Significant political instability existed in Northern Ireland, which created unique risks and challenges in the construction and operation of the network.
  - Uncertainties at initial investment around future regulatory treatment given the absence of established regulatory precedent.

Thames Tideway Tunnel, Risk sharing

Ex-ante determination of cost forecast with full certainty on cost treatment up to a threshold

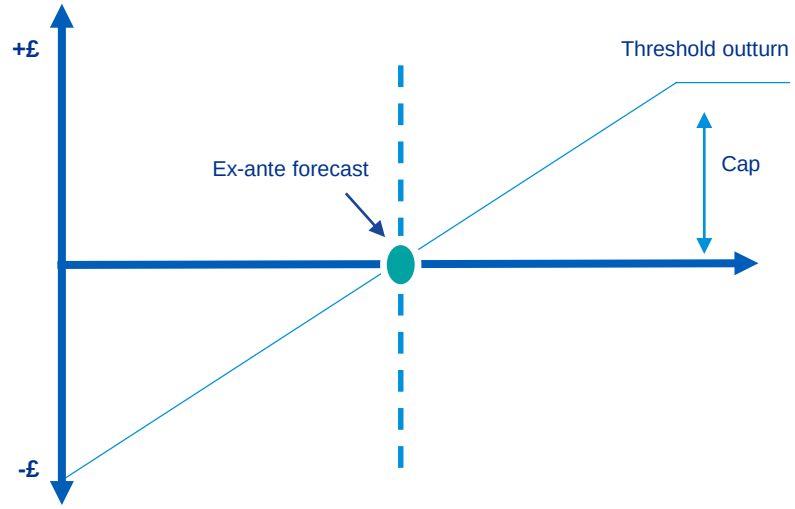
Revenue based recovery: under recovery is trued up in future years

Risk sharing mechanism with upside cap

- Extent of overrun/under spend shared between investors and bill payers in defined proportions (40% to shareholders, 60% to customers).
- Upside cap, no limit on the downside.
- Symmetric.
- Full allowance of costs that are deemed efficient compared to original target.
- Revenue adjustment made to RCV post construction period

Discretionary treatment of costs above the cap:

- Above the Threshold outturn the Promoter may apply for an Increase in Allowed Revenue.
- Ofwat has full discretion in defining the additional expenditure and WACC in an IAR determination.
- Ofwat will apply an ex-ante approach determining what Additional Allowable Project Spend will be accepted and determine if Additional Allowable Project Spend could be avoided by prudent management action, taking into account the views of an Independent Technical Assessor.



Pros/cons

- High degree of transparency and certainty of cost treatment up to the threshold.
- Minimum regulatory discretion until costs go above the threshold
- Comparable incentives are applied to the contractors.
- Threshold caps the risk exposure of the promoter
- Threshold requires forward looking cost forecasting by the promoter to gain certainty over reimbursement before costs are incurred.
- May be costly and time consuming for the regulator and technical advisor

ORR, Enhancement Cost Adjustment Mechanism

- Network Rail's regulatory framework allows the company to retain full outperformance of opex and maintenance costs over the regulatory period and the financing costs of efficient capital under/overspends for five years from the year in which they are incurred. It must also bear the financing costs of the first £50 million of overspending on enhancements and any further manifestly inefficient spends.
- The regulatory framework for Network Rail is unique due to its status as a private sector company financed by debt guaranteed by the government. It is difficult for ORR to create strong financial incentives for the company as any risk or reward is ultimately borne by the government rather than shareholders.
- This has led to a regulatory framework in which the ORR has created greater management and reputational incentives and provides greater oversight and scrutiny of NR's activities to estimate the scope for potential efficiency savings.
- The size, scale and unpredictability of NR's investment programme – Particularly in CP5 has also led to the incorporation of 'change control' mechanism to account for ongoing changes in the scope, design and costs of projects which were at an early stage of planning at the time of the regulatory decision.
- In CP5 ORR was faced with a high level of uncertainty over the scope and costs of a large number of Network Rail enhancement projects. Approximately £7 billion of the total £12 billion portfolio of projects were at an early stage of development including 12 major projects such as the Midland Mainline Electrification, Reading station area redevelopment and Great Western electrification programme.
- Because of the immaturity of the enhancements plan the ORR concluded that it was unable to set an 'efficient' cost forecast for these projects to incentivise NR. Instead it developed an Enhancements Cost Adjustment Mechanism (ECAM) to enable the costs of these projects to be incorporated into the regulatory framework as the project progressed.
- This mechanism postpones setting an efficient cost forecasts for individual projects and thus the total cost of the whole enhancements portfolio until each project has reached GRIP stage 3. At this stage the ORR undertakes an assessment of the costs to set an efficient cost target.
- This assessment involved a five step process including submission of information from ORR, initial review by ORR, joint workshop by the ORR and Network Rail to discuss the project, further analysis by ORR (and its consultants) before defining an efficient cost for the project.
- As part of the ORR's detailed review it considered several factors including the assessment of options, potential risks and contingency allowance, cost base and direct and indirect costs.
- The majority of schemes submitted for ECAM increased in costs. On most of the ECAM schemes ORR has typically not made material reductions to NR's revised costs. As a result of this process the total costs for CP5 have risen substantially. The costs forecast for projects such as the electrification of the GWML increased from £1.6 billion to £2.8 billion for example.

Channel Tunnel, Competition

Competition for design, management and operation

A fixed link between England and France had been considered a number of times and in 1984, the respective governments decided to proceed with the idea. To develop the project the governments agreed a set of safety and environmental standards, as well as guarantees regarding political risk.

The two governments then issued an invitation to promotors to provide proposals for a fixed link. This did not proscribe a particular design which was left to the bidding firms to develop. The tender process had four key areas that bidders were required to comply with, including;

— Technical feasibility.

— Financially viability.

— Anglo-French rail requirements.

— Environmental Impact Assessment.

In total, 10 proposals were submitted of which four were considered to be feasible and shortlisted. These consisted of both road/rail and tunnel/bridge schemes. The cost of the proposals varied between $2.9 billion and $11 billion.

The 'Concession Contract' was awarded to Channel Tunnel Group/FranceMache (CTG/FM) in 1987. The winning bidder then restructured itself in to Eurotunnel PLC and Eurotunnel SA.

Competition for construction

In order to construct the actual tunnel, Eurotunnel tendered out the construction of the project to potential bidders, with Transmanche Link (TML) awarded the contract. This contract was important in defining the scope of work, cost, timeline and rules of engagement between the two parties, and was subsequently seen as having a number of limitations.

The general construction contact signed in 1987, set out three cost categories between the parties;

1. Target cost for tunnelling, done on a cost-plus fixed-fee basis, with a target cost above or below which would be a sharing of the difference.
2. Lump sum for the terminals and the mechanical and electrical works.
3. The procurement contract for rolling stock and associated major equipment was procured on a cost-plus-percentage-fee basis.

The original contact meant Eurotunnel was responsible for around 70% of cost overruns and TML was responsible for the remaining 30%, capped at a maximum 6% of the total cost. As costs escalated a revised agreement was meant to provide a more equitable distribution with Eurotunnel responsible for £1.58 billion and TML responsible for 30% of everything above that figure.

In terms of the construction in total it required 46 contractors and 15,000 workers to complete. In terms of the delivery of actual tunnelling this was three months early but ongoing safety concerns led to delay of delivery.

TTT, Contract incentive mechanisms

As part of the TTT contract Ofwat has proscribed the nature of the risk sharing allocation between TTT, its main works contractors, suppliers under the Alliance Agreement and the wider tier of suppliers. The incentives included under the framework are shown in the table below.

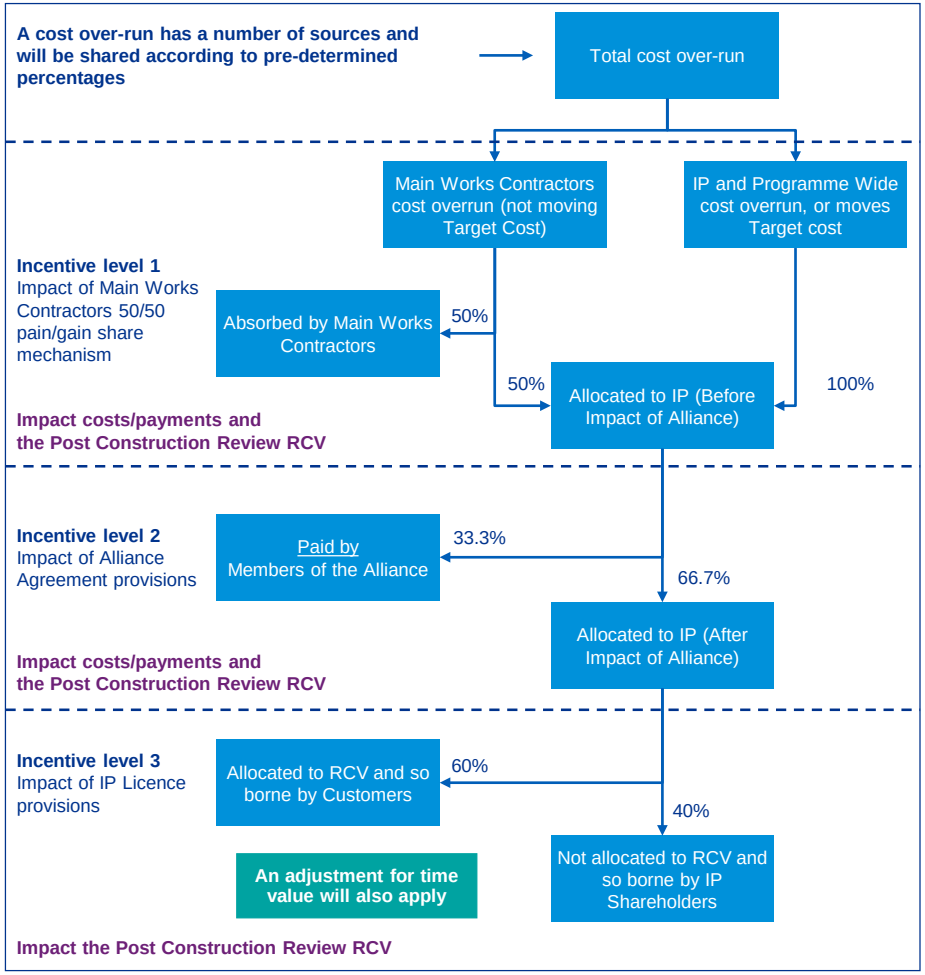
Characteristic	Main Works Contract (Level 1)	Alliance Agreement (Level 2)	Draft Project Licence (Level 3)	Project Management Contract
What is the purpose?	Pain/gain share mechanism with 50/50 sharing on cost over- or under-runs with no change in Target Cost between the IP and the Contractor.	To manage the programme effectively to deliver it on budget and on time.	To incentivise the IP to deliver on budget and on time.	Incentivising the contractors to minimise the Project spend and to deliver before milestone.
How is the reward/ penalty calculated?	If Target Cost is not adjusted, then 50% of pain or gain is paid to the Contractor by the IP. If the over or under spend moves the Target Cost, then no pain/gain share mechanism will be applied (and so the IP will be liable to pay the full cost increase).	The total incentive is allocated between all parties in proportion to the level of control and impact each party has over each specific milestone or interface.	Post Construction RCV is reduced by 40% of any net overspend during the project. 40% of any underspend is added to Post Construction RCV. Amounts are adjusted for time value of money using BWACC. There is a step-down in WACC for the delay period.	Reward is linked to the contract value.
To what does it apply?	Payments made are fully capitalised and included in the RCV of the IP, including incentive payments to contractors. Only applies to the Main Works Contracts and not to the IP or programme wide contractors' capex.	Reward payments made by the IP is fully capitalised and included in the RCV of the IP. Any receipts as a result of penalties are deducted from the RCV of the IP.	Cost adjustment applies to the Post Construction Review RCV. 50% of the delay adjustment is deducted from RCV and 50% from revenues.	Draft PMC does not make it clear whether the payment from the IP has any effect on its RCV.

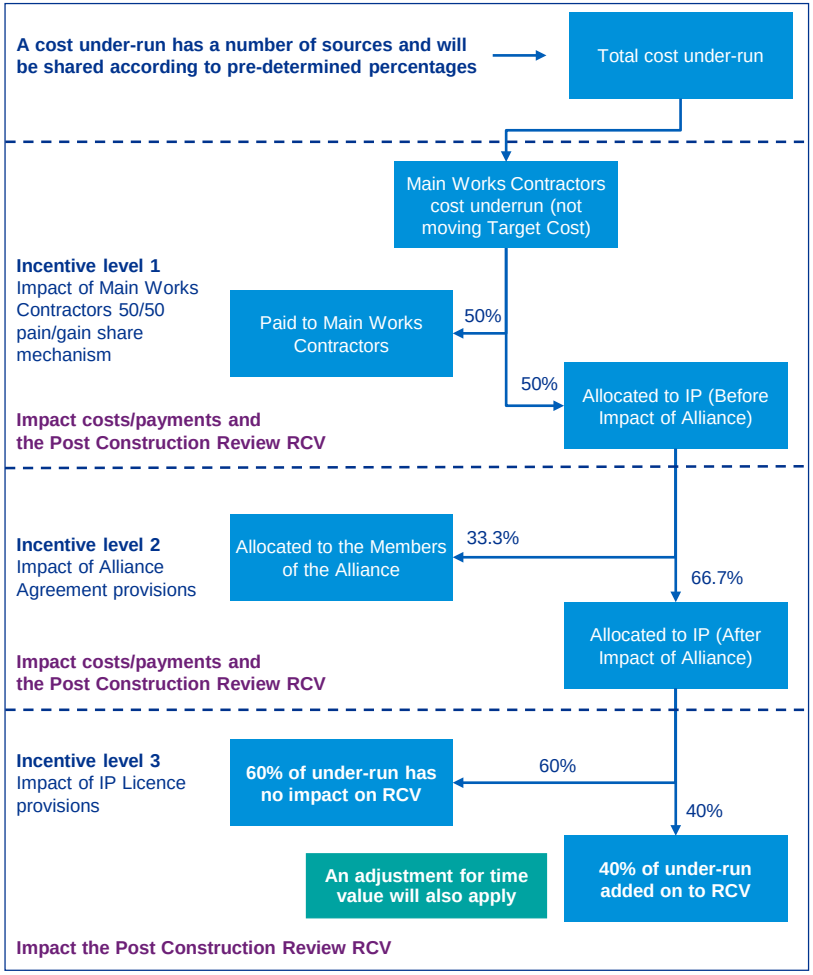
TTT, Contract incentive mechanisms (cont.)

As part of the TTT contract Ofwat has proscribed the nature of the risk sharing allocation between TTT, its main works contractors, suppliers under the Alliance Agreement and the wider tier of suppliers. The incentives included under the framework are shown in the table below.

Characteristic	Main Works Contract (Level 1)	Alliance Agreement (Level 2)	Draft Project Licence (Level 3)	Project Management Contract
What is the trigger for the incentive?	There is an over- or underspend and no change in Target Cost.	Key project milestones, specific site milestones and cost over – Or underspend.	Cost over- or underspend up to Threshold Outturn. Delay in System Acceptance Date.	Cost incentive is payable only if the savings are greater than £50 million. Milestone incentive is payable if one or more milestones are achieved.
Is there any cap for the incentive?	Each Main Works Contractor has a maximum limit on the pain, which equals the greater of £100 million or 25% of the respective Target Cost.	Total incentive package is £100 million, cost incentive at £50 million and programme incentive also at £50 million. Prior to any adjustment in respect of KPI scores and upward/ downward adjustment of payments to/from the SI.	Cost adjustment is applied up to Threshold Outturn. £15 million annual cap (indexed) on revenue adjustment proportion of the delay penalty.	Cost incentive is capped at £15 million. Milestone incentive is max 5% of contract value.
When is it applied?	Throughout the Construction Period.	Throughout the Construction and Handover and Acceptance Period.	Cost at Post Construction Review. Delay at and following Post Construction Review.	During construction and Handover and Acceptance Period.

TTT, Contract incentive mechanisms (cont.)





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Appendix 3
Long list of scheme risks

Introduction to Appendix 3

This appendix provides a long list of scheme risks.

Appendix 3 – Scheme risks

Long list of risks

Category	Risk
Planning permission	— The DCO process gets delayed, jeopardising runway opening date.
	— The Compulsory Purchase Order (CPO) may delay the start on site in critical areas.
	— Failure to designate the NPS in the timescales assumed will delay delivering new airport capacity. Without an NPS, considerable time would be spent settling policy issues, including matters of principle, as part of any Development Consent Order (DCO) application.
	— Securing planning permission may be a lengthy process – There is no clear precedent.
	— Levies and 106 agreement cannot be accommodated within the current cost plan.
	— Preparation of planning applicants is resource intensive and might be higher than expected.
Community compensation	— Some housing losses will be required and the costs will be higher than assumed.
	— Airport expansion will increase the noise-affected population in the local area by more than expected.
Environmental regulation	— Rules on air quality may present challenges.
	— Onerous environmental mitigations may delay the programme in critical areas.
Scope	— Scoping Issues – Project scope does not fully address organisational business requirements.
Design	— Approvals required for novel runway concept at ENR.
	— Local airspace design likely to be controversial and might require additional spend to rectify.
	— The briefed area for the terminal building is insufficient once bottom-up functional brief is developed.
	— Incomplete or fluid design – Construction commences based on an incomplete design and project scope is continually in flux.

Long list of risks (cont.)

Category	Risk
Business case	— Commercial facilities are developed without a supporting business case.
	— Additional commercial facilities will be required that are not included in the base case cost.
	— Lack of integrated budgeting and planning – Business requirements are not aligned with the budget and execution plan.
	— Unrealistic schedules – Project delays during planning and approval result in compressed schedule and unrealistic completion targets being set by management.
Enabling works	— Ground contamination especially in landfill zones may delay earthworks and the start of infrastructure works.
	— Archaeology findings may delay earthworks and the start of infrastructure works.
Flooding	— Management of flood risk is important and costs associated might be higher than expected.
	— Water works and management of flood risks in the interim phase may delay the infill of the existing rivers and lakes on site and of the overall earthworks operation.
Surface Access	— Tensions regarding utilisation of rail links may require promoter to contribute additionally to unaccounted new capacity.
Utilities	— Thames Water can not cope with the additional waste water from (Gatwick) facilities.
Team	— Inexperienced or unqualified project team – Project team lacks appropriate skills and expertise to manage the project.
External	— Resources/labour market (other mega projects likely to be concurrent to 3R e.g. HS2, Hinkley Point C, Thames tunnel, etc.).
	— National risk register identified risks which may impact on scheme i.e. pandemic, terrorism, extreme weather etc.

Long list of risks (cont.)

Category	Risk
Supply chain	— Resource shortages and inexperienced project teams – Lack of available craft labour, experienced supervision personnel or qualified project management team members.
	— Availability of key materials.
Technology	— Failure to agree technology solution according to schedule.
	— Testing and commissioning may take longer than estimated especially if new untested technologies are deployed.
Business management	— Organisation and contracting strategy.
Contract	— Unfavourable contract – Contract favours one party in areas such as payment terms, change order pricing, overhead and profit/fee and penalties for non-performance.
Forecasts	— Poor estimating – Contractors place overly optimistic bids, poor or outdated cost data, missed scope items, flawed assumptions regarding constructability, labour and material price escalation.
Construction	— Airside space may be required on main construction site once a more detailed plan is developed
	— Unidentified below ground services are found on site once construction has commenced
	— Third parties fail to deliver essential works according to our schedule
	— The current landside APM is in poorer condition that first anticipated and can't accommodate expected extension and increased movements.
	— A phased approach of construction may lead to inefficient working that is higher than forecast.
	— Re-provision of hotels, commercial facilities, waste plant takes longer than expected introducing commercial risk.
	— There is a risk of unidentified obstructions below ground

Long list of risks (cont.)

Category	Risk
Surface Access	— Complex overlap between new T5/T6 access roads and existing roads to T5 and car park.
Land	— The land assembly and relocation strategy delays commencement of R2 construction.
	— The development valuations are incorrect.
External	— There is a risk of potential disruption from lobby groups (anti airport expansion).
Utilities	— UKPNS scope and costs are not defined.
	— Existing unknown utilities may delay the enabling woks and subsequent infrastructure works.
Organisation	— Insufficient tools and project management infrastructure – Project tools and infrastructure are not set up to effectively plan, deliver, track and report performance.
	— Overly aggressive schedule – Aggressive schedule leading to delivery inefficiencies and unrecoverable overtime/premium time.
Airspace	— Interactions with RAF Northolt require monitoring.
	— Aerodrome Licensing including safety case is delayed preventing airport opening and be costly to rectify.
Business operations	— The volume of handovers proves onerous and difficult to manage.
System migration	— Systems migration – The interface between old technology installations and newly installed technology does not function as required.

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