

Managing uncertainty

Questions for decision-makers to ask in an uncertain environment



Good practice guide for leaders and practitioners

August 2023

This guide aims to support policy and delivery professionals across government to make value-for-money decisions in the context of uncertainty.

We are the UK's independent public spending watchdog

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Uncertainties are things that are not known, or are in a state of doubt, or are things whose effect is difficult to know. They have the potential to have major consequences for a project, programme, portfolio or policy intervention (collectively referred to in this guide as 'programmes') meeting its objectives.

Government programmes are likely to be subject to high levels of uncertainty as they exist in a constantly evolving economic, political and social environment. Uncertainty also comes from such programmes being among the largest, longest-running and most complex programmes undertaken, as well as often being innovative; for example, programmes aiming to exploit new technologies.

Some uncertainties that may have an impact on a programme achieving its objectives can be reduced with time and research. They can be analysed, managed, mitigated and potentially resolved.

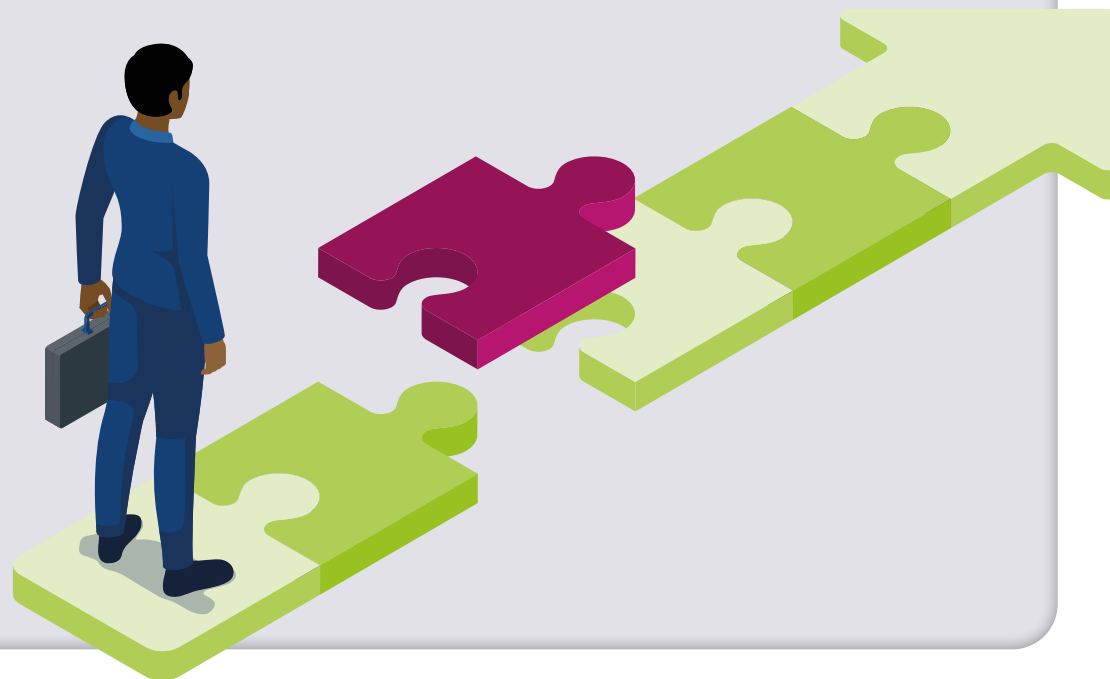
For example, when designing and building a new railway line, there will be elements of uncertainty which the programme team will be able to anticipate and seek to manage. These might include the cost of construction materials, ground conditions or the exact route of the track. The programme team will need to estimate the likelihood and consequence of occurrence of different outcomes, gather additional information, and put measures in place (such as allocating contingency funding) to manage impact.

There are other wider uncertainties where the team may have little control and which cannot be managed or eliminated, but which could still affect the overall value for money of the programme. In our rail example, these could include long-term patterns of demand for train travel, available funding, the impact of other interdependent policies, such as the government's strategy for reaching net zero, or unforeseen events such as a pandemic.

Dealing with such uncertainties is an inherent part of delivering the sorts of complex and innovative programmes for which government is responsible. To secure the benefits of innovative approaches and to address complex challenges, government needs to be more comfortable working with uncertainty.

We have found that, in planning and delivering programmes, decision-makers and programme teams do not always take time to understand and consider these wider uncertainties or can underestimate their impact.

As a result, options and plans may not sufficiently take account of the underlying uncertainties, providing a false sense of certainty or making plans insufficiently resilient to change. In these cases, it is less likely that the programme will deliver its intended objectives or be able to respond to opportunities and, ultimately, public trust in government's ability to deliver programmes is more likely to be eroded.





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Decision-makers still need to make value-for-money decisions even in the context of uncertainties that are harder to anticipate or mitigate. This guide aims to help you to work with uncertainty.

It covers:



Identifying uncertainty



Analysing uncertainty



Planning for uncertainty

It is based on National Audit Office (NAO) insights from reports across a wide range of government projects, programmes, portfolios and policy interventions as well as government guidance relating to risk and uncertainty.¹

It complements our [Delivery Environment Complexity Analytic](#), which aims to help organisations understand the risks arising from the external delivery environment and the steps that can help to address such complexities. We have also produced other relevant toolkits, such as our [Framework to review programmes](#); [Framework to review portfolios](#); [Survival guide to challenging costs in major projects](#); and [Over-optimism in government projects](#). You can find further resources at the end of this guide.

What this guide contains



Questions to ask



Case studies



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¹ The [Orange Book](#) is HM Government's guidance on the management of risk.



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Identifying uncertainty at programme conception and design phase

It is important that you identify the range of uncertainties that may impact on a programme, and how they impact the programme's objectives, in order to inform your decision-making on the programme. Having a full understanding will take time but is a vital part of developing a strong business case for a programme. Failure to identify uncertainty means that programmes may be less well-placed to address threats and to respond to opportunities.

In examining government programmes, we have noticed common sources of uncertainty in the external and internal environment (see factors that impact the level of uncertainty overleaf). Sources of uncertainty may also include wider policy areas or other programmes that could influence your programme. The NAO's [Delivery Environment Complexity Analytic](#) is a useful tool for identifying sources of complexity, which often lead to uncertainties.


**Questions to ask**


- Have we taken a structured approach to identifying and mapping uncertainties in the external and internal environment, involving stakeholders with a broad range of perspectives?
- Have we identified the range of scenarios under which the programme might need to operate and the sensitivity of programme outcomes to different uncertainties?
- Have we identified the programme's interdependencies – for example, how reliant it is on successful delivery of other programmes – and the resulting levels of uncertainty?
- Have our programme options been informed by a thorough review of the evidence from comparable previous programmes and the impact that uncertainty had on their delivery?
- For highly innovative programmes or those on an accelerated timetable, have we recognised the inherent additional uncertainty and risk?


**Case studies**


The complexity of the criminal justice system, and interdependencies with other organisations such as the police, probation services and legal professions, created uncertainty in how the interactions between different parts of the system would affect the plans to reduce the backlog in criminal courts. ([Reducing the backlog in criminal courts](#), 2021)

The long-term nature of government's commitment to net zero emissions and the reliance on new technology creates significant uncertainty. We have noted that the pathway, feasibility and costs of achieving net zero in many sectors is highly uncertain, because it is not yet known how quickly some technologies will develop or how much individuals will be willing to change their behaviours. ([Achieving net zero](#), 2020)

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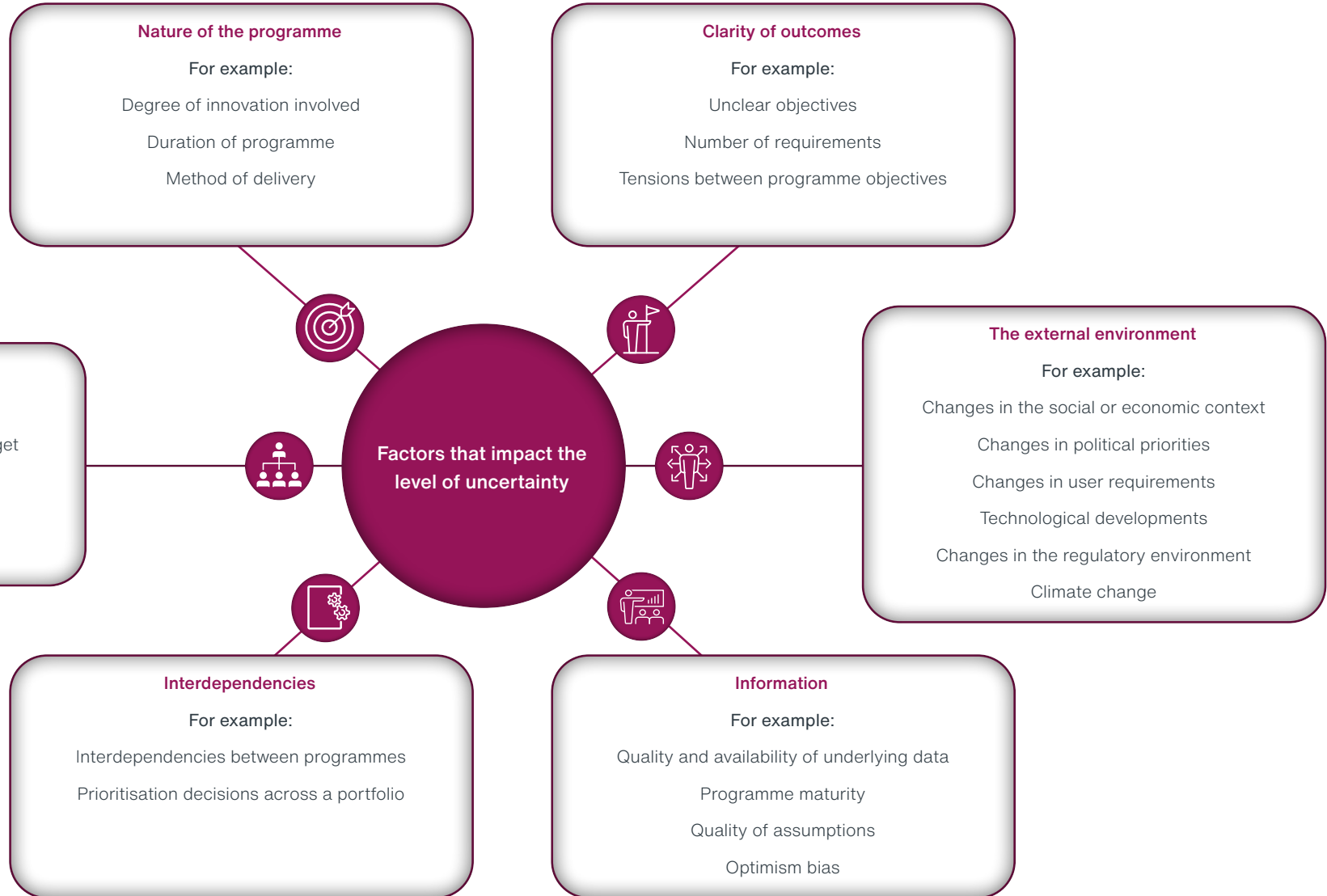
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Common sources of uncertainty from our examination of government programmes





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Identifying uncertainty in digital programmes

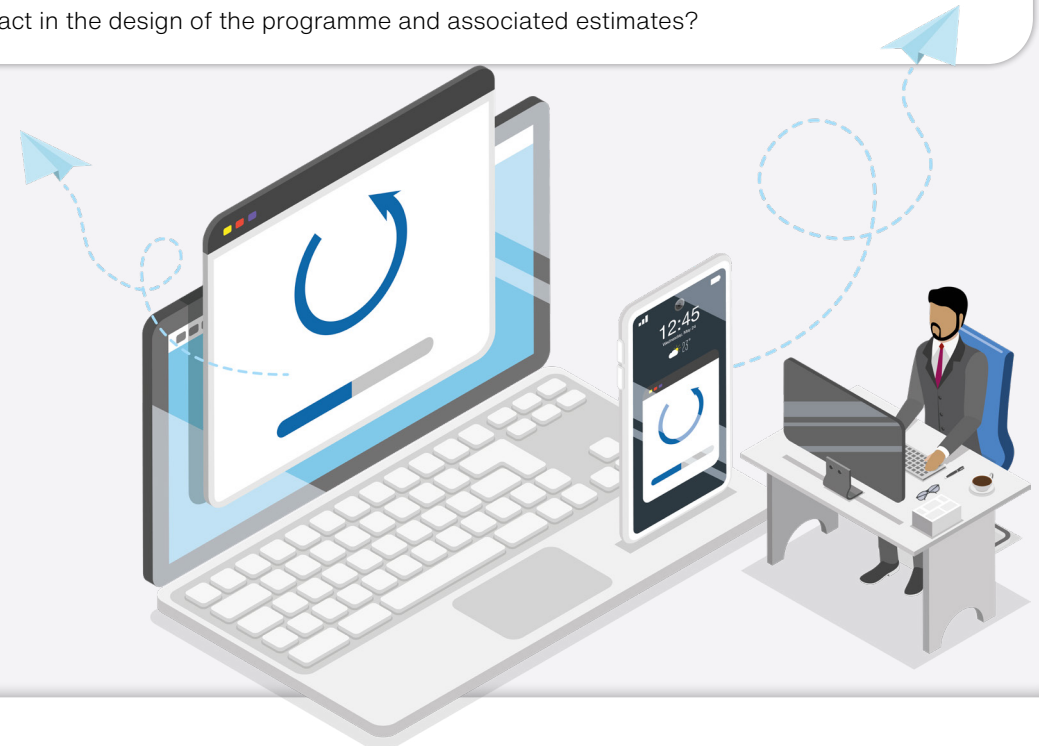
Programmes with a significant digital element can often be characterised by a high degree of uncertainty, and identifying these uncertainties is critical. In business transformation initiatives with significant digital elements, the intangible nature and use of novel technology introduces many more 'unknown unknowns'. In contrast, for some infrastructure programmes, programme teams can visualise a concrete end product allowing a clearer sense from the outset of what is realistically feasible.

Our report on [The challenges in implementing digital change](#) sets out the areas which are essential to get right for a programme to succeed. Among these, we noted that it is difficult to define the scope and costs of large digital programmes until teams perform detailed exploratory work and build their understanding. However, programmes need business cases early to secure funding. Digital leaders told us that the current business case process does not work well for digital programmes because it locks in assumptions too early and gives a false impression of certainty.



Questions to ask

- Do we understand the scale, feasibility and complexity of the digital elements of the programme?
- Have we allocated sufficient time and funding in the early stages of the programme to understand the business need and improvements we want to deliver, and therefore to allow proper scoping of the digital elements of the programme as part of the business case?
- Do we have the appropriate level of digital skills and capability to deliver?
- Have we done enough upfront thinking to use Agile methods to deliver digital elements of the programme? If so, is Agile being used appropriately, and not being used to hide uncertainties?
- Are the digital elements of the programme particularly innovative, and if so, have we reflected the impact in the design of the programme and associated estimates?



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Analysing uncertainty

Decision-makers need information on the potential impact of different uncertainties, and the range of possible outcomes that may occur and their relative likelihoods, to be able to make informed and resilient plans. HM Treasury's [Aqua Book](#) guidance on producing good-quality analysis for government explains that if the impact of uncertainty on outcomes is not analysed explicitly, it will be done implicitly when decisions are made. For example, the decision may be based on a central estimate alone, implying that the range of possible outcomes is not important.

Analysing uncertainty is challenging. There are a number of techniques that programme teams can use to understand the range and likelihood of different outcomes. Government has an [Uncertainty toolkit for analysts](#) which lays out the different methods and when they should be used. Some uncertainty can be measured, depending on the quality and availability of data – for example, if data are available on the distribution of cost overruns in similar programmes. Other types of uncertainty will be harder to measure – for example, where the likelihood of an event occurring is unknown. In these circumstances, it may be better to use techniques such as scenario planning to illustrate the range of plausible outcomes.

Often decision-makers must make decisions based on incomplete data and assumptions, particularly where the programme includes a high degree of innovation. It is therefore important that the programme team conducts robust analysis using the best available data; communicates their analysis, including key assumptions and limitations, clearly and transparently; and that the analysis is subject to challenge and scrutiny. This is valuable both for accountability, and to provide assurance and build confidence in the outcomes and limits of the analysis.

**Questions to ask**

- Do we have the capability to carry out a proportionately rigorous assessment of uncertainty?
- Have we used a range of techniques and best available data to estimate the impact of uncertainty on the cost, duration and benefits of the programme, and are these appropriate to the stage of development of the programme?
- Have we tried to qualitatively describe difficult to quantify uncertainties which matter for the programme, and is there a plan to revisit the measurement of these uncertainties over time?
- Do we have an established process to ensure that there is appropriate challenge and quality assurance of our analysis throughout the duration of the programme, including external challenge independent of the delivery of the programme such as from external experts or affected communities and stakeholders?
- Have we ensured that the leadership, culture and governance structure of the programme enables constructive challenge, transparency and learning?
- Do our key programme documents set out in an accessible way the extent and potential impact of uncertainty as part of their headline messages?
- Is it clear what assumptions we have used in the analysis, and the basis for these assumptions?
- Where we have presented a central case, have we made the uncertainties clear, such as the variation in possible outcomes?
- Are we prepared to accept and report on analysis that challenges widely held assumptions or that reports unfavourable outcomes?
- Has our communication of uncertainty led to a shared understanding of its potential impact among all key stakeholders?



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Our report on *The rollout of the COVID-19 vaccination programme in England* found that NHS England and NHS Improvement (NHSE&I) were open about uncertainties they faced. They made use of techniques such as scenario planning and sensitivity analysis to explore the impact of certain patterns of vaccine availability, vaccine uptake and rollout speed. ([The rollout of the COVID-19 vaccination programme in England](#), 2022)

Consulting with affected stakeholders can provide useful challenge on assumptions. In our report on *The Police Uplift Programme* we set out that the Home Office accepted that the evidence base for the Programme's business case was limited. For example, it had made assumptions on officer effectiveness but acknowledged there are no data that can be used to validate these. We considered the estimates on effectiveness to be optimistic. In our survey of chief constables, 30 out of 40 responses indicated they thought the Department's assumptions around recruits' effectiveness were too optimistic. ([The Police Uplift Programme](#), 2022)

Our report on *Financial modelling in government* found that when estimating government's expected losses from three COVID-19 loan guarantee schemes to business, the Department for Business, Energy & Industrial Strategy (BEIS) and the British Business Bank (the Bank) developed and communicated a range around their weighted estimate.² BEIS and the Bank used a weighted estimate of four scenarios to estimate expected credit losses, using changes in several uncertain assumptions. ([Financial modelling in government](#), 2022)

² On 7 February 2023, the government announced that the Department for Business, Energy & Industrial Strategy (BEIS) would close, and its responsibilities would transfer to new departments, including the Department for Business & Trade. The Department for Business & Trade has overall responsibility for business.



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Most government programmes will not be able to avoid operating without some uncertainty, especially given the complex, innovative and long-term nature of many of these programmes. Decision-makers still need to make value-for-money decisions in this uncertain context. Taking explicit account of this uncertainty will often be critical to a programme's success and the programme team's ability to demonstrate that it has secured value for money.

In some situations, decision-makers may need to weigh up the trade-offs of rethinking a programme's scope to reduce uncertainty against continuing with high levels of uncertainty. Rethinking a programme's scope may require exploring a wide range of feasible options that would meet the programme's objectives and be more resilient to uncertainty, gathering more information, or delaying a programme until there is a better understanding of how to manage and respond to uncertainty.

Often, uncertainty cannot be completely removed or mitigated. Programme teams will need to consider how to design the programme to be flexible enough to deal with ongoing uncertainty. This might include using approaches that are more able to adapt to changing circumstances, such as taking a phased approach or piloting to test and learn; building flexibility into commercial arrangements to take account of uncertainty; or developing contingency plans to prepare for plausible alternative scenarios.

**Questions to ask**

- Could the potential impacts of uncertainty make the programme scope undeliverable, and have we considered the trade-offs required to reduce uncertainty (such as pausing or delaying some elements)?
- When selecting the preferred option for the programme, have we considered which option is most resilient to a range of plausible scenarios rather than focused on the option that performs best in our central scenario? Can we design the programme to be sufficiently flexible to be able to adapt to a range of scenarios?
- Have we identified the 'no regrets' elements of the programme that perform well across a range of scenarios?
- Have we put in place plans to continue to monitor and assess the impact of uncertainty throughout the duration of the programme?
- Have we designed the programme to include robust contingency arrangements, which use lessons from comparable programmes, for those scenarios which could have a significant impact on programme objectives and could reasonably occur?
- Do we have clear criteria in place for activating contingency plans, including where funding comes from?
- Does our procurement approach recognise that the scope and requirements of the programme may need to adapt in response to an uncertain external environment?
- Have we explicitly built flexibility into contracts where there is a high degree of uncertainty about requirements, such as demand for a service?
- Does our commercial approach reflect who is best placed to respond to uncertainties, taking into account the resilience of the commercial landscape and the potential impact of supplier failure?
- Do we have structures in place to manage tensions when making uncertain decisions, for example between interdependent programmes and between important stakeholders?



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Our report *Achieving net zero* noted the importance of government clearly defining what it is aiming to achieve from the outset, enabling government to identify the people, policies and funding that may be needed, both within government and the wider set of actors which it is dependent on, such as businesses and individuals. We recommended that the government should identify and evaluate the elements of the net zero strategy which are uncertain and develop a plan to reduce this over time, including assigning responsibilities for managing reduction in uncertainty, and set out its timetable for when key decisions in the pathway to net zero will need to be taken. We also said that the costs of achieving net zero are highly uncertain, but the costs of inaction would be far greater. ([Achieving net zero](#), 2020)

In our report on the Department for Environment, Food & Rural Affairs' (Defra's) programme to improve the UK's science capability for managing animal diseases, we found Defra has invested time upfront to help manage risk and reduce uncertainty through: moving ahead with work that would be needed on the site regardless; re-testing, as information improves, the core assumptions in the delivery plan; fine-tuning the cost and schedule estimates; and through site surveys. ([Improving the UK's science capability for managing animal diseases](#), 2022)

To mitigate the risks of implementing a complex system HM Revenue & Customs (HMRC) adopted a phased approach to developing and implementing its Customs Declaration Service (CDS). HMRC also delayed the rollout of CDS primarily because of the uncertainty caused by the EU referendum in 2016. ([The Customs Declaration Service: a progress update](#), 2018)

Our report on *The decommissioning of the AGR nuclear power stations* concluded that the defueling programme carries substantial risks which, if poorly managed, could result in costs increasing significantly. We said that the Department for Business, Energy & Industrial Strategy will need a clear view of how the programme is performing as a whole and will need to act quickly and decisively should problems emerge.³ We recommended review of the risks of early closure at each of the AGR stations to ensure appropriate contingency planning is in place. ([The decommissioning of the AGR nuclear power stations](#), 2022)

Our report on *Asylum accommodation and support* found that the Home Office considered the balance of risk between accommodation providers and the Department when making changes to the pricing mechanism for accommodation contracts. The new contracts have a pricing mechanism in which some costs are fixed and others vary with the number of people accommodated. This better reflects costs to providers, since the accommodation facilities are permanent and must be paid for even if rooms are not used. ([Asylum accommodation and support](#), 2020)

³ On 7 February 2023, the government announced that the Department for Business, Energy & Industrial Strategy (BEIS) would close, and its responsibilities would transfer to new departments, including the Department for Energy Security & Net Zero (DESNZ). DESNZ has overall responsibility for ensuring the government achieves its power sector ambitions.



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[Support for innovation to deliver net zero](#)

This report examines whether the government is set up to deliver value for money from its approach to investment in research and innovation to deliver net zero in the UK.

[Lessons learned: Resetting major programmes](#)

Draws together insights to help decision-makers determine whether they should reset a programme and how to increase the chances of a reset succeeding.

[How to improve operational services](#)

A series of good practice guides that share practical tips on how to improve the quality and efficiency of day-to-day services provided by government.

[The Delivery Environment Complexity Analytic: Understanding challenges in delivering project objectives](#)

The NAO developed the Delivery Environment Complexity Analytic (DECA) as a tool to help organisations develop a high-level overview of the challenges, complexity and delivery risks for a project, programme, policy or area of work.

[Evaluating government spending: an audit framework](#)

Evaluation is a vital tool that can help government make informed decisions about whether to launch, continue, expand or stop an intervention. It can help government to learn what works from past interventions and improve the design and implementation of future ones.

[Framework to review models](#)

The framework provides a structured approach to review models, which organisations can use to determine whether the modelling outputs they produce are reasonable, robust and have a minimal likelihood of errors being made.

[Framework to review portfolios](#)

Our insights have helped us develop questions that we, and others, can ask to assess whether a portfolio is set up to achieve value for money. These questions can also be used to decide if portfolio thinking could be valuable, for example, when delivering large programmes with some of the characteristics of portfolios.

[Lessons learned: Delivering programmes at speed](#)

Identifies insights to help decision-makers determine when or how a programme should be delivered at speed and then continually test whether they can successfully deliver the programme.

[The challenges in implementing digital change](#)

Sets out the lessons for the centre of government and departments to learn from the experience of implementing digital change. It is particularly useful for senior decision-makers who may not have direct technical experience.

[Framework to review programmes](#)

This framework draws from our experience of around 200 studies reviewing public sector programmes since 2010. Our reports on these programmes, available on our website, cover a broad range of government programmes.



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[Improving operational delivery in government](#)

A good practice guide for senior leaders. This guide highlights principles of operational management – the specific skills and ways of working needed to translate policy intent into effective services for end users.

[Lessons learned from Major Programmes](#)

This report examines the root causes of the issues we see most often and why we think they occur, in order to identify learning points that we think government should focus on in order to improve its performance on major programmes.

[Survival guide to challenging costs in major projects](#)

This publication outlines some of the challenges in estimating and managing costs and offers Accounting Officers and senior decision-makers some ground rules and thoughts on factors to consider when challenging costs.

[Over-optimism in government projects](#)

This report looks at a particularly persistent risk management problem – the difficulties caused for government projects by unrealistic expectations and over-optimism.