CAA consultation on the future regulatory framework for Heathrow expansion

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Report prepared for Heathrow Airport Limited

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Contents

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Figures and Tables

Executive summary

Heathrow Airport Limited (HAL) has commissioned Oxera Consulting LLP (Oxera) to assist in its response to the CAA's recent 'Working paper on regulatory models'.[1]

The paper assesses potential future regulatory models for Heathrow Airport in the context of a third runway and wider capacity expansion, outlining several possible approaches alongside the CAA's proposed assessment framework.

As part of HAL's consultation response, we evaluated the regulatory models identified by the CAA by reviewing 21 infrastructure projects and drawing conclusions about their relevance and applicability to Heathrow.

Using the CAA's analytical framework—covering its six criteria of support for expansion, costs, finance, practicality, promotion of effective competition, and service quality—we conducted a primarily qualitative assessment that synthesises key insights from the projects reviewed. Inevitably, the analysis involves a degree of judgement, particularly in applying the CAA's framework across a diverse set of infrastructure examples.

In the context of our evaluation, we assign each project reviewed to one of the CAA's regulatory models presented in the Working Paper. As the CAA recognises in that paper[2], some of the models can be applied together as they cover different aspects of regulation and in many cases overlap. For example, there could be mandated design and build contracts in place (Model 4b) with the prices for users set based on a light-handed approach to regulation (Model 9c).

Assessment methodology

We consider that the long list of regulatory models covers three main areas:

- models 1–3 concern potential adjustments to HAL's current **capital expenditure (CAPEX) governance process** (i.e. who decides on the investment and over which timelines);
- models 4–8 concern the **procurement process** (i.e. which entity builds, designs, finances, operates and maintains the asset);
- model 9 concerns **economic regulation** and alternative approaches to the existing regulatory asset base (RAB)–WACC framework (i.e. how the prices for users are set).

[1] Civil Aviation Authority (2025), 'CAP 3195: Working Paper on regulatory models', 25 November, https://www.caa.co.uk/our-work/publications/documents/content/cap3195/, accessed 14 January 2026.
[2] Ibid., para. 4.2.

As part of our assessment, we first determine how each project fits into the different procurement process models outlined by the CAA (models 4 to 8). For each project, we then summarise its CAPEX governance and economic regulation approach such that we cover all relevant aspects of the CAA's list. We assign projects to individual CAA models in line with our understanding of each model's specific features, as outlined in the Working Paper.

The assessment is based on publicly available information collected within the timeframe of the consultation period (less than two months). As such, the conclusions we reach are informed by our judgement on the information collected across the projects, and are therefore qualitative in nature.

Overview of our assessment

The table below gives an overview of the projects reviewed.

Overview of the projects reviewed

	Mapped to regulatory model	Financing source	Regulator	Timeframe of price determination (years)	Investment value (£bn)
Sizewell C	4a	Mixed	Ofgem	12	38.0
Frankfurt Airport Terminal 3 (Frankfurt T3)	4a	Private	Government	4	3.5
Salerno Airport	4a	Private	ART	3	0.2
Terminal 4, Madrid–Barajas Airport (MAD T4)	4b	Public	Government	1	5.3
Terminal 2, Dublin Airport (Dublin T2)	4b	Public	CAR	5	0.8
Western Sydney Airport	4b	Public	ACCC	n/a	2.6
Centralny Port Komunikacyjny (CPK)	4b	Mixed	ULC	n/a	8.8
Berlin Brandenburg Airport (BER)	4b	Public	Government	n/a	5.9
High Speed 1 (HS1)	5a	Public	ORR	n/a	6.1
Crossrail Elizabeth line	5a	Public	ORR	n/a	18.9
London Overground—East London line extension (ELLX)	5a	Public	ORR	n/a	1.0

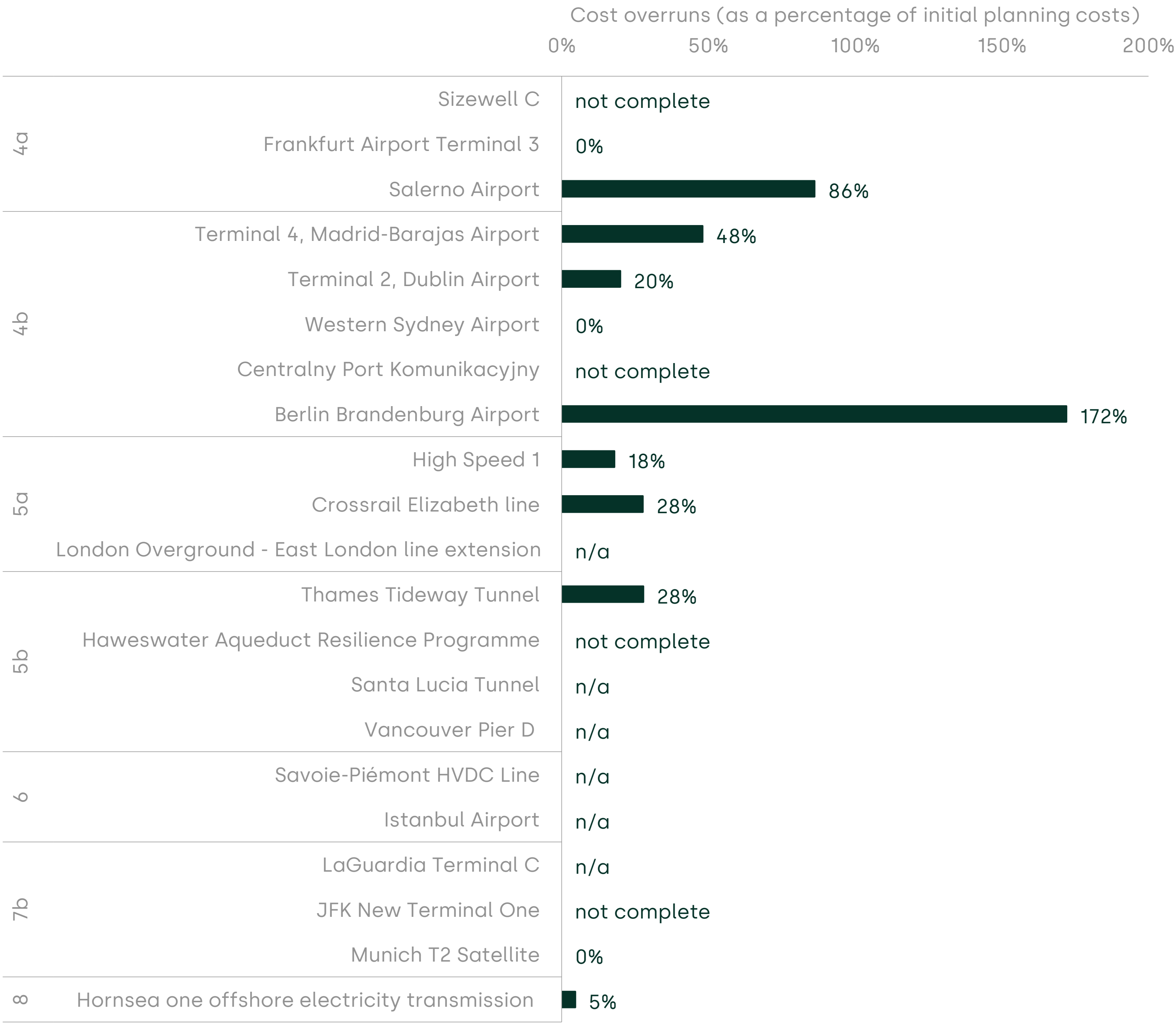
	Mapped to regulatory model	Financing source	Regulator	Timeframe of price determination (years)	Investment value (£bn)
Thames Tideway Tunnel	5b	Private	Ofwat	15	4.6
Haweswater Aqueduct Resilience Programme (HARP)	5b	Private	Ofwat	25	3.0
Santa Lucia Tunnel	5b	Private	ART	5	0.9
Vancouver Pier D	5b	Public	Government	1	0.2
Savoie-Piémont HVDC Line	6	Mixed	ARERA, CRE	10	1.2
Istanbul Airport	6	Private	Government	25	9.4
LaGuardia Terminal C	7b	Mixed	Local authority	1	3.0
JFK New Terminal One	7b	Private	Local authority	1	6.7
Munich Terminal 2 Satellite (Munich T2 Satellite)	7b	Mixed	Government	1	0.8
Hornsea One offshore electricity transmission (OFTO)	8	Private	Ofgem	25	1.2

Note: The acronyms used in the table are defined in the review of each project. The financing source corresponds to the profile of entities with equity in the project. The timeframe of the price determination is presented as of the date of the final investment decision; where different price determination timeframes will apply for construction and operations, we have presented the construction period. 'n/a' indicates projects where no specific regulatory model was identified for the construction period of the asset. Investment value is reported in nominal terms as at the date of delivery and converted into £bn using the prevailing exchange rate from local currency to GBP at the point of delivery.
Source: Oxera analysis.

The figures below illustrate the extent of cost overruns and delays for each project for which data was available.

As shown in the cost overrun chart, there were many projects for which no publicly available information was identified ('n/a' values in the chart). This could indicate that either the project did not incur any cost overruns or this information is not public. When data was available, no cost savings were found (i.e. where costs were lower than planned) and publicly reported cost overruns were typically significant (more than 15%).

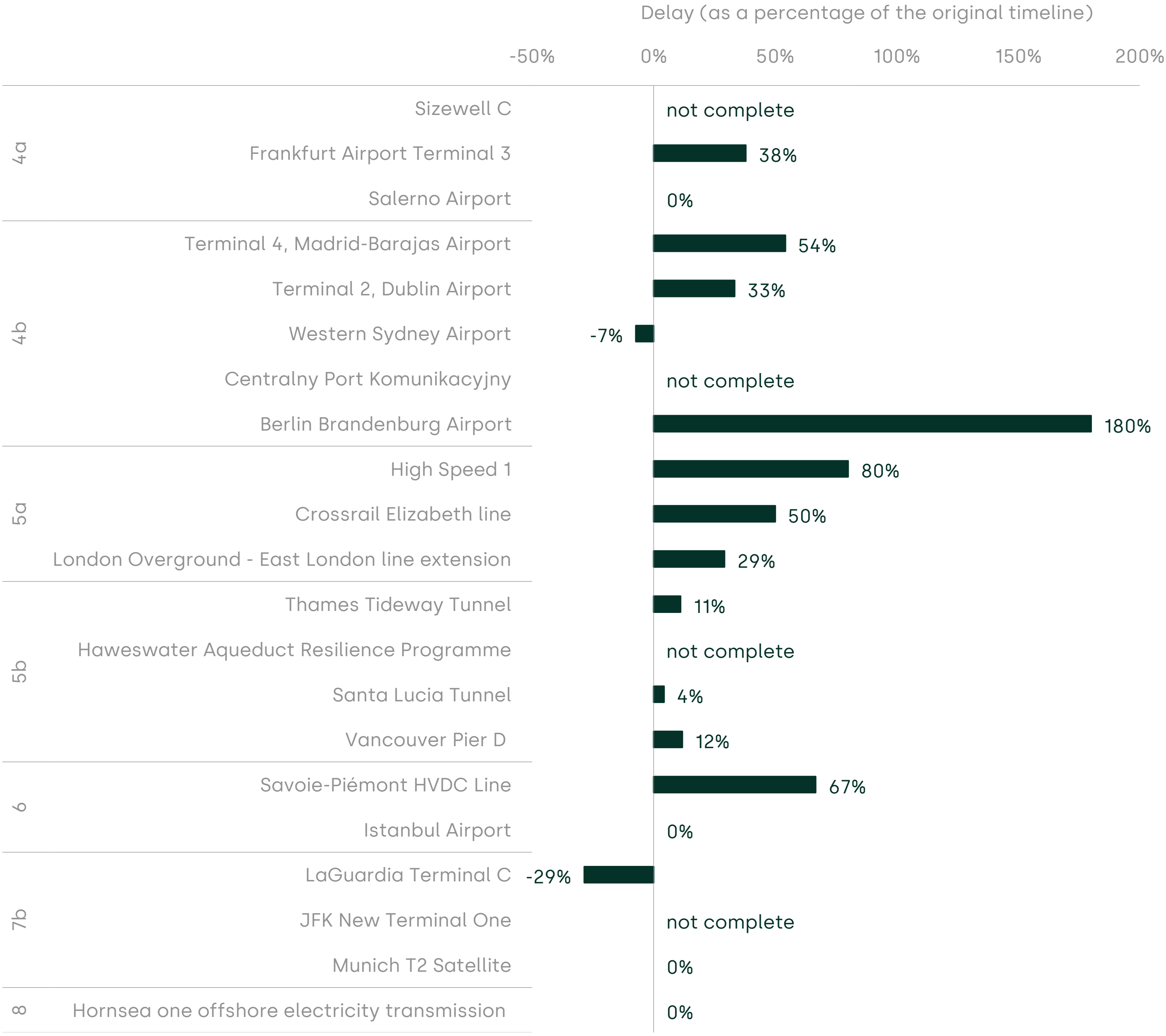
Cost overrun as a percentage of initial planning costs, by project



Note: Cost overrun estimated as a ratio between the ex post cost of the project and the initially planned costs using publicly available information. 'Not complete' indicates projects that are not yet complete; 'n/a' indicates projects for which information on cost overruns was not found.
Source: Oxera analysis.

As shown in the chart below, a couple of projects were delivered earlier than planned (Western Sydney Airport and LaGuardia Terminal C), while several others were delayed (Frankfurt T3, Thames Tideway Tunnel, Vancouver Pier D), in part due to the effect of the COVID-19 pandemic.

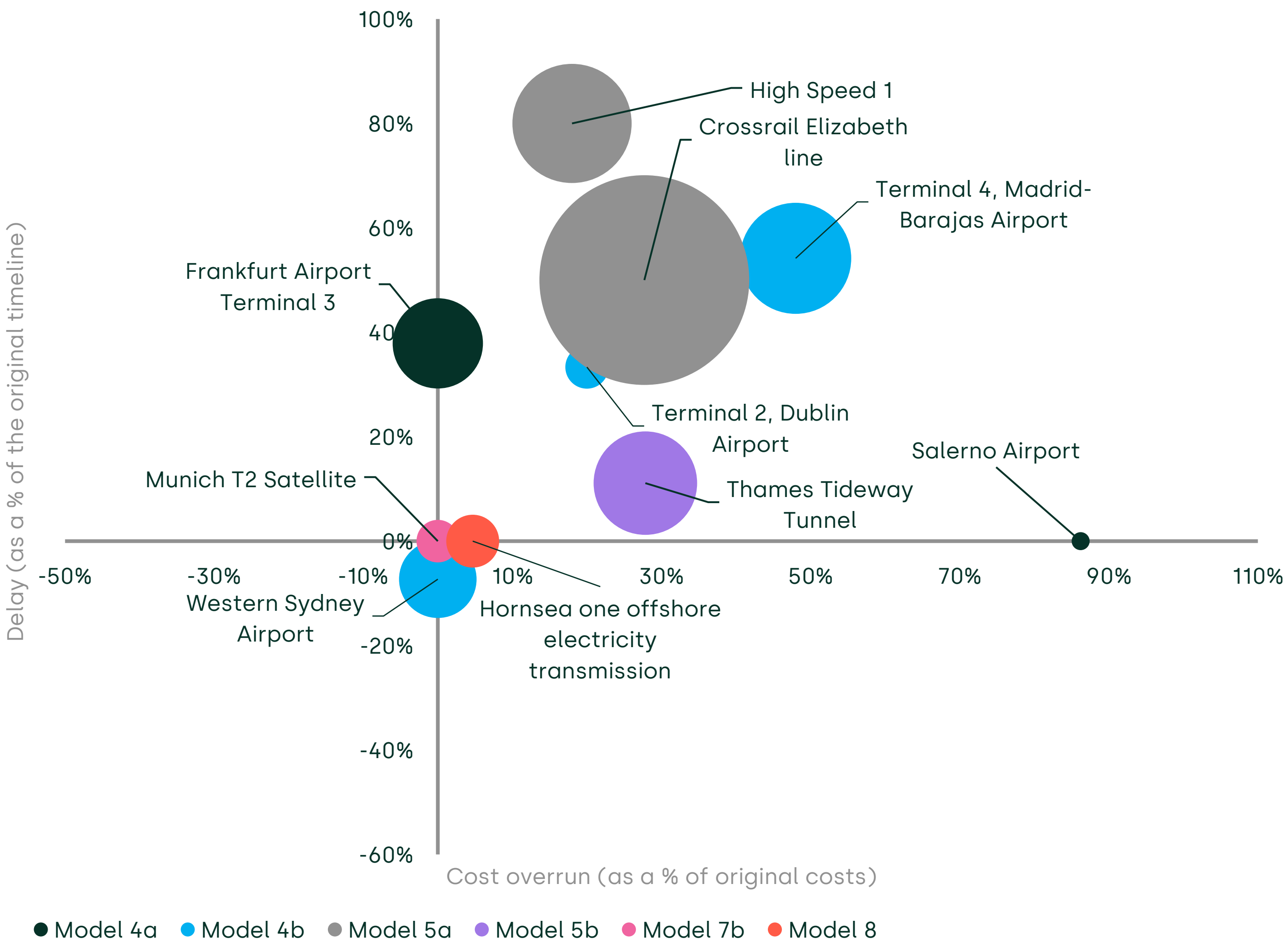
Delay as a percentage of initial planning scope, by project



Note: Delays estimated as a ratio between scheme's ex post time to completion and the initially planned timeframe using publicly available information. 'Not complete' indicates schemes that are not yet complete; 'n/a' indicates schemes for which information on delays was not found.
Source: Oxera analysis.

We have combined the cost overruns and delays into one chart below. The bubble size represents the investment value: the nominal value in £ as at the date of the delivery of the scheme. Projects that are still in construction or have no publicly available information on both cost overruns and delays were excluded from the chart. Berlin Brandenburg Airport is excluded for readability of the chart as it is an outlier (172% cost overrun; 180% delay).

Cost overrun and delay (in percentage terms) for the projects considered



Note: Only projects for which both cost overrun and delay data was available are presented in this chart.
Source: Oxera analysis.

Key takeaways

Based on our review, we have identified the following key messages.

There are few private schemes, and even fewer that are of a similar size to Heathrow R3

Of the 21 projects reviewed, only nine raised equity finance from private sources and another five raised a mix of private and public equity. Of these, only Sizewell C (£38bn) is of a scale comparable to Heathrow R3, even when taking account of the fact that some projects were constructed many years ago. There are examples of projects for which equity finance was raised from private sources for the CAA's models 4a, 5b, 6, 7b and 8. We were not able to find any examples for models 4b and 5a.

Some use of public finance in private schemes

Even where equity finance was raised, there was always some non-equity public support. For projects in the EU (at the time of development), this was often through loans from the European Investment Bank (EIB) (Frankfurt T3, Dublin T2, London Overground extension) or from the National Wealth Fund (NWF), a government-resourced investment fund in the UK (Thames Tideway Tunnel and HARP). This demonstrates the lack of examples of the CAA models being applied for a purely privately financed project on the scale of Heathrow R3, among the projects that we have reviewed.

No clear relationship between the procurement model and the type of regulation

The projects reviewed are characterised by different levels of regulatory oversight, from more limited oversight (the German airports, Vancouver Airport) to more detailed RAB–WACC frameworks (Sizewell C and Thames Tideway in the UK). In particular for models 6 and 7b, we note that the private schemes reviewed mainly featured very different regulatory oversight (often more akin to light-touch regulation) compared to HAL's current regulatory framework.

No examples of regulation changing while schemes are being developed

We have not found examples of schemes for which the regulatory framework was changed while the asset was already in operation as part of an expansion, as the CAA is currently considering in the context of R3.

Delays are often for project-specific reasons, but can be caused by the regulation

A number of projects were delivered late, for a variety of reasons. Some delays were due to the idiosyncrasies of particular projects and, as such, it is difficult to read across any lessons to the context of Heathrow. However, in other cases, features inherent in the models led to longer procurement and/or delivery timeframes. For example, the negotiations around the HARP Direct Procurement for Customers contract; Crossrail being pushed back several years due to budget cuts; and the negotiations around the framework to privatise the Berlin Brandenburg Airport, which were abandoned.

Cost overruns are multifactorial

A number of projects had cost overruns. The reasons for these differed across projects, including limited regulatory oversight, unrealistic assumptions in the planning phase (on productivity and labour costs, for instance) and unforeseen events (such as the COVID-19 pandemic).

Competition for the market is common in procurement

Across the models and schemes reviewed, there was a significant degree of competition in procurement processes for the design and build, and in some cases, competition for the market in terms of designating the operator of the scheme. However, in order for competition for the market to be most effective, sufficient regulatory oversight is required, both by the main constructor of the asset and by independent institutions. Cases such as the Berlin Brandenburg Airport have shown that insufficient oversight can contribute to significant delays and cost overruns.

Competition in the market applies only in very specific cases

Competition in the provision of services has been identified in a limited number of sectors (e.g. ports, airports), although in this assessment, we have reviewed schemes in the aviation sector only. At the US airports reviewed, the schemes were developed in the context of an existing regulatory framework allowing for competing operations, and in all cases the asset owner was a public institution developing the scheme in the context of a public–private partnership. Additionally, these schemes had investment values of less than £10bn, representing only a fraction of the expected size of the Heathrow Airport expansion.

1 Introduction

Heathrow Airport Limited (HAL) has commissioned Oxera Consulting LLP (Oxera) to assist in its response to the CAA's 'Working paper on regulatory models'.[3]

Following the government's announcement of the choice of HAL's scheme proposal for a third runway,[4] the CAA set out its proposed framework to assess potential future regulatory models to apply at Heathrow Airport.

In the Working Paper, the CAA:

1. outlines the case for changing the regulatory framework;
2. defines a framework for the evaluation of potential new regulatory models;
3. proposes a 'long list' of possible alternative regulatory models.

As part of HAL's consultation response, we have undertaken an evaluation of the regulatory models set out by the CAA against the assessment framework that it has established, by reviewing 21 infrastructure projects. We draw conclusions about each regulatory model based on the projects reviewed, which informs our conclusions on the relevance and potential applicability of the different regulatory models to Heathrow.

The report is structured as follows:

- **section 2** describes the methodology we have used to identify and assess the projects on the basis of the framework outlined in the CAA's Working Paper;
- **sections 3–9** present assessments of the individual projects grouped by regulatory model.

[3] Civil Aviation Authority (2025), 'CAP 3195: Working Paper on regulatory models', 25 November, https://www.caa.co.uk/our-work/publications/documents/content/cap3195/, accessed 14 January 2026. (Henceforth, the 'CAA Working Paper'.).
[4] Department for Transport (2025), 'Heathrow Airport Limited's third runway proposal will be basis for expansion', press release, November, https://www.gov.uk/government/news/heathrow-airport-limiteds-third-runway-proposal-will-be-basis-for-expansion, accessed 14 January 2026.

2 Assessment methodology

2.1 Introduction

In its Working Paper, the CAA set out its proposed framework to assess potential future regulatory models for Heathrow expansion. The Working Paper is structured around three main sections: the case for changing the regulatory framework; a description of the general framework of evaluation; a 'long list' of possible alternative regulatory models.

As our assessment focuses on an evaluation of the different regulatory models, we do not explicitly consider the case for changing the regulatory framework that is applicable to Heathrow Airport. However, the conclusions we draw about the regulatory models are relevant in assessing the case for change.

In this section, we describe the framework established by the CAA to assess potential future regulatory models for Heathrow expansion, and how we have applied this framework in the context of our analysis of different infrastructure projects. We first provide an overview of the CAA's analytical framework and how we applied it (section 2.2), before presenting the CAA's 'long list' of regulatory models (section 2.3).

2.2 Overview of the framework set out in the CAA's Working Paper

2.2.1 The CAA's general framework for evaluation

To assess and compare potential regulatory models for Heathrow, the CAA has outlined six evaluation criteria (see Table 2.1 below). It notes that these are defined so as to allow it to assess the models in the context of its duties under the Civil Aviation Act 2012 (CAA12). These include not only its primary duty to further the interests of consumers, but also its secondary duties, such as ensuring that the licensee is able to secure financing; that reasonable demands of users are met; and that economy and efficiency are promoted.

Table 2.1 The CAA's analytical framework

Criteria	Definition	Assessment objective
A. Appropriate support for capacity expansion	The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	Evaluate whether each model could be fit for purpose for the delivery of the scale, type and complexity of the expansion programme
B. Costs	The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	Evaluate whether each model could be used to ensure that the capital costs of expansion are kept to an efficient level from the outset and that the risk of cost escalations is appropriately managed
C. Finance	The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	Evaluate whether each model would support the very considerable level of finance needed to deliver expansion (including environmental mitigations) at an efficient price so that financing costs are no higher than necessary
D. Practicality	It is likely to be practical to implement the model in a timely way	Evaluate whether each model is capable of being implemented in a timely and effective manner
E. Promotion of effective competition	The model promotes competition in the provision of airport operation services where appropriate	Evaluate whether each model is capable of being used to promote competition and how this would provide better outcomes for consumers
F. Service quality	The model promotes an appropriate level of service quality including improvements where appropriate	Evaluate whether each model is capable of being used to promote an appropriate level of service quality both during and after the delivery of expansion

Source: CAA Working Paper.

Based on the above criteria, the CAA proposes to assess whether an alternative regulatory model would be preferable to the current one for Heathrow.

The CAA also notes that an objective assessment would ideally be based on quantitative metrics, but acknowledges that a quantitative assessment can be challenging for some elements of the framework. As such, it proposes a RAG (red, amber, green) rating to assess the different models against the criteria. An A possible approach to this assessment, reproduced from the Working Paper, is presented in Figure 2.1 below.

Figure 2.1 Illustrative RAG rating assessment, taken from the Working Paper

Source: Figure 8, CAA Working Paper.

2.2.2 Oxera's approach to the framework of evaluation

Our approach to interpreting the criteria in the CAA's framework in the context of our assessment is summarised in Table 2.2 below.

Table 2.2 Oxera's application of the CAA's analytical framework

Criteria	Oxera considerations in our assessment
A. Appropriate support for capacity expansion	We assessed any issues in the scheme development (delays, coordination issues, etc.) and whether the regulatory framework applied to the scheme is likely to have played a role in this outcome.
B. Costs	We assessed whether there were any cost overruns and what role, if any, the applicable regulation played in mitigating these overruns and providing incentives for cost efficiency during development.
C. Finance	We summarised the profile of the asset investors (public, private or mixed) and financing sources used to develop the asset, to the extent that information was publicly available. As R3 will be privately financed, finding comparable projects with private financing is relevant to assess the applicability of the model to Heathrow.
D. Practicality	We summarised the key changes to Heathrow's current regulatory model that would need to be made to align it with the model used for the scheme reviewed. This assessment is partial in nature, as a complete evaluation of the practicality and timeliness of applying a different regulatory model to Heathrow would require a legal review, which is outside the scope of this assessment.
E. Promotion of effective competition	We assessed the promotion of two aspects of competition: competition for the procurement and delivery (E1); and competition for the provision of airport services (E2). Under E1, we assessed the extent of competition for the design and build of the scheme. Under E2, we assessed the extent of competition in the provision of services. We found competition in the provision of services for airport schemes only, as it is relevant only for schemes/sectors where competing operations are possible. While there is competition for the market in some cases (e.g. rail franchises), which leads to some degree of competition in the market among rail services, for a given rail franchise there is no competition in the provision of services.
F. Service quality	We assessed the service quality outcomes of the project and to what extent the applicable regulatory framework had an impact on those outcomes (e.g. through oversight from an independent regulator of the quality/performance of the asset).

Source: Oxera.

Our assessment is mainly qualitative in nature and focuses on drawing together key takeaways from individual projects. This assessment therefore inevitably relies on a degree of judgement.

As noted by the CAA, identifying appropriate quantitative metrics to use in the assessment of the six criteria above is challenging, particularly as there may not be sufficient information available across projects such that meaningful comparisons can be made. We do, however, present quantitative metrics on delays and cost overruns, to assist in comparing their performance.

2.3 Scope of the regulatory models reviewed

2.3.1 The CAA's long list of regulatory models

The CAA set out a long list of nine regulatory models (15 including individual model variants) that could be applied to Heathrow Airport. It defines a regulatory model as 'an intervention that can govern the terms upon which airport operation services are provided at Heathrow, including (but not limited to) the delivery of capacity expansion'.[5] We therefore understand that the term 'regulatory model' in this context is used in a broader sense than just describing the approach taken to determine prices for regulated services.

The table below summarises the CAA's long list and includes a brief overview of each model, as well as the example case study (if any) for the model that the CAA presented in its Working Paper. To this, we have added how the ownership, design, build, manage and operation of the asset would be split between HAL and a third party, as implied by the CAA's description of each model in its Working Paper. We have done this for models 4–8 only, as the other models do not cover procurement explicitly (see section 2.3.2 below).

[5] CAA Working Paper, para. 4.2.

Table 2.3 Overview of the CAA's long list of regulatory models

Regulatory model	Brief overview	Procurement framework implied			Case study examples
		Asset owner	Design/construction responsibility	Asset operator	
Variations of the current regulatory framework					
Model 1a: Changes to the CAPEX governance processes	Strengthened CAPEX governance including, for example: (i) greater scrutiny of the cost efficiency of HAL's proposal; (ii) timely availability of relevant information to stakeholders; (iii) strengthening the CAA's/airlines' role; (iv) the provision of relevant information at stages after Gate 3.				No specific case study
Model 1b: Separating HAL's system planning function from its operational function	More significant intervention with a separation of the function of determining which projects to undertake and when (system planning) from the function of constructing/financing/operating the assets. Similar to the concept of 'Capital Investment Committee' proposed by Heathrow Reimagined.				National Energy System Operator (NESO)
Model 2: Targeted adjustments to the existing incentive regime	Focus on amending the system of capital incentives, including (i) adjusting the proportion of cost under- and overspends that HAL bears (currently 25%); (ii) amending the way that ex ante incentives are implemented within the current governance framework (e.g. cost allowances and delivery obligations to be agreed in stages rather than at G3 stage, further adjustments to previously agreed cost allowances).				No specific case study

Regulatory model	Brief overview	Procurement framework implied			Case study examples
		Asset owner	Design/construction responsibility	Asset operator	
Model 3: Longer-term regulatory framework for expansion	Reflects HAL's proposal for a multi-period commitment either via (i) a formal lengthening of the HAL price control through the licence; or (ii) a published policy statement without a formal lengthening (policy commitment) including Weighted Average Cost of Capital (WACC), profiling, capital governance of the price control or of the expansion assets specifically.				No specific case study
Interventions to facilitate competition in the delivery of infrastructure					
Model 4a: Enhanced scrutiny of HAL's approach to procurement	HAL retains primary responsibility for its approach to procurement but the CAA would exercise oversight, for instance in reviewing HAL's procurement strategy, monitoring major tenders, and providing observations or requiring justification where the CAA considers that competition had not been used effectively.	HAL	HAL	HAL	No specific case study
Model 4b: Mandated design and build contracts	HAL would procure certain assets through one or more design and build contracts (through a competitive tender) that would be mandated by the CAA.	HAL	Third party (through CAA mandate)	HAL	Design and build approach applied to Istanbul New Airport, La Guardia Airport, Newark Liberty International Airport, and Changi Airport. Heathrow T2 and T5.
Model 5a: Operation (management contract)	HAL would tender contracts for the operation of airport assets only, and would pay the contractor availability payments or performance-linked fees. HAL would retain ownership of the asset and the design and build role.	HAL	HAL	Third party	Rail franchise system in the UK (e.g. London Overground, Elizabeth Line)
Model 5b: Design, build and operate	A competitively procured partner would be responsible for designing, building and operating new assets.	HAL	Third party	Third party	Direct Procurement for Customers (DPCs) for water companies, e.g. HARP

Regulatory model	Brief overview	Procurement framework implied			Case study examples
		Asset owner	Design/construction responsibility	Asset operator	
Approaches to facilitate competition under third-party ownership					
Model 6: Third party builds assets, then transfers ownership to HAL	A third party designs, finances and builds a new asset, and transfers it to HAL upon completion. HAL becomes the long-term owner and operator, with the asset entering HAL's RAB.	Third party (then transferred to HAL)	Third party	HAL	No specific case study
Model 7a: Upstream supplier model	The third party would act as a provider of services that would be an input into the overall airport operation services. The third party would recover its required revenues through a charge to HAL.	Third party	Third party	Third party	Competitively Appointed Transmission Owners (CATOs) proposed by Ofgem. Expected to be launched in 2026
Model 7b: Direct competition for airport operation services	A third-party would compete directly with HAL's own provision of services to users.	Third party	Third party	Third party	Independent terminal ownership at JFK International Airport and independent cargo operations at Hong Kong International Airport
Model 8: Transfer of ownership and operation of an existing asset	HAL would be required to transfer ownership and operation of an existing asset to a third party.	HAL (then transferred to the third party)	HAL	Third party	No specific case study
New frameworks for setting airport charges					
Model 9a: Price benchmarking	Setting maximum allowed charges with reference to the charges levied by comparable airports globally.				Changi Airport since 2018. (Where it is unable to recover its efficient costs, it is able to request public funding to address the shortfall)

Regulatory model	Brief overview	Procurement framework implied			Case study examples
		Asset owner	Design/construction responsibility	Asset operator	
Model 9b: LRIC	Charges are set by reference to the forward-looking cost associated with providing an additional increment of output.				A LRIC (long-run incremental cost) approach was considered in the context of the Competition Commission report in respect of the Q5 price control review
Model 9c: 'Lighter-touch' regulation	The regulator allows the airport operator more freedom to set prices and manage operations through commercial contracts and voluntary commitments.				Gatwick Airport since 2014 (Q6)

Source: CAA Working Paper.

2.3.2 Oxera's approach to the assessment

As the CAA recognises in the Working Paper, some of the models can be applied together as they cover different aspects of regulation and in many cases overlap.[6] For example, there could be mandated design and build contracts in place (Model 4b), with the prices for users set based on a light-handed approach to regulation (Model 9c).

We consider that the long list of regulatory models covers three main areas:

- models 1–3 concern potential adjustments to HAL's current **CAPEX governance process** (i.e. who decides on the investment and over which timelines);
- models 4–8 concern the **procurement process** (i.e. which entity builds, designs, finances, operates and maintains the asset);
- model 9 concerns **economic regulation** and alternative approaches to the existing RAB–WACC framework (i.e. how the prices for users are set).

As part of our assessment, we first identify infrastructure projects and consider how these fit into the CAA's procurement process models (models 4–8). For each project, we then summarise its CAPEX governance and economic regulation approach such that we cover all relevant aspects of the CAA's list.

Identifying projects and categorising them into CAA models

We have selected the 21 projects for our assessment based on the following considerations.

- Ensuring a sufficient number of projects for each model (where possible), in order to be able to draw conclusions for a given model.
- Including the projects listed by the CAA in the Working Paper.
- Focusing on airport projects and projects within Europe, but also using examples from other sectors and jurisdictions where relevant.

As the CAA defined each regulatory model in relation to the regulation applied to HAL and to future Heathrow expansion, it is not always possible to apply it directly to other infrastructure schemes. In addition,

[6] CAA Working Paper, para. 4.4.

specific schemes that we have identified as projects of interest may not fall neatly into the CAA's defined categories. We therefore had to exercise some judgement to assign individual schemes to each procurement model.

Our assessment covers most of the models outlined in the CAA's Working Paper, except the case studies on: CATOs, NESO, Gatwick 'lighter-touch' regulation, and the LRIC approach to regulation. However, a couple of comments can be made on these case studies.

- As the CAA notes, the CATO framework has been developed by Ofgem since 2016. It required primary legislation, which itself took several years to get passed. As of now, no projects have yet been developed under CATO and therefore there are no precedents to draw from in order to assess how this framework performs against the CAA's criteria.
- NESO is a system planner for the UK's energy sector that is intended to act as a coordinator at a national level between different operators. The applicability and potential benefits that a framework such as NESO would bring to the Heathrow expansion remain unclear.
- We have not found any examples of the LRIC approach being applied to airport regulation. This approach is more common in the telecoms sector and other sectors in which a forward-looking approach is important in order to be able to reflect dynamic market changes (e.g. changes in technology).

Our approach to assigning schemes to the CAA's models 4–8 is summarised in Table 2.4 below, which lists the 21 projects that we have reviewed across seven sectors and ten jurisdictions. For each scheme, Oxera has assigned a procurement model based on our interpretation of the CAA's model description, as explained below.

The assessment itself is based on publicly available information collected within the limited timeframe of the consultation period. In addition, the conclusions we reach are qualitative in nature and informed by some judgement based on the information collected across the schemes.

Table 2.4 Oxera's application of the CAA's procurement models

Regulatory model	Oxera's application	Projects reviewed
Model 4a: enhanced scrutiny of HAL's approach to procurement	In general, it is challenging to determine whether projects fit under model 4a or 4b unless there is a clear indication that design and build procurement is mandated externally, which is seldom the case.	• Sizewell C (Energy, UK) • Frankfurt T3 (transport—airport, Germany) • Salerno Airport (transport—airport, Italy)
Model 4b: mandated design and build contracts	In practice, we have assessed public infrastructure schemes under model 4b, as publicly owned entities are typically expected to comply with public procurement rules. Private schemes were assessed under model 4a.	• MAD T4 (transport—airport, Spain) • Dublin T2 (transport—airport, Ireland) • Western Sydney Airport (transport—airport, Australia) • CPK (transport—airport, Poland) • BER (transport—airport, Germany)
Model 5a: Operation (management contract)	This model applies to projects where the design and build are managed by one party, but a third party is identified to operate the asset. In practice, rail infrastructure schemes fit into this category.	• HS1 (transport—rail, UK) • Crossrail (transport—rail, UK) • ELLX (transport—rail, UK)
Model 5b: design, build and operate	This model applies to projects for which an asset is owned by one party who identifies a third party to build, design, and operate it.	• Thames Tideway Tunnel (utilities—water, UK) • HARP (utilities—water, UK) • Santa Lucia Tunnel (transport—highways, Italy) • Vancouver Pier D (transport—airport, Canada)
Model 6: Third party builds assets, then transfers ownership to HAL	This model applies to projects for which an asset is designed/built by one party, but ownership and operation is then transferred to a third party.	• Istanbul Airport (transport—airport, Turkey) • Savoie-Piémont HVDC Line (utilities—electricity, Italy/France)
Model 7a: Upstream supplier model	The CAA has not provided examples of projects in this model as CATO has not yet been applied in practice. We have not	No project reviewed

	independently identified examples of projects that would fall under this category.	
Model 7b: Direct competition for airport operation services	This model applies to projects where there is competition in the market. In this category, we have identified examples of projects in the airports sector only.	• LaGuardia Terminal C (transport—airport, USA) • JFK New Terminal One (transport—airport, USA) • Munich T2 Satellite (transport—airport, Germany)
Model 8: Transfer of ownership and operation of an existing asset	While it is challenging to meaningfully distinguish this model from model 6 when applied to schemes other than the Heathrow expansion, we have reviewed an OFTO scheme (Hornsea One) under this model.	• Hornsea One OFTO (utilities—electricity, UK)

Source: Oxera.

3 Model 4a: Enhanced scrutiny of HAL’s approach to procurement

3.1 Introduction

According to the CAA’s definition, under Model 4a, ‘Enhanced scrutiny of HAL's approach to procurement’, HAL would retain primary responsibility for its approach to procurement, but the CAA would exercise oversight through reviews of HAL’s procurement strategy and monitoring of major tenders, and would generally ensure that competition is used effectively in the development process.

Under this model, HAL would not be formally mandated by the CAA (or any independent capital governance process) to competitively tender the design and construction works. However, the CAA would reserve the right to engage with HAL by providing feedback and requiring further justification where the regulator considers that competition has not been used effectively.

We identify the following projects as falling under Model 4a:

1. Sizewell C;
2. Frankfurt Airport T3;
3. Salerno Airport.

For these projects, our findings regarding the CAPEX governance and price-setting models, as well as the different areas of the CAA’s analytical framework, are set out below.

Table 3.1 Model 4a—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	Across the projects reviewed, major CAPEX decisions are overseen by a formal regulatory body to ensure transparency. However, the extent of external regulatory oversight differs. For Salerno Airport, ENAC undertook detailed oversight (including applying penalties on delayed works), and Ofgem will be similarly involved in the construction of Sizewell C, while the expansion of Frankfurt Airport was not subject to detailed regulatory oversight.
Price-setting model	The price-setting model varies across the projects reviewed. While the expansion of Frankfurt Airport was subject to annual price-setting periods before a four-year agreement on charges was made with airlines, Sizewell C and Salerno Airport are subject to RAB–WACC approaches based on longer price control periods.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	Delivery risk is mitigated in the projects, through centralised oversight (in the case of Frankfurt T3) or strong CAPEX incentives set by regulation (in the case of Sizewell C and Salerno Airport).
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	For Salerno Airport and Sizewell C, there are incentives for cost efficiency based on detailed regulatory oversight of project CAPEX.
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	All projects were funded through a mix of private and public investments, including public shareholdings in the relevant entities, public loans, and state guarantees. This procurement model is not associated with a specific financing profile—i.e. public or private.
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	The procurement model is practical to implement, whereas, depending on the project considered, the CAPEX governance and price-setting model may require changes to HAL's current regulatory framework (e.g. a total expenditure (TOTEX) approach for Sizewell C, and limited regulatory oversight for Frankfurt T3).

The CAA's analytical framework	Overall assessment
E1. Promotion of effective competition for the procurement and delivery	Except for Sizewell C (for which the same suppliers as Hinkley Point C were appointed in order to benefit from cost efficiencies), competitive tenders were held to determine which contractors would undertake the project.
E2. Promotion of effective competition in the provision of airport services	None of the analysed airport projects involves an alternative provider of airport services.
F. Service quality. The model promotes an appropriate level of service quality, including improvements where appropriate	In most cases, service quality levels cannot yet be observed due to the assets not being operational. However, the regulatory frameworks are designed to provide strong incentives for high-quality service delivery.

3.2 Sizewell C

Sizewell C will be a nuclear power plant on the East Suffolk coast, designed to provide electricity to approximately 6m homes. Located near the Sizewell A and B facilities, Sizewell C will leverage established infrastructure to support efficient construction and long-term operations.

Project type: New infrastructure

Approval period:[1] 2020–25

Geography, sector: UK, energy

Construction period:[2] 2025–30s

Investment value:[3] £38bn

Capacity increase:[4] 3.2GW

CAPEX governance model[5]	**Procurement model**[6]		**Price-setting model**[7]	
In 2009, the Energy Secretary initially identified Sizewell C as one of eight potential sites for new nuclear development. However, over the following 14 years, the project did not receive full funding under successive governments. Throughout this period, a range of stakeholders—including the UK government, the Office for Nuclear Regulation (ONR), and the energy regulator Ofgem—played key roles in overseeing and guiding the project.	**Model type (DBFOMT[7] framework)**	Model 4a, as Sizewell C is the owner, procurement manager, and operator	**Economic regulator**	Ofgem
	Asset owner	Sizewell C	**Price-setting model**	RAB-based (pre-post-construction review (PCR) phase) with TOTEX (post-PCR phase)
	Asset design and construction entity	Civil Work Alliance (including major construction companies)	**Timeframe of price determination**	12 years pre-PCR 5 years post-PCR
	Asset operator	Sizewell C		

The CAA's analytical framework

A. Support for expansion

- Ofgem has established an economic regulatory framework specific to the construction and operational phases of the project.[8]
- The initial official estimate of £20bn has been revised upwards to £38bn, to reflect 'inflation or risk' before the regulatory model was finalised.[9]

B. Cost

- During the pre-PCR phase, a technical adviser will provide independent scrutiny of eligible costs.[10]
- During the operations phase, Ofgem will apply a TOTEX approach for all CAPEX and operational expenditure (OPEX).[11]

C. Finance—mixed

- The government will hold an initial 44.9% stake. Private shareholders include La Caisse (20%), Centrica (15%), Amber Infrastructure (7.6%), and EDF (12.5%).[12]
- The NWF will provide £36.6bn in debt.[13]

D. Practicality

- Procurement model: practical to implement; CAPEX governance/price-setting model: would need adjustments compared to current model (e.g. to implement a TOTEX framework).

E1. Promotion of effective competition for the procurement and delivery

- Sizewell C chose to partner with the construction firms delivering works at Hinkley Point C without conducting a public tender in order to benefit from their experience and cost efficiencies.[14]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- As the project is under construction, service quality cannot be assessed. The economic regulatory regime is designed to encourage licensees to improve service quality during both the pre- and post-PCR operational phases, with specific incentives outlined in the economic licence.[15]

[7] Acronym stands for Design, build, finance, operate, maintain, and transfer.

3.3 Frankfurt Airport T3

Terminal 3 will become operational in 2026 with a capacity of up to 19mppa (million passengers per annum) and is expected to finish on budget. Once open, it will help resolve the congestion issues at the other terminals at Frankfurt Airport.

Project type: Infrastructure expansion

Approval period:[16] 2001–15

Geography, sector: Germany, aviation

Construction period:[17] 2015–26

Investment value:[18] €4bn (£3.5bn)[19]

Capacity increase:[20] 19mppa (+30%)

CAPEX governance model[21]	Procurement model[22]		Price-setting model[23]	
Fraport AG decided to invest in the asset and is financing the construction of T3 through loans and its own equity. External oversight exists, as the public owners placed several individuals Fraport's governing board. The project's budgeting and scheduling are managed internally by the management centre for the T3 construction site, which is fully incorporated in FAS GmbH. Other than that, Fraport has to follow general auditing guidelines as a publicly traded company in Germany.	**Model type (DBFOMT framework)**	Model 4a, as Fraport is the owner, procurement manager, and operator	**Economic regulator**	State-level ministry of transport (Hesse)
	Asset owner	Fraport AG (52% publicly owned, 25% free float, remaining equity owned by PE firms)	**Price-setting model**	During construction and operations: airport-led cost recovery
	Asset design and construction entity	FAS GmbH (100% owned by Fraport). Asset construction was awarded through tenders	**Timeframe of price determination**	During construction and operations: annual, or multiannual based on negotiation with airlines Since 2025: multi-year fee agreement until 2028, with yearly adjustments
	Asset operator	Fraport AG		

The CAA's analytical framework

A. Support for expansion

- The opening was delayed twice because of COVID-19, which pushed back the initial opening date from 2021 to 2026.[24] It is now expected to open in line with the new opening date.
- The creation of its own subsidiary allowed Fraport to centrally monitor and plan schedules and budgets.[25]

B. Cost

- The project did not incur any cost overruns.[26]
- Separate units for auditing, contractor screening and contract management enabled efficient oversight.[27]
- CAPEX overruns are subject to the regulator's approval case by case.[28]

C. Finance—private

- Approximately 10% of the project value was financed through a loan from the EIB.[29]
- Apart from this, Fraport was the sole bearer of the risk associated with the financing of the project.[30]

D. Practicality

- Private financing aligns with HAL's expansion plans; price setting would need adjustment to change to a different framework.

E1. Promotion of effective competition for the procurement and delivery

- Fraport is required to issue tenders for all contracts over the EU mandated and national thresholds respectively for procurement.[31]

E2. Promotion of effective competition in the provision of airport services

- No competition for the provision of services (Fraport).

F. Service quality

- Cannot be observed at this time, as the terminal has yet to open.

3.4 Salerno Airport

The redevelopment of the Salerno Airport includes the extension and upgrading of the runway, the expansion of the aircraft aprons, a new passenger/commercial aviation terminal, and the reorganisation of the internal airport road system. The airport opened to commercial aviation in July 2024.

Project type: Redevelopment works

Approval period:[32] 2015–20

Geography, sector: Italy, aviation

Construction period:[33] 2020–24

Investment value:[34] €161m (£139m)[35]

Capacity increase:[36] up to 3.3mppa

CAPEX governance model[37]	Procurement model[38]		Price-setting model[39]	
ENAC approved the Airport Development Plan for Salerno Airport in 2015. Assets under construction are remunerated at the WACC, with depreciation starting only once they become operational. If work on an asset stalls and no progress is recorded as work in progress (WIP), its remuneration is suspended unless the delay is due to factors beyond the operator's control.	**Model type (DBFOMT framework)**	Model 4a, as GESAC is a procurement manager and operator (not an owner, as it is a concession)	**Economic regulator**	Italian transport regulatory authority (ART)
	Asset owner	Italian state (concession to GESAC)	**Price-setting model**	RAB–WACC price cap
	Asset design and construction entity	GESAC tendered the project to a consortium of engineering and construction firms	**Timeframe of price determination**	Three years (up to five years under the framework)
	Asset operator	GESAC (also Naples Airport)		

The CAA's analytical framework

A. Support for expansion

- The airport started commercial aviation operations in July 2024 without delays, while construction is still ongoing. The airport is expected to be fully operational in 2026/27.[40]

B. Cost

- The Airport Development Plan costs rose from €86.4m to €160.9m (+86%) due to design updates, COVID-19 material price increases, and contractor adjustments.[41]
- Any increases in CAPEX beyond the amounts initially planned are subject to ENAC's approval.[42] Strong CAPEX incentives, including suspension of the WIP remuneration and penalties for operator-attributable delays.[43]

C. Finance—private

- €134m of the €254m total expected costs over the concession period (which runs until 2043) of the airport construction and additional infrastructure works to be financed with public funds.[44,45]
- Regione Campania is providing an additional €150m for the enhancement of airport access infrastructure.[46]
- In 2024 GESAC invested €28m in the Salerno Airport Development Plan.[47]

D. Practicality

- Procurement model: practical to implement; CAPEX governance/price-setting model: broadly in line with current HAL model.
- Possible for the CAA to implement it in a timely manner.

E1. Promotion of effective competition for the procurement and delivery

- Competition in the design and build of the asset through an international tender procedure.[48]

E2. Promotion of effective competition in the provision of airport services

- No competition on the provision of services, as per the concession regime (GESAC).

F. Service quality

- As the airport has only recently opened, service quality performance is not yet clear.
- Under the regulatory model, tariffs are asymmetrically adjusted (-2% to +1%) based on the achievement of quality and environmental objectives in the previous period. ENAC verifies target achievement annually.[49]

4 Model 4b: Mandated design and build contracts

4.1 Introduction

According to the CAA's classification, under Model 4b, 'Mandated design and build contracts', HAL would procure certain assets through one or more design and build contracts.

Unlike Model 4a, HAL would be mandated by the CAA (or by an independent capital governance process) to competitively tender the design and build works. HAL would continue to manage these contracts, but there would be regulatory oversight regarding which schemes need to be tendered.

If implemented, this approach would require the CAA to introduce licence conditions or guidance obliging HAL to use design and build procurement for specified projects. HAL would retain ownership, financing, and operational responsibilities, as well as responsibility for managing and coordinating its contractors.[8]

It is challenging to identify projects where procurement decisions have been mandated by a regulator or external governance body, as described by the CAA under model 4b. For this reason, in identifying infrastructure projects that can be categorised under this model, we focus on publicly owned entities, interpreting Model 4b as most clearly applicable where public bodies play an important role in capital governance, and where public procurement rules apply for development schemes. For example, the EU public procurement rules impose competitive tendering obligations above certain thresholds.[9]
We identify the following projects as falling under Model 4b:

1. Madrid Barajas Airport T4;
2. Dublin Airport T2;
3. Western Sydney Airport;
4. Centralny Port Komunikacyjny;
5. Berlin Brandenburg Airport.

Our findings regarding the different areas of the CAA's analytical framework, as well as the CAPEX governance and price-setting models, for the projects identified as falling under Model 4b are set out below.

[8] CAA Working Paper, para. 4.61.
[9] See, for example, Directive 2014/24/EU on public procurement, https://eur-lex.europa.eu/eli/dir/2014/24/oj/eng, accessed 12 December 2025.

Table 4.1 Model 4b—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	For all five projects, major CAPEX decisions are subject to oversight by a central government body, ensuring alignment with strategic objectives and regulatory requirements. While the MAD T4, BERG and the Western Sydney Airport projects took place without specific CAPEX incentives, the Dublin T2 development relied on case-by-case approval by the regulator for discretionary costs, while CPK has an external CAPEX governance supervising body with a structured oversight process.
Price-setting model	The price-setting model varies from project to project, in line with existing price-setting models at the airports (where applicable). For example, a RAB–WACC price cap was applied to Dublin T2, while an airport-led cost-recovery approach (a shadow RAB–WACC) was used for MAD T4. As we have not been able to identify price-setting models for Western Sydney Airport and CPK during construction, we set out the price-setting framework likely to apply during the operational phase based on the framework applied to other airports in Australia and Poland respectively.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	While some of the identified projects resulted in significant delays, partly due to limited external oversight and regulatory incentives, others were better managed.
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	With the exception of Sydney Airport, the projects tended to result in cost overruns, especially in the design phase. Economic regulation helps mitigate cost overruns during the construction phase.
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	Given their public ownership, the projects generally benefited from government support in various forms, including loans, equity contributions, and guarantees. This support was particularly critical for Dublin T2, as its development coincided with the 2008 financial crisis, which had a significant impact on Ireland.
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	The procurement model is practical to implement, whereas the CAPEX governance and price-setting model may require changes in the regulation. For instance, in the CPK case, a separate government body oversees infrastructure investment decisions. In the Australian case, airports are subject to a light-touch price monitoring model.

The CAA's analytical framework	Overall assessment
E1. Promotion of effective competition for the procurement and delivery	All the models promoted competition in project procurement and delivery, with large international engineering and construction contractors ultimately winning the bids. Despite this, the quality of the tendering and the delivery outcome were poor for BER.
E2. Promotion of effective competition in the provision of airport services	None of the analysed airport projects involves an alternative provider of airport services.
F. Service quality. The model promotes an appropriate level of service quality including improvements where appropriate	Where already operational, the projects have led to improved service quality levels. However, other than for Dublin T2, the existing model does not appear to offer strong service quality incentive mechanisms, as illustrated by the MAD T4 and Western Sydney Airport projects.

4.2 Madrid Barajas Airport T4

In the early 1990s, AENA developed Plan Barajas, an expansion programme that included a new terminal complex (T4 and satellite) and other infrastructure works at the airport (new parallel runways, airport access). While the publicly funded scheme delivered significant service improvements, the lack of independent regulatory oversight at the time (prior to Directive 2009/12/EC) could be linked to project-related issues (cost overruns and planning delays).

Project type: Infrastructure expansion

Approval period:[50] 1997–99

Geography, sector: Spain, aviation

Construction period:[51] 1999–2006

Investment value:[52] €6.2bn (£5.3bn)[53] (in 2006 prices)

Capacity increase:[54] from 35mppa to 70mppa (+100%)

CAPEX governance model[55]	Procurement model[56]		Price-setting model[57]	
AENA and the Spanish government were the main decision-makers on the project. AENA developed a Madrid-Barajas Master Plan which was approved by the Spanish government. At the time of the expansion project, the regulatory regime did not include any specific CAPEX incentive mechanisms or commitments on key parameters (e.g. the WACC or price path) across years.	**Model type (DBFOMT framework)**	Model 4b, as AENA is owner/procurement manager/operator and complied with public procurement rules	**Economic regulator**	Ministry of Fomento
	Asset owner	AENA (100% publicly owned)	**Price-setting model**	During construction and operations: airport-led cost recovery
	Asset design and construction entity	Estudio Lamella (design)/Ferrovial (construction); tendered by AENA	**Timeframe of price determination**	During construction and operations: one year
	Asset operator	AENA		

The CAA's analytical framework

A. Support for expansion

- Full process handled by AENA and the Spanish government with limited input from other stakeholders.
- More than two-year delay from initial four-year plan caused by late court-ordered land evictions and a two-year wait for approval of the Environmental Impact Statements.[58]

B. Cost

- Significant cost overruns: €2bn more than the €4.2bn originally planned (c.48%) due to higher expropriation costs and interest accrued on late payments.[59]
- Limited incentive under the price-setting model for cost-efficient delivery.

C. Finance—public

- Mostly financed by AENA. The Ministry of Fomento provided public funds to AENA for the project development.[60]

D. Practicality

- No change to the existing procurement framework required but changes required to the price-setting model (i.e. light-touch regulation in place at the time).

E1. Promotion of effective competition for the procurement and delivery

- Competition in the design and build of the asset (tender through EU public procurement).

E2. Promotion of effective competition in the provision of airport services

- No competition for the provision of services (AENA).

F. Service quality

- Asset delivered improvement in punctuality and growth in traffic volumes.[61]
- Regulatory model played a limited to no role in quality improvements.

4.3 Dublin Airport T2

The T2 project at Dublin Airport was undertaken to expand the airport's capacity, support sustained passenger growth, and reduce congestion in the existing terminal. The programme delivered a 75,000m² terminal building, a new boarding-gate pier with multiple air bridges, a combined heat and power energy centre, additional aircraft parking stands, and an upgraded internal road network.

Project type: Infrastructure expansion

Approval period:[62] 2005–07

Geography, sector: Ireland, aviation

Construction period:[63] 2007–10

Investment value:[64] €923m (£798m)[65] (in 2013 prices)

Capacity increase:[66,67] 10–15mppa (+88%)

CAPEX governance model[68]	**Procurement model**[69]		**Price-setting model**[70]	
CAPEX allowances are established at the start of each regulatory period. CAR does not set definitive rules for how to treat investments made without clear airline support, with approval decisions instead made case by case. For the T2 investment, the Department of Transport appointed a verification team to review the project's specifications and costs at different stages of development.	**Model type (DBFOMT framework)**	Model 4b, as DAA is owner, procurement manager, and operator, and complied with public procurement rules	**Economic regulator**	CAR (now the IAA)
	Asset owner	Dublin Airport Authority (DAA)	**Price-setting model**	During construction and operations: RAB–WACC price cap
	Asset design and construction entity	A consortium of engineering and construction firms; tendered by DAA	**Timeframe of price determination**	During construction and operations: five years
	Asset operator	DAA		

The CAA's analytical framework

A. Support for expansion

- There were minor delays, as the project was initially scheduled to open in 2009 but ultimately opened in November 2010.[71]

B. Cost

- According to CAR, the project experienced a 20% cost overrun (€923m versus the €771m approved during planning in 2007).[72]
- DAA was incentivised to control costs through CAR's cost-sharing incentive mechanism, whereby DAA would bear/retain a portion of cost deviations from regulatory allowances.[73]

C. Finance—public

- DAA expressed concerns about its ability to raise funds, particularly in light of credit rating downgrades at that time.[74]
- The EIB provided a loan of up to €300m for the project.[75]
- The airport also secured a €600m Eurobond issue to fund the wider programme around T2.[76]

D. Practicality

- Procurement model: practical to implement; CAPEX governance/price-setting model: similar to current HAL model.

E1. Promotion of effective competition for the procurement and delivery

- Competition in the design and build of the asset.

E2. Promotion of effective competition in the provision of airport services

- No competition for the provision of services (DAA).

F. Service quality

- The airport improved its customer service ranking, rising from 24th to 4th out of 28 European airports in 2011.[77]
- CAR had a system in place to monitor service quality. An incentive mechanism based on penalties was introduced in the 2009 price determination.[78]

4.4 Western Sydney Airport

As the existing Sydney Airport cannot meet future needs, A decision was made to build the Western Sydney International Airport, which opened with a 10mppa capacity with plans to upgrade it afterwards. The airport was built, owned and operated by a government-owned company (WSA Co), and was delivered within budget and seven months ahead of schedule.

Project type: New infrastructure

Geography, sector: Australia, aviation

Investment value:[81] AU$5.3bn (£2.58bn)[82]

Approval period:[79] 2014–18

Construction period:[80] 2018–25

Capacity increase:[83] up to 10mppa initially

CAPEX governance model[84]	**Procurement model**[85]		**Price-setting model** (applied to other airports in Australia)[86]	
WSA Co and the Australian government were the main decision-makers on the project. The WSA Co has to report annually to the Australian government, which is also represented on the WSA Co's board. Financial performance, including CAPEX, is continuously reviewed through WSA's annual Corporate Plan. As the airport is not subject to price regulation, no specific CAPEX incentive mechanisms are in place.	**Model type (DBFOMT framework)**	Model 4b, as the Australian government is in charge of procurement and operations through WSA Co	**Economic regulator**	ACCC
	Asset owner	Australian government	**Price-setting model**	Light-touch model: the ACCC monitors without regulating actively
	Asset design and construction entity	WSA Co oversaw construction; asset construction tendered to private contractors	**Timeframe of price determination**	One year for price monitoring
	Asset operator	WSA Co		

The CAA's analytical framework

A. Support for expansion

- Delivery occurred seven months ahead of schedule.[87]

B. Cost

- The project was delivered on budget, even though there are no regulatory CAPEX incentives in place.[88]
- Collaboration between the main delivery partners enabled efficient procurement of subcontractors through competitive bidding.[89]

C. Finance—public

- Fully financed by the Commonwealth Government through public funds by investing equity in WSA Co.
- Equity contributions totalled AU$5.3bn over ten years.[90]

D. Practicality

- Procurement model would be practical to implement; however, governance/price-setting would require changes from the current framework to implement a light-touch model.

E1. Promotion of effective competition for the procurement and delivery

- Competitive public tenders were used for design and construction and were assessed by the Australian National Audit Office as delivering value for money.[91]

E2. Promotion of effective competition in the provision of airport services

- No competition for the provision of services (WSA Co).

F. Service quality

- As the airport is not yet fully operational, service quality cannot be observed.

4.5 Centralny Port Komunikacyjny

The new airport, CPK, is part of a wider expansion plan to develop the transport infrastructure and cross-connectivity between air, rail and roads around Warsaw. This 'Multiannual Programme' is set to take place over the 2024–32 period, and has a total value of PLN 131.7bn (equivalent to £27bn).

Project type: New infrastructure

Approval period:[92] 2023–26 (expected)

Geography, sector: Warsaw, Poland

Construction period:[93] expected start in 2026

Investment value:[94] PLN 42.7bn (£8.8bn)[95]

Capacity increase:[96] 34mppa initially

CAPEX governance model[97]	**Procurement model**[98]		**Price-setting model** (model applied to other airports in Poland)[99]	
Strategic oversight over the new airport's CAPEX decisions is in the hands of the 'Government Plenipotentiary for the CKP', which is part of the Ministry of Infrastructure. Formally, it sets the rules for CPK's preparation, financing, delivery and related land-acquisition processes. The EU Parliament also applied some oversight, as CPK is included in the TEN-T programme.	**Model type (DBFOMT framework)**	Model 4b, as CPK is owner, procurement manager and operator, and complied with public procurement rules	**Economic regulator**	ULC (Polish Civil Aviation Authority)
	Asset owner	CPK	**Price-setting model**	Airport-led cost recovery
	Asset design and construction entity	Consortium between Foster & Partners and Buro Happold	**Timeframe of price determination**	Annual consultation
	Asset operator	CPK Lotnisko (49% Vinci Airports and IFM, 51% Polish State Treasury)[100]		

The CAA's analytical framework

A. Support for expansion

- The Supreme Audit Office deemed the Plenipotentiary's oversight inadequate and labelled initial analyses and deadlines 'unrealistic and unfeasible'.[101]
- Initial plan expected construction to start in 2023 for the airport to be operational by 2028 (now expected to be in 2026 and 2032, respectively).[102]

B. Cost

- Given that construction is expected to start in 2026, there is currently no indication of cost management; however, official estimates have increased significantly.[103]

C. Finance—mixed

- 40% from Vinci and IFM (through 49% equity purchase of CPK Lotnisko).
- 60% from debt financing through bonds and bank loans.[104]
- CPK is also applying for CEF grants from the EU.[105]

D. Practicality

- Creation of a government body (or powers given to the CAA) to supervise HAL's investment decisions would require some adjustments from the current framework.

E1—promotion of effective competition for the procurement and delivery

- A competition was organised to award the design of CPK, in which seven large firms placed bids.[106]
- Construction and project management contracts will be awarded through tenders.

E2. Promotion of effective competition in the provision of airport services

- No indication that the operator will change in the future.

F. Service quality

- Cannot be observed at this time, as the airport has yet to open. The tender offers for the CPK's general contract engineer are still under consideration.

4.6 Berlin Brandenburg Airport

Following reunification, plans for a new Berlin airport changed from a private project to a development led by public authorities. Construction began in 2006 with a planned budget of €2.5bn and an opening date of 2011, but issues in the strategic decision-making from management ultimately pushed costs to about €6.8bn and delayed opening until 2020.[107]

Project type: New infrastructure

Approval period:[108] 1992–2006

Geography, sector: Germany, aviation

Construction period:[109] 2006–20

Investment value:[110] €6.8bn (£5.88bn)[111]

Capacity increase:[112] up to 43mppa initially

CAPEX governance model[113]	Procurement model[114]		Price-setting model[115]	
After the initial plan to privatise the airport failed in the early 2000s, the three administrations involved announced that they would build the airport under public sponsorship. FBB GmbH was the key decision-maker, as there was no external oversight of the project. Independent ex post audits found that the regulatory mechanisms in place were insufficient and did nothing to stop the significant delays and overspending.	**Model type (DBFOMT framework)**	Model 4b, as DBB is owner, procurement manager, and operator, and complied with public procurement rules	**Economic regulator**	State-level ministry of transport (Brandenburg)
	Asset owner	FBB GmbH (100% publicly owned)	**Price-setting model**	Airport-led cost recovery
	Asset design and construction entity	While designed by gmp Architekten, asset construction was awarded through tenders	**Timeframe of price determination**	Annual, or multiannual, based on negotiation with airlines
	Asset operator	FBB GmbH (100% publicly owned)		

The CAA's analytical framework

A. Support for expansion

- Project was delayed by nine years.[116]
- Lack of external oversight and lack of a general contractor to coordinate the various contractors.[117] Supervision was internal and independent auditors found it not to be sufficient.[118]

B. Cost

- Significant cost overrun as construction costs almost tripled, from €2.5bn to €6.8bn (+172%).[119] Cost overruns stemmed from weak project governance, excessive tender fragmentation, and lack of external oversight.[120]
- CAPEX overruns subject to the regulator's approval, but latter's ownership in FBB likely contributed to inefficiencies.[121]

C. Finance—public

- 40% of the investment value was financed through grants or loans from the public owners; the remaining 60% via state-guaranteed capital-market loans.[122]
- Cost overruns created the need for constant refinancing which first required EU approval, with public owners having to bail out FBB GmbH several times.[123]

D. Practicality

- Given its flawed approach, the project serves as a cautionary example for other megaprojects
- Application of regulatory framework would require changes to the current HAL framework.

E1. Promotion of effective competition for the procurement and delivery

- The lack of a general contractor overseeing the project led to inefficiencies, causing major overspend and delays.[124]

E2. Promotion of effective competition in the provision of airport services

- No competition for the provision of services (FBB GmbH).

F. Service quality

- The airport was recently named the 'Most Improved Airport 2025' by Skytrax, reflecting strong service improvements since its 2020 opening.[125]
- Unclear role played by the regulatory model in quality improvements.

5 Model 5a: Operation (Management Contract)

5.1 Introduction

According to the CAA's definition, under Model 5a, 'Operation (Management Contract)', HAL would tender contracts for the operation of airport assets to a third party, and would pay the third party a fee based on availability payments or performance-linked fees.

Unlike Model 5b, the competitively tendered management contract would only outsource day-to-day operations to a third party without any transfer of responsibilities with regard to designing and building the asset. Asset ownership would also remain with HAL.

HAL would continue to bear all financial responsibility and revenue risk associated with airport operations. It would also have to benchmark operations in line with a framework that the CAA would need to define in order to track the performance of the private asset operator.

This model of competitively tendering the operational aspect of an asset to a third party has been used several times in the UK, particularly for rail schemes.

We identify the following projects as falling under Model 5a:

1 High Speed 1;
2 Crossrail Elizabeth line;
3 East London line extension - ELLX.

Our findings regarding the different areas of the CAA's analytical framework, as well as the CAPEX governance and price-setting models for the projects identified as falling under Model 5a, are set out below.

Table 5.1 Model 5a—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	CAPEX governance for the Elizabeth line was handled by the DfT and Transport for London, which acted as sponsors, thereby taking accountability of investment decisions, securing funding and general governance of the project. CAPEX for the ELLX followed an NEC3 option C mode contract (a target cost contract whereby contractor and client share accountability for any cost overruns). CAPEX was under constant scrutiny by the financiers of this project, namely the EIB, Department for Transport (DfT) and TfL. In the case of HS1, while the UK government remains the ultimate legal owner of the asset, the contract sets out that the concessionaire finances CAPEX and operates the asset.
Price-setting model	Crossrail and London Overground are public transport schemes funded by local and national governments; as such, cost recovery is not pursued solely through user charging (i.e. fares). HS1 is subject to a cost-recovery model, although the project did not have a price-setting model in place during construction.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	Budget cuts and planning errors (e.g. 36 separate parallel procurement contracts in place for the Crossrail development) led to delays for Crossrail and the ELLX. For HS1, the restructuring of the deal through a public–private partnership (PPP) contract with London and Continental Railways (LCR) ensured there were fewer planning hurdles.
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	The NEC3 option C model was applied to the schemes and incentivised cost efficiency through a target contract with an activity schedule and cost sharing. However, delays led to cost overruns. In the case of HS1, cost overruns were controlled, as Rail Link Engineering (RLE) was incentivised to meet target costs and delivery times for each section of the project through its contract.

The CAA's analytical framework	Overall assessment
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	Of the three projects considered to fall in this category, only HS1 was partly financed privately. Crossrail and the ELLX were developed without private equity (PE).
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	All projects reviewed are rail schemes for which a pre-existing regulatory framework was in place to allow for management contracts. In the context of HAL, a regulatory framework would need to be defined to allow for a new operator to provide services on a specifically outlined part of the infrastructure (including a methodology for the separation of activities between HAL and a new operator).
E1. Promotion of effective competition for the procurement and delivery	All projects efficiently utilised competitive procedures for procurement as they were legally required to do so.
E2. Promotion of effective competition in the provision of airport services	For the projects reviewed, a competitive procedure was used in the appointment of the operating third party (competition for the market). However, these schemes cannot be compared directly to a third-party operator competing with HAL in the provision of airport services, as there is no effective competition in the market.
F. Service quality. The model promotes an appropriate level of service quality including improvements where appropriate	All projects led to improvements with respect to service quality. Strict tendering processes and reference models presented before the tender began ensured high-quality service for these projects.

5.2 High Speed 1

HS1 is a high-speed rail link connecting London with the Channel Tunnel, through new tunnels and bridges, enabling fast, reliable international services from the UK to mainland Europe. Its overarching goal was to boost capacity, cut journey times and support wider economic development by integrating the UK into the European high-speed rail network.

Project type: New infrastructure

Geography, sector: UK, rail

Investment value:[128] £6.1bn

Approval period:[126] 1991–98

Construction period:[127] 1998–2007

Capacity increase:[129] 9.3mppa

CAPEX governance model[130]	Procurement model[131]		Price-setting model[132]	
While the UK government remains the ultimate legal owner of the assets, the contract sets out that the concessionaire finances CAPEX (via revenues, debt and investor financing). Simultaneously, the Office of Rail and Road (ORR) reviews and approves funding/charges through periodic regulatory reviews.	**Model type (DBFOMT framework)**	Model 5a, as HS1 has a concession to operate the line	**Economic regulator**	ORR
	Asset owner	Department for Transport	**Price-setting model**	Regulated cost recovery
	Asset design and construction entity	RLE via London and Continental Railways (LCR)	**Timeframe of price determination**	Five years
	Asset operator	Pre-2010: LCR Post-2010: HS1		

The CAA's analytical framework

A. Support for expansion

- The large scale of the project made it very sensitive to regulatory and public scrutiny, as well as macroeconomic factors.
- To reduce financial risk and maintain public support, the project was split into two phases, at the cost of a four-year delay.[133]
- Restructuring of the deal through a PPP contract with LCR meant that the expansion faced fewer hurdles.[134]

B. Cost

- Cost overruns (+18% overruns from initial projections) were caused by optimistic assumptions about passenger demand and additional construction works.[135]
- Through its contract, LCR was incentivised to meet target costs and delivery times for each section of the project.

C. Finance—public

- Project received over £1.8bn in government grants, funded by the taxpayer.[136]
- Contract with LCR placed it in charge of raising private financing for the remaining £4bn.
- LCR faced insolvency, and the project was restructured with government-backed debt.[137]

D. Practicality

- Separation of activities between HAL and a new operator would be required, including negotiations regarding cost sharing, impact on RAB and cost recovery.

E1. Promotion of effective competition for the procurement and delivery

- An open PPP tender determined who would fund and operate HS1. The project delivery structure was selected via competitive procurement, with bids from multiple consortia.[138]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- Passenger numbers increased and there were improvements in journey times, but both fell short of original forecasts.[139]
- Strong delivery incentives were built into contracts, including the risk of losing management fees, driving high performance.[140]

5.3 Crossrail Elizabeth line

The Elizabeth line is TfL's project to enhance connectivity for commuters and tourists by connecting Heathrow Airport and other areas to Central London in under 45 minutes. Initially conceived in 2002 (under the name 'Crossrail'), the project was delivered 18 years later, following significant delays and cost overruns.

Project type: New infrastructure

Approval period:[141] 2004–09

Geography, sector: UK, rail

Construction period:[142] 2009–22

Investment value:[143] £18.9B

Capacity increase:[144] 200mppa

CAPEX governance model[145]	Procurement model[146]		Price-setting model[147]	
The NEC3 form of contract introduced incentives to remain cost-efficient due to a 50/50 pain/gain share on all main works and specific fee-retention policies in the case of termination. The Crossrail Bill also ensured that the ORR retained regulatory oversight over the infrastructure.	**Model type (DBFOMT framework)**	Model 5a, as only GTS Rail operates the line owned by TfL	**Economic regulator**	ORR
	Asset owner	TfL	**Price-setting model**	Mayor/TfL-led administrative pricing model
	Asset design and construction entity	Grimshaw, Maynard, AtkinsRéalis, Arup, Systra	**Timeframe of price determination**	Annual
	Asset operator	Pre-2025: MTR Corp Post-2025: GTS Rail		

The CAA's analytical framework

A. Support for expansion

- Timeline of project delivery was pushed back from 2018 to 2022 due to 2010 budget cuts.
- Delivery of 36 separate, parallel contracts increased the delivery and cost risks and vulnerability.[148]

B. Cost

- The project costs exceeded initially projected costs by over £4bn (£18.9bn versus £14.8bn).
- Overruns were mainly due to delays caused by lower-than-expected productivity.[149]

C. Finance—public

- Approximately two-thirds of project financing came from private debt issued to BAA, Canary Wharf Group and the Corporation of London.[150]
- The remaining third came from direct funds from government grants.[151]
- The construction of the project did not involve issuance of PE.

D. Practicality

- Separation of activities between HAL and a new operator would be required.

E1. Promotion of effective competition for the procurement and delivery

- Construction projects were competitively tendered as required by the Crossrail Act 2008 and NEC3.[152]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- According to a post-opening survey, the Elizabeth line led to strong improvements in connectivity (+71,000 trips daily across London).[153]
- It scored the highest in terms of satisfaction across TfL's network.
- A strict tendering process meant high quality in the delivery of the service, but at the cost of lengthy delays.[154]

5.4 East London line extension

This extension transformed the former East London Underground into part of the London Overground Network, extending the line both North and South. The first phase started in 2005 and was completed in 2010, while phase 2 was finished in 2012. The whole project was part of the TfL's £10bn Investment Programme and it was required to host the 2012 Olympic Games.

Project type: Infrastructure expansion

Approval period:[155] Phase 1 2004–05; Phase 2 2009–10[156]

Geography, sector: UK, rail

Construction period:[157] Phase 1 2005–10; Phase 2 2010–12

Investment value:[158] £1bn

Capacity increase:[159] from 10.4 to 35.4mppa (+240%)

CAPEX governance model[160]	Procurement model[161]		Price-setting model[162]	
The ELLX was initiated by the government in 2001. Regulatory oversight was held by TfL and ORR. The project followed the NEC3 option C model, and was subject to EU Directive 2004/18/EC. The project was under the scrutiny of TfL and other stakeholders, such as the DfT and EIB, and the Mayor of London, who is responsible for transport strategy under the Greater London Authority Act 1999.	**Model type (DBFOMT framework)**	Model 5a, as only Arriva Rail operates the line owned by TfL	**Economic regulator**	ORR
	Asset owner	TfL	**Price-setting model**	Mayor/TfL-led administrative pricing model
	Asset design and construction entity	Parsons Brinckerhoff (programme manager), Taylor Woodrow, Balfour Beatty and Carillion, Birse Metro	**Timeframe of price determination**	Annual
	Asset operator	MTR Laing Metro Limited; Arriva Rail London Limited from 2016 onwards		

The CAA's analytical framework

A. Support for expansion

- Phase 1 was completed in 2010, in line with initial expectations, while Phase 2 got delayed by seven months and missed the May 2012 deadline.[163]

B. Cost

- An NEC3 option C model was applied to the scheme. It is a target contract with an activity schedule and a pain/gain system to ensure efficient spending.

C. Finance—public

- The project was fully financed by public entities.
- EIB provided £450m in debt funding.[164]
- DfT provided £64m.[165]
- The construction of the project did not involve issuance of PE.

D. Practicality

- Different CAPEX governance and price-setting models, which would be challenging to apply to HAL.
- A new operator for part of the airport may require its own operating licence and related legal/regulatory changes.

E1. Promotion of effective competition for the procurement and delivery

- TfL was subject to EU Directive 2004/18/EC on public procurement.[166]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- TfL reports that the infrastructure upgrade delivered increased train frequency, better management and service quality improvement.[167]
- The ELLX is part of the reason for the London Overground's best public performance measure up to 2011.[168]

6 Model 5b: Design, build and operate

6.1 Introduction

According to the CAA's definition, under Model 5b, 'Design, build and operate', a competitively retained partner would be responsible for designing, building, and operating new assets on HAL's behalf and within a contractual structure.

Unlike Model 5a, HAL would be required by the CAA (or by an independent capital governance process) to competitively tender to a third party not only the operation, but also the design, construction works and financing. HAL would nevertheless continue to supervise the partner in accordance with a regulatory framework set out by the CAA.

If implemented, this approach would require the CAA to introduce licence conditions or guidance obliging HAL to use 'design, build and operate' procurement for the specified project. Although HAL would retain ownership of the asset, operational responsibilities and the associated risks would be outsourced to the partner, as well as the responsibility for managing and coordinating subcontractors.

It is challenging to identify projects where the existing operator has been mandated by a regulator or external governance body to procure a partner to design, build and operate, as described by the CAA under model 5b.

We identify the following projects as having elements of Model 5b, whilst highlighting that they do not exactly conform to the CAA's description of this model:

1. Thames Tideway Tunnel (construction, financing and maintenance are contracted to a third-party, but design and operations are handled by the existing operator);
2. HARP (design, construction, financing and maintenance are contracted to a third-party, but operations are handled by the existing operator);
3. Santa Lucia Tunnel (design, construction, operations, maintenance and financing are contracted to the concessionaire, but the concession contract is with the government rather than an existing operator);
4. Vancouver Pier D (design, construction, operations, maintenance and financing are contracted to the concessionaire, but the

concession contract is with the government rather than an existing operator).

Our findings regarding the different areas of the CAA's analytical framework, as well as the CAPEX governance and price-setting models for the projects we have considered under Model 5b, are set out below.

Table 6.1 Model 5b—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	For all four projects, major CAPEX decisions must be approved by an oversight body, ensuring alignment with strategic objectives and regulatory requirements. However, the degree of regulatory oversight varies. Thames Tideway Tunnel's CAPEX was regulated by an independent technical advisor (ITA) who conducted monthly reviews of CAPEX spending, with any overspending resulting in penalties. For HARP, Ofwat maintains strict control on CAPEX through its DPC framework as the 'Allowed Revenue Direction' allows it to control CAPEX-related payments. For Vancouver Pier D, the operator only needed general approval for the construction of the asset. CAPEX was governed internally through its board, with some government oversight. For the Santa Lucia Tunnel, the regulator has a binding opinion on the eligibility of CAPEX to enter the RAB.
Price-setting model	The price-setting model varies between the projects, in line with them being from different sectors and jurisdictions. For Thames Tideway, in the construction and early operations period, the rate of return is determined competitively by a reverse auction. Similarly for HARP, during construction, the long-term rate of return is implicit in the contract with the project company. During operations, HARP relies on an 'Allowed Revenue Direction', as prices are set through a competitive bidding process under the DPC framework. Price setting for the Santa Lucia Tunnel occurs through a RAB–WACC model; whereas there is no direct regulation of Vancouver Airport's cost recovery.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	With the notable exception of HARP (with the extensive tendering process in context of the DPC causing delays), all projects were delivered without major delays.

The CAA's analytical framework	Overall assessment
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	HARP and the Thames Tideway Tunnel are developed under frameworks that incentivise cost efficiency. Vancouver Airport stayed on budget despite the absence of CAPEX incentives. The Santa Lucia Tunnel was also delivered on budget, with the concessionaire bearing cost overrun risks.
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	All projects raised the necessary financing to construct the asset. Of the four projects, only Vancouver Airport does not involve PE stakes. All other projects are privately financed.
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	The DPC framework used for HARP would have to be adjusted to fit into the current procurement framework, while the approach for Vancouver Airport is tied to the operators being community-driven, non-profit companies, which is not the case for HAL.
E1. Promotion of effective competition for the procurement and delivery	All projects used competitive procedures to some degree for the procurement of private subcontractors. Any differences can mostly be attributed to the respective local legislation on procurement.
E2. Promotion of effective competition in the provision of airport services	None of the analysed airport projects involves an alternative provider of airport services.
F. Service quality. The model promotes an appropriate level of service quality including improvements where appropriate	This is difficult to assess as HARP is not yet operational and there is no information on service quality for the Santa Lucia Tunnel. While service quality at Vancouver Airport is high, there are no regulatory mechanisms in place to incentivise service quality. For the Thames Tideway Tunnel, the role of regulatory oversight in ensuring performance is unclear.

6.2 Thames Tideway Tunnel

The Thames Tideway Tunnel is a system designed to prevent sewage entering the River Thames. The £4.6bn project started in 2015 and was completed and opened in 2025. The tunnel is being delivered with private finance and, once complete, ownership will remain with Tideway, while Thames Water takes on operations. It is expected to reduce sewage discharges by over 90%.

Project type: New infrastructure

Geography, sector: UK, water

Investment value[171]: £4.6bn

Approval period:[169] 2014–15

Construction period:[170] 2015–25

Capacity increase:[172]1.6m cubic metres

CAPEX governance model[173]	Procurement model[174]		Price-setting model[175]	
The initial solution to the sewer problem was identified in a study from 2005, and further confirmed in the 2012 National Policy Statement for Waste Water, which presented the Thames Tideway Tunnel as the only solution for the sewers. While the allowable project spend is verified by the ITA, which is appointed by Thames Water and approved by Ofwat, it is Ofwat that determines the regulatory capital value (RCV).	**Model type (DBFOMT framework)**	Model 5b—design, build and maintenance by Bazalgette	**Economic regulator**	Ofwat
	Asset owner	Bazalgette Tunnel Limited	**Price-setting model**	RCV-fixed return[176] (2.497%, RPI-linked) during construction; afterwards Ofwat sets an allowed WACC
	Asset design and construction entity	Three different consortia won tenders for different geographic areas	**Timeframe of price determination**	For the construction phase: from 2015 to 2030 During operations: five years
	Asset operator	Thames Water		

The CAA's analytical framework

A. Support for expansion

- Thames Water appointed an ITA which oversaw the construction process.[177]
- Ofwat ensures a reward-penalisation system that imposes penalties in case of late completion.[178]
- The construction was completed in 2025, later than its initial 2024 schedule, as COVID caused delays.[179]

B. Cost

- The ITA oversees spending and calculates the allowable project spend. Any excess spending ends up in penalties through an incentive adjustment factor (IAF).[180]
- The allowable project spend is verified monthly by the ITA.[181]
- Cost overrun of around £1bn compared to initial estimations.[182]

C. Finance—private

- The EIB provided a £700bn, 35-year loan.[183] Shareholders invested £1.3bn (about 50% from UK investors such as pension funds).
- Long-term debt stands at £3.674bn, with a net debt to adjusted RCV of 68%.[184]

D. Practicality

- HAL and the new operator would have to share critical services, such as IT and security.
- Applying a completely different procurement/operation and price control framework would likely require important regulatory/legal changes.

E1. Promotion of effective competition for the procurement and delivery

- Procurement process oversight by Thames Water under Specified Infrastructure Project (SIP) regulation.[185]
- Process was overseen by Defra and Ofwat.[186]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- The project was already able to capture 850,000 tonnes of sewage after heavy rains in 2024.[187]
- Projected capability of reducing sewage overflow by 95%.[188]
- Prior to procurement, a reference design was presented, setting the initial requirements for performance.[189]

6.3 Haweswater Aqueduct Resilience Programme

HARP is replacing six tunnel sections of the 110km Haweswater Aqueduct with the intention to secure drinking water supply for 2.5 million people across north-west England. STRABAG UK will lead the design, construction and operation. It is the UK's first major DPC project.

Project type: Infrastructure expansion

Approval period:[190] 2021–28 (expected)

Geography, sector: UK, water

Construction period:[191] expected 2026–35

Investment value:[192] £3bn

Capacity increase:[193] resilience for 2.5m current customers

CAPEX governance model[194]	Procurement model[195]		Price-setting model[196]	
HARP was proposed by United Utilities (UU) and will be delivered under Ofwat's DPC framework. Ofwat exercises regulatory control over UU's operations. The operator is incentivised through target-cost and KPI mechanisms to ensure cost efficiency, while recovery of charges is dynamically governed through periodic Allowed Revenue Direction (ARD) adjustment.	**Model type (DBFOMT framework)**	Model 5b, as design, build, finance and maintain by Cascade Infrastructure Ltd	**Economic regulator**	Ofwat
	Asset owner	UU	**Price-setting model**	Privately negotiated contract for construction; regulatory allowed revenue for UU operations
	Asset design and construction entity	Cascade (STRABAG, GLIL)	**Timeframe of price determination**	Contractual period (25 years from end of construction)
	Asset operator	UU handles the operation, while Cascade handles the maintenance		For operations by UU: five years

The CAA's analytical framework

A. Support for expansion

- The DPC model ensured competitive tendering and strong alignment of incentives throughout construction, but came at the cost of administrative delays.
- Contract was issued in August 2025 rather than the initially planned March 2022 due to extended negotiations.[197]
- Ex ante assessment of timeliness is not possible.

B. Cost

- Too early to evaluate HARP's construction cost efficiency, as construction is yet to start.
- Contractual terms between the asset operator and owner (UU) specify that UU will fund capital cost overruns that exceed the (proposed) 30% threshold.[198]

C. Finance—private

- The project is financed through private debt (NatWest, Aviva, PIC, PPF) and the NWF.[199]
- The NWF funds 10%, PIC 10%, Aviva 6.6%, and NatWest 5%.[200]
- NWF's £300m Credit Enhancement Guarantee Facility reduced the project's risk profile.[201]

D. Practicality

- The DPC would have to be made to fit into the current sophisticated procurement framework.
- Time required to implement contractual negotiations can be significant, as shown in the case of HARP.

E1. Promotion of effective competition for the procurement and delivery

- The DPC ensured competitive tendering of major infrastructure projects to third parties which design, build, finance and operate them.[202]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- Construction has yet to start.
- Ofwat holds special administration rights if the operator's performance does not meet its principal duty, and can appoint a new provider. This should incentivise the consortium to provide high-quality service.[203]

6.4 Santa Lucia Tunnel

The Santa Lucia Tunnel is the main underground work of the A1 Barberino–Calenzano, which represents an upgrade of the current Firenze Nord highway. It was developed to increase the capacity of the Firenze–Bologna motorway and to be the longest three-lane road tunnel in Europe, at 7.9 km.

Project type: New infrastructure

Geography, sector: Italy, highway

Investment value:[206] €1bn (£0.88bn)[207]

Approval period:[204] 2010–13

Construction period:[205] 2016–22

Capacity increase:[208] reduce travel time by 30%

CAPEX governance model[209]	**Procurement model**[210]		**Price-setting model**[211]	
Investments are defined in the concession agreement, with the concessionaire being responsible for presenting the design/ technical schemes for each project to the Ministry for approval. The CAPEX plan is included in its Piano Economico–Finanziario (PEF), which specifies allowed costs for each investment. The Ministry then assesses and approves the plan, and ART, as the regulatory authority, issues a binding opinion on the eligibility of CAPEX overruns for recognition in the RAB.	**Model type (DBFOMT framework)**	Model 5b, as design, build, finance and operate by ASPI	**Economic regulator**	ART
	Asset owner	Ministero delle infrastrutture e dei trasporti (MIT)	**Price-setting model**	Allowed revenue, WACC–RAB model
	Asset design and construction entity	Autostrade per l'Italia (ASPI) via Pavimental SpA	**Timeframe of price determination**	Five years: 2025–29
	Asset operator	ASPI		

The CAA's analytical framework

A. Support for expansion

- The tunnel was supposed to open by the end of 2021 but ended up being ready at the end of Q1 2022, with a three-month delay.[212]

B. Cost

- No identified cost overruns on the construction cost for ASPI.
- The construction risk is generally borne by the concessionaire.[213]

C. Finance—private

- EIB granted a loan for €250m for the construction of the infrastructure, including the tunnel.
- Overall, the rest of the project, as with the rest of the CAPEX plan, is financed by ASPI.[214]

D. Practicality

- Procurement and price-setting models similar to HAL's.
- Any changes to the regulatory model would be limited.

E1. Promotion of effective competition for the procurement and delivery

- Motorway concessionaires have an obligation to tender out a certain share of their works and services.[215]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- Concessionaire service quality is monitored by the regulator.[216]
- Projects like this tunnel contribute to the overall concessionaire service quality performance (e.g. a 30% reduction in travel times).[217]

6.5 Vancouver Pier D

Vancouver Airport is operated by the Vancouver Airport Authority (VAA) through an 80-year lease. VAA presented a new CAD$9.1bn expansion plan, including the CAD$300m Pier D project. As VAA is a non-profit company, it finances its infrastructure projects entirely through debt from the capital market and its own revenue streams.

Project type: Infrastructure expansion

Approval period:[218] 2015–17

Geography, sector: Canada, aviation

Construction period:[219] 2017–21

Investment value:[220] C$300m (part of C$9.1bn project) (£162m)[221]

Capacity increase:[222] 25mppa to 35mppa (40% increase) for the whole expansion plan

<table>
<tr><th>CAPEX governance model[223]</th><th colspan="2">Procurement model[224]</th><th colspan="2">Price-setting model[225]</th></tr>
<tr><td rowspan="4">The VAA decided to expand its capacity to resolve congestion issues. As a non-profit organisation that reinvests its profits into airport development and operations, it was able to make this decision by itself. However, the expansion plan had to be approved by the Canadian Minister of Transport. External oversight exists through a Board of Directors appointed from the local community. As there is no direct regulation on the CAPEX, VAA is able to raise more funding by increasing its airport improvement fee (AIF).</td><td>Model type (DBFOMT framework)</td><td>Model 5b, as design, build, finance, operate by VAA</td><td>Economic regulator</td><td>n/a—no economic regulator</td></tr>
<tr><td>Asset owner</td><td>Transport Canada</td><td>Price-setting model</td><td>Airport-led cost recovery</td></tr>
<tr><td>Asset design and construction entity</td><td>All contracts >C$100,000 must be tendered. VAA is responsible for procurement. Design was handled by Kasian, and construction by PCL Construction</td><td rowspan="2">Timeframe of price determination</td><td rowspan="2">Set by the airport annually during the 80-year lease from Transport Canada</td></tr>
<tr><td>Asset operator</td><td>VAA</td></tr>
</table>

The CAA's analytical framework

A. Support for expansion

- Construction was halted for four months due to COVID-19.[226]
- Mandated competitive tendering ensured an efficient procurement process.[227]

B. Cost

- The project had no known cost overruns and finished within budget.[228]
- As there is no direct regulation on AIFs, VAA could theoretically handle any CAPEX overruns by increasing its fees.[229]

C. Finance—public

- VAA received no public funding.[230]
- Funding was raised by loans from the capital market (C$2bn), and through other revenue streams such as the AIFs, land development and co-owned malls.[231]
- VAA is free to increase its AIF, which is almost solely used for CAPEX at VAA5.[232]

D. Practicality

- VAA is able to raise the AIF independently, which is not possible for HAL under the existing CAA framework.

E1. Promotion of effective competition for the procurement and delivery

- Competitive tendering for private contractors is mandated for any single contract bigger than C$100,000.[233]

E2. Promotion of effective competition in the provision of airport services

- VAA is the sole operator at Vancouver International Airport.

F. Service quality

- Vancouver International Airport was awarded 'Best Airport in North America' by SkyTrax in 2025.[234] Good service quality performance with limited regulatory oversight.

7 Model 6: Third party builds assets, then transfers ownership to HAL

7.1 Introduction

According to the CAA's definition, under Model 6, 'Third party builds assets, then transfers ownership to HAL', a third party designs, finances, and builds a new asset, but transfers ownership to HAL upon completion.

Under Model 6, HAL would remain the owner and operator of the asset in the long term, which would be included in its RAB. The CAA would play an important role in assessing the scope of the assets being transferred, as well as when in the procurement process this occurs, and how the price at which the asset is transferred is determined.

The CAA has proposed two possible approaches as part of this model:

- an ex ante approach, where agreement on the transfer price takes place before the third party assumes ownership of the asset, such as during the planning process;
- an ex post approach, in which an independent authority chooses the transfer price after construction has taken place, allowing the price to be based on measures such as efficient costs incurred.

We identify the following projects as falling under Model 6:

1. the Savoie-Piémont HVDC Line;
2. Istanbul Airport.

Our findings on the different areas of the CAA's analytical framework, as well as the CAPEX governance and price-setting models for the projects identified as falling under Model 6, are set out below.

Table 7.1 Model 6—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	The approach to CAPEX governance differs between these two infrastructure construction projects, despite both of them relying on a separate third-party private entity to build and operate the asset before transferring it to a public entity. While the Savoie–Piémont HVDC Line construction was under the supervisory scrutiny of the sector regulator(s), CAPEX governance for the new airport in Istanbul was mostly in the hands of the airport's construction consortium, with incentives created through the structure of the contracting process.
Price-setting model	Despite construction and operations of Istanbul Airport being undertaken by the iGA consortium, price-setting powers remained in the hands of the economic regulator (Turkish Airports Authority) and were to be determined annually once the asset was in operation (there was no price-setting model in place during construction). The HVDC Line has a two-phase price determination framework, whereby charges are market-based until the asset gets transferred to Terna and RTE, at which point the asset will be subject to a RAB–WACC model.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	Constructors' incentives were aligned with the objective of delivering the project in a timely manner due to the relatively short timeframe before the assets would be transferred, after which they will not be able to recoup their investment.
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	Neither project had significant cost overruns, at least in part due to the procurement framework and financial risk being borne by the constructor. There is limited information available on the cost-efficiency performance of these two projects.

The CAA's analytical framework	Overall assessment
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	Both projects are privately financed.
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	Both schemes appear to be developed under a build-operate-transfer procurement framework for specific reasons. For the electric transmission infrastructure, this was to ensure the development of an investment that was perceived as risky and less attractive to private investors. For Istanbul Airport, it was to ensure that a constructor/operator with adequate experience would lead the project. These concerns are not relevant for the Heathrow expansion scheme.
E1. Promotion of effective competition for the procurement and delivery	Both projects used competitive procedures to some degree for the procurement of private subcontractors. Any differences can mostly be attributed to the respective local legislation on procurement.
E2. Promotion of effective competition in the provision of airport services	Not applicable to the electric transmission infrastructure project. There is no active competition for operations at Istanbul Airport.
F. Service quality. The model promotes an appropriate level of service quality including improvements where appropriate	There is no specific indication that the regulatory model influences outcomes on service quality.

7.2 Savoie-Piémont HVDC Line

The Savoie-Piémont HVDC Line is a 190km underground electric transmission infrastructure that connects Italy and France. It is the longest DC cable power line in the world installed along motorway infrastructure. It is one of the Projects of Common Interest (PCI) of the European Commission, as it contributes to the creation of North–South infrastructural electricity transmission corridors.

Project type: New infrastructure

Approval period:[235] 2009–11

Geography, sector: Italy–France, electricity

Construction period:[236] 2013–23

Investment value:[237] €1.4bn (£1.23bn)[238]

Capacity increase:[239] from 2,650MW to 4,400MW (+66%)

CAPEX governance model[240]	Procurement model		Price-setting model[241]	
When the asset was transferred to Terna after the period of exemption, ARERA became responsible for the regulatory approval and subsequent monitoring of CAPEX for inclusion in the RAB under the current Italian regulatory framework for electricity transmission.[242] The ownership transfer scheme enabled a private investor to profit from higher congestion revenues between France and Italy before transferring the asset to Terna at book value, in accordance with EU law.	**Model type (DBFOMT framework)**	Model 6, ownership transfer post-construction	**Economic regulator**	ARERA (Italy); CRE (France)
	Asset owner	Piemonte–Savoia S.r.l., transfer of ownership to Terna and RTE at the end of regulatory exemption period (2033)[243]	**Price-setting model**	Market-based until end of regulatory exemption period, then RAB–WACC model[244]
	Asset design and construction entity	Consortium of seven companies led by Prysmian[245]	**Timeframe of price determination**	10 years (2023–33)[246]
	Asset operator	Until 2033: Piemonte-Savoia; after 2033: Terna–RTE[247]		

The CAA's analytical framework

A. Support for expansion

- The project was completed four years later than initially expected (2023 versus 2019).[248]
- The project falls under the EU regulation on the Trans-European Networks for Energy (TEN-E), is classified as a PCI and benefits from faster planning and increased investability.[249],[250]

B. Cost

- The new ARERA regulation on CAPEX recognition states that only cost-efficient and necessary expenditure are recognised in the RAB.[251]
- Piemonte-Savoia bore all the financial risk associated with the construction costs, disincentivising overruns.
- No cost overruns have been identified.

C. Finance—mixed

- €500m invested by Terna and RTE.
- EIB loan of €130m.
- €338m from a pool of banks, including Cassa depositi e prestiti, which lent €113m.[252]

D. Practicality

- CAA would have to amend the regulation applicable to the asset during the early years of operations.

E1. Promotion of effective competition for the procurement and delivery

- Terna and RTE follow Directive 2014/25/EU, which ensures competitiveness in the procurement process.[253]

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- Terna-RTE are subject to service quality obligations, with which the infrastructure they exploit such as the Savoie-Piémont HDVC Line needs to comply.[254]
- Ambitious environmental considerations were also delivered on.[255]

7.3 Istanbul Airport

As Atatürk Airport could not handle the increasing traffic, plans were made to build a new international airport. The Turkish government tendered a 25-year contract to 'build-operate-transfer' the new airport, which was won by Istanbul Grand Airport A.S (iGA), a consortium of five Turkish construction firms that paid €22bn for the right to develop the new airport.

Project type: New infrastructure

Approval period:[256] 2013–14

Geography, sector: Türkiye, aviation

Construction period:[257] 2014–18

Investment value:[258] £9.4bn

Capacity increase:[259] 90mppa

CAPEX governance model[260]	Procurement model[261]		Price-setting model[262]	
The Turkish government offered a tender for a new airport in Istanbul under the build-operate–transfer model for a 25-year lease. As there would be no public funding, all risk was borne by the winning consortium, which financed the project through loans from private banks and their own equity. The oversight was done mostly internally by iGA, although there was some high-level oversight from the General Directorate of State Airports Authority (DMHI) and the Turkish government. iGA pays around €1bn annually to the Turkish government as part of the loan agreement. Income over the guaranteed amount is paid back to the state.	**Model type (DBFOMT framework)**	Model 6, as ownership transfer post-construction	**Economic regulator**	DHMI
	Asset owner	DHMI	**Price-setting model**	During operations: charges are set by the DHMI
	Asset design and construction entity	iGA	**Timeframe of price determination**	During operations: charges set annually under 25-year iGA lease
	Asset operator	iGA		

The CAA's analytical framework

A. Support for expansion

- The airport was constructed without any delays and opened on time.[263]
- The limited time to generate revenues through the lease likely incentivised efficient construction processes.

B. Cost

- No known cost overruns.
- Operating consortium has a window of only 25 years to recoup its investment, highly incentivising efficient budgeting to maximise its profitability.[264]

C. Finance—private

- The project received no public funds and was fully funded by the private consortium.[265]
- 75% was financed through loans from banks, 70% of which came from state-owned banks. The other 25% was financed through the equity from consortium firms.[266]

D. Practicality

- UK airport regulation would need to adopt the build-operate-transfer approach.[267]

E1. Promotion of effective competition for the procurement and delivery

- Subcontractors were used for most of the construction process. However, it is unclear whether these contracts were procured through competitive processes.[268]

E2. Promotion of effective competition in the provision of airport services

- No active competition on operations at Istanbul Airport. There was competition in the tendering for the build-operate-transfer.[269]

F. Service quality

- Istanbul Airport has been credited as a 'Level 5' airport by Airports Council International—an accolade received by only three other airports for their level of service quality—and is also a '5-Star' airport according to Skytrax.[270]
- There are no regulatory incentives relating to service quality.

8 Model 7b: Direct competition for airport services

8.1 Introduction

According to the CAA's definition, under Model 7b, 'Direct competition for airport services', the operator would compete directly with HAL's own provision of services to users.

By involving a third party, the CAA explains that this model introduces stronger competitive pressures. Consequently, HAL would be incentivised to engage in cost reduction and service quality improvement strategies.

The implementation of model 7b would require the CAA to assume a monitoring and enforcement role regarding HAL's cost-allocation decisions between the competed services and the wholesale services. This would also entail the implementation of a non-discriminatory requirement on the wholesale services provided to HAL's own downstream assets such that prices are no lower than those charged to the third party. Market power determinations would also need to be undertaken by the CAA ahead of contracting, to assess the extent of competition between the third party and HAL.[10]

We identify the following projects as falling under Model 7b:

1 LaGuardia Airport Terminal C;
2 JFK Airport New Terminal One;
3 Munich Airport T2 Satellite.

Our findings regarding the different areas of the CAA's analytical framework, as well as the CAPEX governance and price-setting models for the projects identified as falling under Model 7b, are set out below.

[10] CAA Working Paper, para. 4.82

Table 8.1 Model 7b—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	While all three projects intended to promote competition by contracting with different operators across terminals, the governance structure varied across jurisdictions. In the USA, the Port Authority retained full ownership of the assets , as well as oversight over CAPEX decisions; whereas the expansion project for the Munich T2 Satellite transferred 40% ownership to the third party, and relied on internal control mechanisms.
Price-setting model	Price determination models vary between projects. For the Munich T2 Satellite), prices were determined through consultation with airlines. Under the terms of their long-term lease, the operators of the JFK New Terminal One and LaGuardia Airport Terminal C have to demonstrate that they are charging reasonable market prices, and present an annual report to the Port Authority.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	For the projects reviewed, operators are incentivised to build the infrastructure on time and efficiently, as they bear the financial risk of the project. However, the US schemes were developed under an existing framework that accommodated direct operator competition.
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	Given the scale of these projects, cost overruns were limited, although JFK New Terminal One is not complete yet (delivery expected in 2030) and is already over budget at this stage. This limiting of cost overruns was facilitated by financial risks often being borne by the operator, which is consequently incentivised to stay within the initial budget. However, these projects were developed under light-touch regulatory models that do not feature explicit incentives for cost efficiency.

The CAA's analytical framework	Overall assessment
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	These projects relied primarily on private financing.
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	As outlined by the CAA in its Working Paper, applying this model may require significant work to put it into practice, including a new market power determination for HAL, setting up a framework for wholesale access to services, and a methodology to separate HAL's cost allocation between the competed services and the wholesale services.
E1. Promotion of effective competition for the procurement and delivery	The designers, builders and contractors of operational services were selected through competitive tenders, which ensured that selection was based on objective criteria.
E2. Promotion of effective competition in the provision of airport services	The Munich Terminal 2 Satellite example is different from the US examples, as Flughafen München GmbH is part of a joint venture with Lufthansa to build the terminal. Competition between T2 and the rest of Munich Airport is limited, unless there is spare capacity between terminals such that carriers can switch between them. While the schemes feature direct competition for services, there is no scope for the operator to be replaced. The initial selection processes for the competing operator was reliant on private negotiations rather than competitive tenders.
F. Service quality	Quality of service performance is positive for most projects, supported by the operators' long-term orientation and incentive alignment, and strengthened by the implementation of rankings-based performance provisions for JFK New Terminal One.

8.2 LaGuardia Terminal C

Between 2018 and 2024, LaGuardia Airport started a series of major infrastructure investments, totalling $8bn. This 'Improvement Project' included Delta's expansion of two terminals into the 1.3m-square-foot Terminal C, featuring 38 gates and modern amenities, which opened in 2022 and was fully completed in 2024.

Project type: Infrastructure expansion

Approval period:[271] 2016–17

Geography, sector: United States, aviation

Construction period:[272] 2017–22

Investment value:[273] $4bn (£3bn)[274]

Capacity increase:[275] 255 flights daily

CAPEX governance model[276]	Procurement model[277]		Price-setting model[278]	
Delta funded and delivered the $4bn Terminal C under a long-term lease with the Port Authority of NY and NJ (PANYNJ), taking responsibility for design, construction, and operations. PANYNJ retains ownership of the assets, exercises oversight over CAPEX decisions and ensures compliance with airport-wide standards. CAPEX is integrated into the broader Improvement Project, coordinating infrastructure, phasing, and shared systems.	**Model type (DBFOMT framework)**	Model 7b, as direct competition for airport services	**Economic regulator**	PANYNJ
	Asset owner	PANYNJ	**Price-setting model**	During operations: cost-plus recovery
	Asset design and construction entity	Delta Airlines	**Timeframe of price determination**	During operations: annual
	Asset operator	Delta Airlines (until 2050)		

The CAA's analytical framework

A. Support for expansion

- The project was delivered almost two years ahead of schedule as Delta accelerated construction timelines, despite the construction window having overlapped with the COVID-19 pandemic.[279]

B. Cost

- No particular cost overruns were reported publicly.
- The long-term concession ensured alignment of incentives and accountability as Delta bore the risk of delivering the project within budget.[280]

C. Finance—mixed

- Of the total $4B investment, $600M was funded by public entities.
- The remaining 85% was raised from private funds, secured by the concessionaire Delta Airlines (of which: $3.6bn from debt issuance and $300m in equity).[281]

D. Practicality

- Implementation at HAL would require assets to be sufficiently separable to allow for parallel operations
- This would require extensive negotiations on cost allocation between the involved parties as well as potential regulatory changes on how the RAB would be implemented.

E1. Promotion of effective competition for the procurement and delivery

- A joint venture between STV and Satterfield & Pontikes was appointed for construction management.
- Procurement process for subcontractors is unclear.[282]

E2. Promotion of effective competition in the provision of airport services

- The PPP with Delta Airlines was agreed upon through a private lease and partnership agreement (unlike for the simultaneous renovation of LGA terminal B which was subject to competition).[283]

F. Service quality

- The service in LGA Terminal C has greatly improved from this project— Skytrax gave its performance as an airport a 4-star (out of 5) rating.
- Renovations contributed to LGA being labelled the Worst to the Best airport in the New Passenger Survey.[284]
- The PPP with a third party that is also a user of services for the airport (Delta) created strong incentives for the concessionaire to deliver a high-quality service for its customers and to do so without delays.[285]

8.3 JFK New Terminal One

The New Terminal One is part of JFK's $19 billion transformation, designed to target a Top 5 Skytrax quality ranking. It is constructed over the former Terminals 1, 2, and 3. Phase 1 will open in 2026 with 14 gates, and by its full completion in 2030 the terminal will span 2.6m square feet with 23 gates, making it the largest terminal at JFK.

Project type: Infrastructure expansion

Approval period:[286] 2021–22

Geography, sector: United States, aviation

Construction period:[287] 2022–30 (expected)

Investment value:[288] $9.5bn (£6.7n)[289]

Capacity increase:[290] 23mppa (+100%)

CAPEX governance model[291]	Procurement model[292]		Price-setting model[293]	
The Port Authority is not investing any of its own funds, but acts as an oversight body for the concessionaire it has chosen. The long-term lease sets out that the risk of construction is borne by the Ferrovial consortium. The contract also sets a cap on certain CAPEX costs, enforced by a guaranteed maximum price agreement with the construction firm.	**Model type (DBFOMT framework)**	Model 7b, as direct competition for airport services	**Economic regulator**	PANYNJ
	Asset owner	PANYNJ	**Price-setting model**	During operations: cost-plus recovery
	Asset design and construction entity	Aecom Tishman + Gensler	**Timeframe of price determination**	During operations: annual
	Asset operator	Consortium between Ferrovial, JLC, Ullico, Carlyle (until 2060)		

The CAA's analytical framework

A. Support for expansion

- The signature of the long-term lease coincided with the start of the pandemic, leading to a renegotiation of the terms.
- Phased delivery of the terminal over seven years due to the COVID-19 pandemic.[294]

B. Cost

- To date, the project has gone $1.5bn over its initial projected costs of $8bn due to supply chain issues, financial market volatility and the COVID-19 pandemic.[295]
- Lease states that cost overruns are borne by the operator.

C. Finance—private

- The project is fully privately funded.[296]
- 73% debt-funded, with $2.3bn issued as equity.[297]
- Borrowed $2.55m from the (public) NY Transportation Development Corp., benefiting from fixed interest rates.

D. Practicality

- Implementation at HAL would require assets to be sufficiently separable to allow for parallel operation.
- Private negotiations with potential concessionaire would be time-consuming.

E1. Promotion of effective competition for the procurement and delivery

- No information was found on how design/construction providers were appointed.

E2. Promotion of effective competition in the provision of airport services

- There was no public competition for the expansion and operation of the New Terminal One: PANYNJ negotiated privately with the Consortium, led by Carlyle at the time.[298]

F. Service quality

- Lease contains provisions on achieving the top five Skytrax rating.[299]

8.4 Munich Airport T2 Satellite

Terminal 2 at Munich Airport was built, financed and operated as a joint venture by the public owner of Terminal 1, Flughafen München GmbH, and the airline Lufthansa. As Munich is one of Lufthansa's main hub airports, Lufthansa's stakes in Terminal 2 and its satellite expansion allowed it to further solidify its position there.

Project type: Infrastructure expansion

Approval period:[300] 2007–12

Geography, sector: Germany, aviation

Construction period:[301] 2012–16

Investment value:[302] €900m (£778m)[303]

Capacity increase:[304] 11mppa (increase of 44%)

CAPEX governance model[305]	Procurement model[306]		Price-setting model[307]	
OHG, the owners of T2, decided to build and finance the satellite terminal in December 2010 after the government of Bavaria approved the project. This joint venture had already built Terminal 2 together at Munich Airport, which it also mainly financed itself. There was no direct external oversight, although the respective governing boards of Lufthansa and the FMG undertook internal oversight.	**Model type (DBFOMT framework)**	Model 7b, as direct competition for airport services	**Economic regulator**	State-level ministry of transport (Bavaria)
	Asset owner	Terminal 2 Gesellschaft mbH & Co. OHG (Flughafen München GmbH (60%) and Lufthansa AG (40%)	**Price-setting model**	During operations: airport-led cost recovery
	Asset design and construction entity	Designed by Koch & Partner; constructed by private contractors	**Timeframe of price determination**	During operations: annual, or multiannual based on negotiation with airlines
	Asset operator	T2 Gesellschaft GmbH & Co. OHG		

The CAA's analytical framework

A. Support for expansion

- The construction was completed without delays.[308]
- Most of the constructors as well as the design contractor were the same as those that built T2 initially, ensuring efficient planning and scheduling.[309]

B. Cost

- The project was delivered without any cost overruns.[310]
- Any investment can be added to the cost base for determining airport charges only with the regulator's approval, which disincentivises cost overruns.[311]

C. Finance—mixed

- FMG and Lufthansa fully financed the project through equity and loans from the capital market, with FMG fully financing its share through loans.[312]

D. Practicality

- To match the unique ownership structure (in Europe), HAL would need to identify an airline partner and negotiate the cost sharing, as well as its impact on RAB and cost recovery in general. It can be assumed that this process would be time consuming.[313]

E1. Promotion of effective competition for the procurement and delivery

- As an airport operator, T2 is a contracting authority and is required to issue tenders for all contracts over the EU mandated and national thresholds for procurement.[314]

E2. Promotion of effective competition in the provision of airport services

- There is only limited inter-terminal competition, as FMG holds a stake in both terminals.[315]
- The Bavarian court of auditors reprimanded Lufthansa as its partial ownership resulted in an unfair competitive advantage, but this did not lead to any further action.[316]

F. Service quality

- The regulatory model has no particular incentives regarding service quality.

9 Model 8: Transfer of ownership and operation of an existing asset

9.1 Introduction

According to the CAA's definition, under Model 8, 'Transfer of ownership and operation of an existing asset', HAL would be required to transfer ownership and operation of an existing asset to a third party.

The CAA would play an important role in implementing this model. As this model would imply the transfer of an existing asset, the CAA acknowledged that challenges may arise with respect to determining the boundaries of responsibility between the new owner and HAL. The CAA would have to create a regulatory framework that clearly allocates the roles and responsibilities of the involved parties.

As Heathrow Airport has not been designed in a modular fashion, defining the scope of the asset to be transferred such that is not too highly integrated into the general operation of the airport, and clearly defining a framework on how this integrated operation with two separate owners and operators at the same airport is supposed to function, would be among the main responsibilities of the CAA under this model. The CAA would be required to undertake extensive planning and monitoring to ensure an efficient implementation of Model 8.[11]

We describe one project under this model: Hornsea One OFTO construction. Other OFTO projects are also examples of this model. We summarise our findings on Model 8 in the following table.

[11] As discussed in CAA Working Paper, para. 4.85.

Table 9.1 Model 8—the CAA's analytical framework

The CAA's analytical framework	Overall assessment
CAPEX governance model	CAPEX governance for the construction of Hornsea One OFTO was handled by Ofgem. Ofgem only recognised economic and efficient costs as CAPEX in the transfer value and had the final authority with regard to the recognition of CAPEX.
Price-setting model	Post-construction, a transfer value is determined by Ofgem. During the operation phase, tender revenue streams are set after the operator bid for a 25-year revenue stream, which can also be inflation-indexed.
A. Support for expansion. The model is suitable to appropriately support the delivery of expansion and to avoid delay and disruption	The model is designed to allow offshore wind developers to bear construction risk while the tender for the operator is being finalised in parallel.
B. Costs. The model promotes efficiency and control of the costs of expansion, while delivering the benefits of expansion for consumers	Costs overran initially projected costs by almost £200m, but this did not lead to major negative consequences for the construction's progress. The framework is designed to incentivise the constructing entity to maintain cost efficiency as Ofgem undertakes a detailed review of costs to determine the transfer value.
C. Finance. The model supports the raising of sufficient finance to enable the delivery of expansion at an efficient price	The scheme was privately financed.

The CAA's analytical framework	Overall assessment
D. Practicality. It is likely to be practical to implement the model for Heathrow expansion	As the CAA noted in the Working Paper, challenges may arise with respect to determining the boundaries of responsibility between the new owner and HAL. The CAA would have to create a regulatory framework which clearly allocates the roles and responsibilities of the involved parties. The CAA would have to supervise HAL construction costs and define the final transfer value, as well as oversee a public tender process to identify the new asset owner/operator.
E1. Promotion of effective competition for the procurement and delivery	In the context of the scheme reviewed, subcontractors were selected through private sector negotiations without external regulatory oversight.
E2. Promotion of effective competition in the provision of airport services	If this framework were applied to Heathrow expansion, this would result in a separate operator providing competing services on part of the infrastructure.
F. Service quality. The model promotes an appropriate level of service quality including improvements where appropriate	There is limited regulatory oversight during the construction of the asset. However, in the assessment of the transfer value and after the transfer of ownership during the operations phase, Ofgem can investigate whether performance quality issues are related to the construction phase.

9.2 Hornsea One OFTO

The Hornsea One offshore electricity transmission (OFTO) is a 1,200MW connection between the generators and onshore transmission system situated in the southern North Sea about 120km off the East Yorkshire coast.

Project type: New infrastructure

Approval period:[317] 2014–18

Geography, sector: UK, electricity

Construction period:[318] 2018–20

Investment value:[319] £1.175bn

Capacity increase:[320] 1218 MW

CAPEX governance model[321]	Procurement model[322]		Price-setting model[323]	
Ørsted developed the wind farm and was the vendor for the OFTO divestment. It built the OFTO, as, under Ofgem's regime, offshore developers usually build OFTOs themselves. Ofgem only recognises economic and efficient costs as CAPEX in the transfer value, which Diamond paid when it bought the asset and took over operation. Ofgem appoints independent external advisers to support the review and requires the developer to provide detailed cost evidence. The regulator retains final decision-making authority on CAPEX recognition and the transfer value.	**Model type (DBFOMT framework)**	Model 8, transfer of ownership and operation of an existing asset	**Economic regulator**	Ofgem
	Asset owner	Diamond Transmission Partners	**Price-setting model**	Construction phase: one-off transfer value Operation phase: the operator receives agreed bid revenue
	Asset design and construction entity	Ørsted, NKT Cables (construction and installation of cables)	**Timeframe of price determination**	Operations phase: 25 years
	Asset operator	Diamond Transmission Partners		

The CAA's analytical framework

A. Support for expansion

- The project was completed without any delays.[324]

B. Cost

- Recognised cost of £1,175m by Ofgem against a total reported expenditure of £1,230m, as Ofgem did not recognise some of the costs as appropriate.[325]

C. Finance—private

- Ørsted, which is owned 50.1% by the Danish government, owned 50% of Hornsea One Holdings Ltd,[326] which owned the asset during construction.
- £800m of the funding for Hornsea One came from guarantees by the Danish Export Credit Agency.[327]
- The remaining 50% of Hornsea One Holdings Ltd was owned by Global Infrastructure Partners (GIP), which invested £4.46bn (of which £3.5bn as loans from institutional lenders).[328]

D. Practicality

- HAL would be required to procure the terminal's construction through a public tender to the private sector. CAA would have to supervise HAL spending and decide how much would convert into the final transfer value, and find a new asset owner/operator through public tender.

E1. Promotion of effective competition for the procurement and delivery

- Ofgem reviewed the developer's approach to procurement and contract management [329] However, it is unclear whether tenders were used for procurement.

E2. Promotion of effective competition in the provision of airport services

- n/a

F. Service quality

- Operations are in line with expectations.[330]
- Ofgem conducts investigations to determine whether there was oversight during the technical due-diligence process in the case of outages.[331]

Sections 3–9 references

Model 4a

Sizewell C

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