



Ministry
of Defence

Evidence Summary

The Drivers of Defence Cost Inflation

February 2022

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Executive Summary

Cost escalation is the change in the price of goods and services over time. In defence it is primarily caused by the need to match adversaries' technological developments. If Her Majesty's Government wishes to sustain the UK's relative military capability with respect to other nations, then some degree of cost escalation is unavoidable.

Cost growth is the difference between estimates and actual cost. Causes of cost growth in defence include: (i) optimism bias; (ii) poor understanding of risk and assumptions; and (iii) workforce challenges.

Cost growth contributes to Equipment Plan unaffordability, reduced capability, or both. Given the internal departmental and external industrial factors involved, there is scope for interventions to reduce cost growth.

The Ministry of Defence has several ongoing and planned initiatives to address the causes of cost growth and escalation.

The department has investigated cost growth and cost escalation in the past.

Introduction

This paper has been written in response to a recommendation by the parliamentary Public Accounts Committee (PAC).

The PAC report on the Defence Equipment Plan 2020-2030 identified defence cost inflation as a key driver of the plan's continued unaffordability. The PAC recommended that the department should undertake a comprehensive study to understand better the drivers of defence cost inflation; the work should "*not merely be a statistical exercise but should look at attitudes and behaviours within the defence acquisition system, and how commercial realities and competition with other nations drive up costs*" (PAC, 2021a).

It is widely acknowledged that the price of defence goods and services are high and rising at an increasing rate. This was encapsulated in 1983 by Norman Augustine, a former Lockheed chief executive and US army under-secretary, when he famously predicted that by 2054 the entire US defence budget would be needed to purchase a single aircraft (Augustine, 1983). He reached the conclusion by extrapolating forward the historic growth of both military equipment costs and defence budgets.

The reasons why defence goods are more expensive than other goods include high barriers to entry often resulting in monopolistic inefficiency, low order numbers preventing economies of scale, and export restrictions. However, to some extent this has always been the case and does not fully explain the affordability challenges in the Ministry of Defence (MOD) Equipment Plan in recent years. Therefore, this report will focus on why the cost of defence goods is rising, which can be segregated into cost escalation (cost increase over time) and cost growth (cost increase within a project). The report contains three parts:

Part 1: Open-Source Literature Review. Examination of publicly available evidence from external sources (such as academic papers and industry reports) to identify the factors that drive cost escalation and cost growth.

Part 2: Ongoing Work to Address Known Issues. Identification of ongoing and planned departmental work to address cost growth and cost escalation.

Part 3: Compilation of Existing Research. Historic research conducted by the department on factors causing cost growth and cost escalation.

Part 1: Open-Source Literature Review

The literature review has used publicly available information such as academic papers and government publications, supplemented with internal reports to define and research the following concepts:

Cost Escalation:

- Intergenerational Cost Escalation;
- Defence Inflation.

Cost Growth:

- Optimism Bias;
- Poor Understanding of Risk and Assumptions;
- Workforce Challenges.

These headings have been identified using evidence acquired from the literature review. The headings capture the main drivers of cost growth and cost escalation. An overview of these causes can be seen in Figure 1.

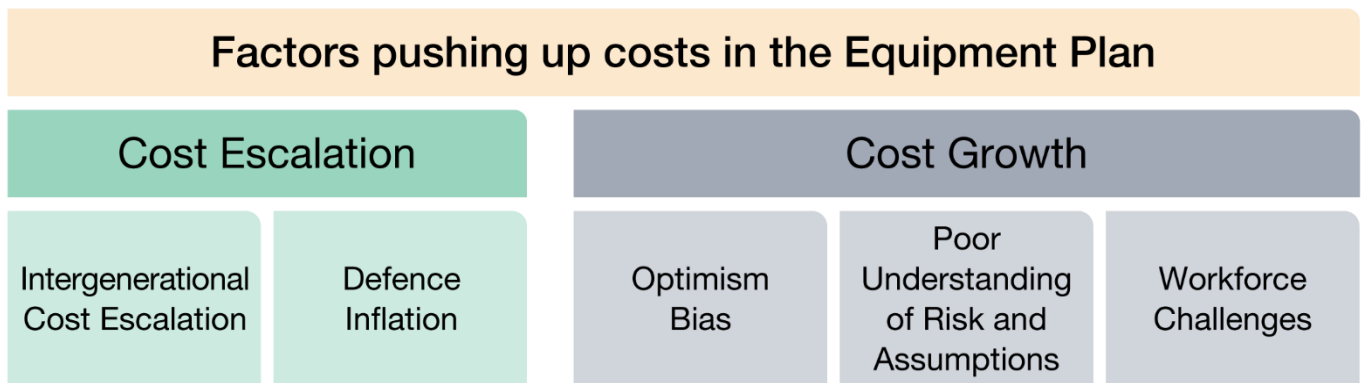


Figure 1: Drivers of defence equipment unaffordability

Cost Escalation

Definition. Cost escalation is defined as the change in price of a specific good or service over time (*Arena et al, 2008*). It can occur both between generations (intergenerational), such as the difference in costs between the Eurofighter Typhoon and the Tornado jets; and within generations (intragenerational), such as the difference in costs between the Brimstone and Dual Mode Brimstone missiles.

Cost escalation is an issue that is common to defence departments across the world, not just the MOD. Existing literature concludes that real terms defence cost escalation is evident in the UK and other countries' historic data, though these estimates vary widely. Variance in estimates arise from key differences in approaches, rigor, reliability of data and differing periods over which cost escalation has been measured (*Davies et al, 2012*), making international comparisons difficult.

One such analysis of US naval ships identified a “stairstep” pattern as intragenerational cost escalation is modest, driven primarily by changes in input costs, whilst costs jump between generations, due to large changes in capability (*Arena et al, 2006*). This section will explore two drivers of cost escalation: intergenerational cost escalation and defence inflation.

Intergenerational Cost Escalation

Definition. Intergenerational Cost Escalation (ICE) is defined as the change in cost between one platform and the next generation of a similar platform of military equipment (*Hartley et al, 2016*).

Causes. Several research papers (*Arena et al, 2006 & 2008*) have identified two principal groups of factors for ICE:

1. **Economy-driven factors** are those over which the government has little control. These factors include wage rates, the cost of equipment and material. Since these are all drivers of cost inputs for defence products, they are mainly accounted for in the inputs-based defence inflation measures, such as the one produced by the MOD (more details on the defence inflation section in part 1).
2. **Customer-driven factors** are those over which the government has more control. These factors include:
 - **Complexity.** Defence equipment can be considered a good where being at the cutting-edge of what is technologically possible is essential to maintain military superiority. RAND and Defence Economics both found that the

complexity of the platform, such as performance characteristics, is the single largest cause of ICE. This cost escalation is exacerbated if the need to counter new investments by adversaries results in a technology race due to the diminishing returns to technology whereby costs increase disproportionately to changes in technology (*Hove et al, 2015*). Defence Economics concluded that this driver of ICE was mainly non-discretionary due to the lack of real choice for certain aspects of equipment (*Davies et al, 2012*). These characteristics are driven by military requirements which in turn are guided by threats. This also means that whilst the latest generation of equipment is typically more technologically advanced, relative capability remains approximately constant against an enhanced threat (*Kirkpatrick, 2008*). Changes in military spending by neighbours and adversaries can be used to indicate the level of perceived threat experienced by a country (*Clements et al 2021*). In addition to threat-driven complexity changes, over-specification of proposals can also contribute to cost escalation. For example, in 2020 the National Audit Office (NAO) identified ‘gold-plating’ and lack of contractual levers as factors that caused nuclear infrastructure projects to cost more than was necessary (*NAO, 2020b*).

- **Regulatory.** The rise in government contractual, statutory and regulatory requirements over recent decades has led to further cost escalation. These regulations cover a number of areas, including the environment, health & safety, security, and controls on the international trade in arms. There are two other key drivers of ICE in defence procurements: increasing restrictions on how and where manufacturers may purchase materials; and measures to support the national defence industry (*Hartley, 2016*). Some of these regulations are applied to achieve wider policy objectives, so diminishing or removing them may not be appropriate measures to combat cost escalation.
- **Production rate.** Unlike certain electronics, whose production enables more powerful subsequent generations to be produced at a cheaper price¹, defence industries are often characterised by short production runs and low volumes, and therefore lack the economies of scale² and learning effects³ necessary to drive down costs. Unit costs may therefore increase if volumes of equipment between generations fall. Since newer generations of equipment cost more than previous ones, and platforms have consolidated, volume has tended to fall over time partly to comply with budgets. This has

¹ A phenomenon known as Moore’s Law.

² Economies of scale reduce unit costs as volumes increase.

³ Learning effects arise from greater experience; a better understanding of operations reduces the likelihood of mistakes.

led to a vicious cycle of higher prices leading to even lower volumes and increased costs. Consequently, the MOD faces higher prices, while the UK industrial base has reduced in size.

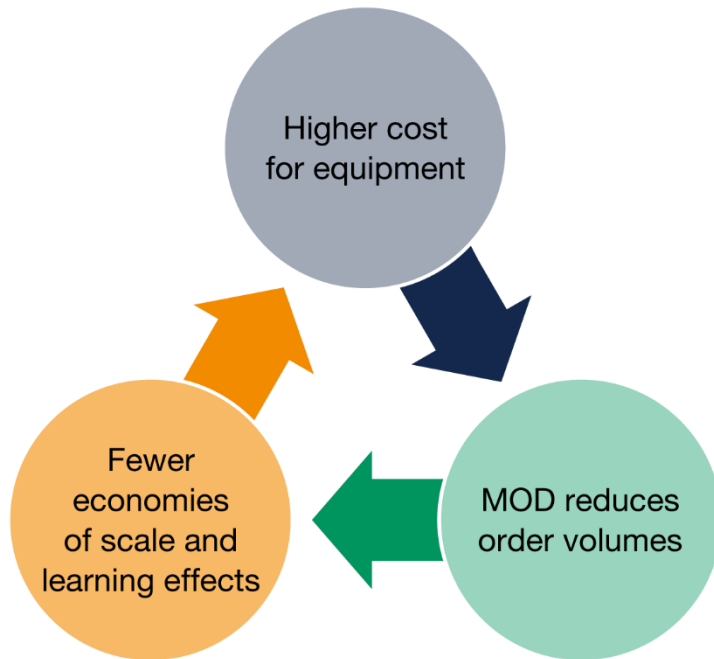


Figure 2: Vicious cycle of cost escalation

- **Competition in the UK defence market.** Changes in defence market characteristics over time, such as the level of competition, can also impact cost escalation. As the sole or major buyer of many domestic defence goods and services, the MOD's buying decisions will influence UK defence industry characteristics such as size, structure, entry and exit (*Hartley 2014*). The MOD's reduction in order volumes over time, partly a response to cost escalation and the consolidation of platforms, have reduced the number of UK suppliers in many sectors of the defence market such as shipyards (*MEWG, 2019*). This reduced competition further fuels ICE in procurements reserved for UK based companies because they have diminished incentives to bear down on costs. The Single Source Regulations Office (SSRO) was established to help mitigate some of these effects by providing regulations and guidance on single source contracts. The SSRO's 2021-2024 corporate plan shows that in 2020/2021 it met its objective to provide assessments to the Secretary of State of the baseline profit and capital servicing rates that demonstrably support value for money and fair and reasonable prices. Despite this, some ICE will likely persist as a result of reduced competition.
- **Other factors** may include the use of non-competitive cost-based contracts for reasons other than national security (*PAC, 2021b*). Whilst such decisions

may be made to support other policy goals, they will nonetheless drive ICE. Another reason is the tendency to develop bespoke equipment from scratch rather than buying it “off the shelf” from the international market when this would provide the required level of both technological sophistication and security (*Hartley, 2016*).

Mitigations. If the department wants to continuously maintain operational advantage, then some degree of cost escalation is unavoidable as new capabilities require costly developments at the edge of the technology frontier. However, there is scope to reduce cost. Whilst some components of ICE are driven by wider macroeconomic conditions, others, particularly those related to industry efficiency, can be more directly influenced by the government. The following mitigations to ICE were identified in academic papers:

- Longer-term contracts and improved sight of procurement plans to provide industry with more certainty about future purchases and thereby encourage investments to increase efficiency (*Arena et al, 2018*).
- More streamlined acquisition processes to reduce administrative costs;
- Fewer changes in orders both in terms of:
 - i. Quantity to retain economies of scale and learning effects; and
 - ii. Characteristics to allow designing and manufacturing flexibility (*Arena et al, 2018*).
- Increased competition in procurements, where appropriate, to drive down costs in acquisitions (*Arena et al, 2018*). The introduction of alternative suppliers may result in fundamentally different approaches which have the potential to reduce cost escalation, especially if new and disruptive technologies are utilised.
- Increased use of international cooperation when developing and procuring defence equipment. This would cut unit costs through augmented economies of scale and reduced development, support and upgrade costs. Cost savings may be lessened, however, if work allocation is not based on relative production efficiency,⁴ decision-making structures are complex, or work arrangements are restrictive (*NAO, 2001*).
- Providing industry with an opportunity to change radically the defining goals or constraints for a concept while it is at the development phase. Credible threats to a firm have been shown to be better drivers for change than opportunities (*Gilbert, 2006*). Consequently, such threats which reduce the certainty of contract award may prevent companies from going down ‘the path of least resistance’ and missing opportunities innovatively to cut costs, thereby

⁴ For example, if the principal of ‘juste retour’ is rigidly adhered to

incentivising the development of less costly capabilities. This is a lesson learned from Sweden’s Gripen jet, a rare example of a new capability that curbed cost escalation in a fundamentally new way (Amann, 2021).

As well as reducing ICE, measures can be taken to prolong the lifespan of existing equipment to minimise the frequency with which equipment is updated. Budgetary pressures and acquisition delays are two reasons that the MOD is having to update existing equipment capabilities instead of making new acquisitions; examples include the Typhoon, Chinook CH-47 and Apache (Brooke-Holland, 2021). The cost savings, however, are partially offset by higher maintenance costs which can rise rapidly in the latter-stages of an equipment’s life span (Hawkes et al, 2008).

Defence Inflation

Definition. The MOD defines defence inflation as the average change in both pay and the prices of goods and services that make up the defence budget, adjusted for quality and volume (MOD, 2017). Consequently, defence inflation contributes to cost escalation by affecting the price at which inputs of an equipment project are bought. Figure 3 outlines the relationship between defence inflation and other drivers of defence cost escalation.

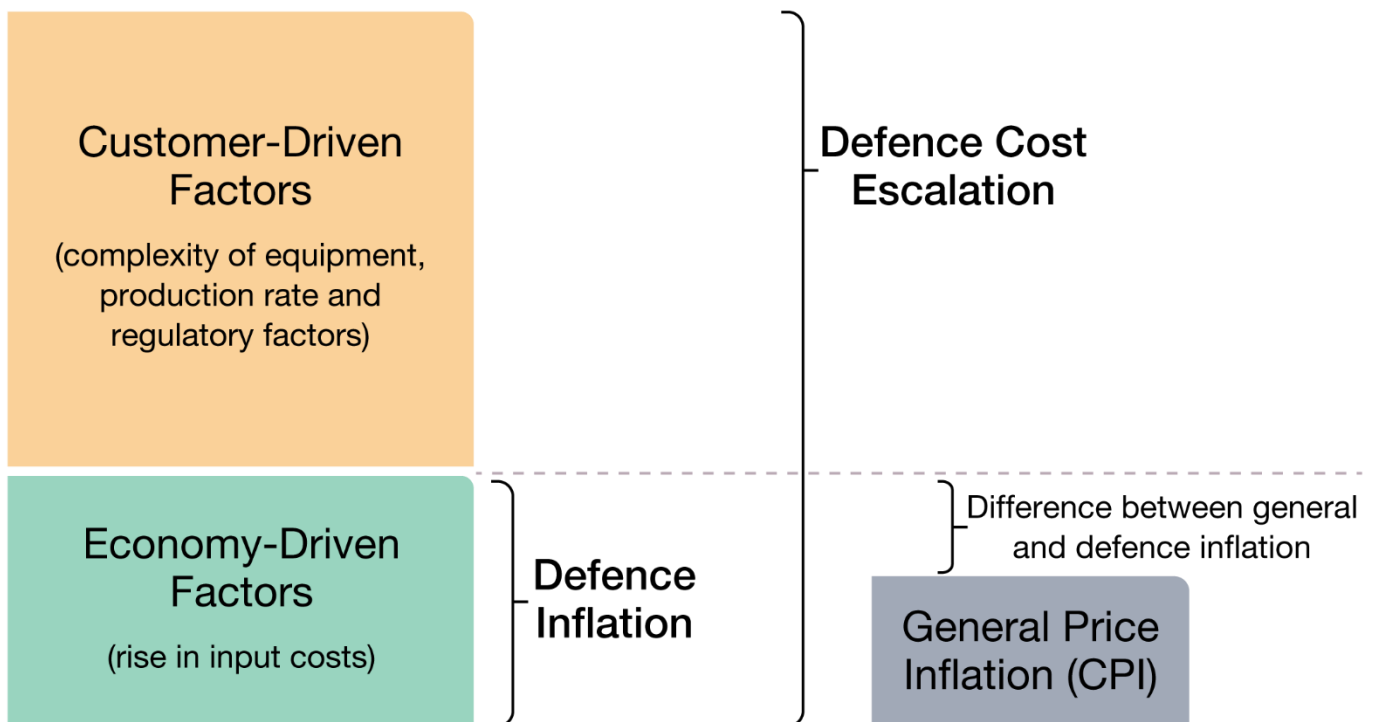


Figure 3: Breakdown of cost escalation. Adapted from (Nordlund, 2016)

Context. An estimated measure of defence inflation has been regularly calculated and published initially externally and subsequently internally⁵ by the MOD Defence Economics Price Indices team since 2010. This followed internal demands for more accurate data to assist with both financial planning and negotiations with the Treasury. There were concerns at the time that defence inflation was higher than measures of output inflation and that it was a driver of MOD cost overruns in the NAO's Major Projects Reports. For example, in 2013 the NAO identified changes in inflation assumptions as the biggest driver of MOD cost increases during the year (*NAO, 2013a*). The MOD's defence inflation reports have subsequently shown that defence inflation is generally higher than measures of inflation in both consumer goods (e.g. CPI) and the whole economy (e.g. GDP deflators). For example, in 2015/16, the latest year when MOD externally published defence inflation estimates, defence inflation was 3.1% higher than the GDP Deflator (*MOD, 2017*). However, these are not directly comparable because defence inflation only considers the cost of defence inputs, whereas the GDP deflator measures changes in outputs i.e. the price of final products and services. In general, input measures tend to have higher growth rates than comparable output measures because the former do not consider productivity improvements or economies of scale, where the level of output for a given level of input increases over time. Defence inflation affects the department's real term spending when it exceeds budget growth and suppliers pass on the additional cost.

Methodology. The MOD's estimate of defence inflation uses a weighted average of the change in labour costs and prices of goods and services that make up the defence budget, with quality and quantity held constant, allowing the pure price change to be measured.

⁵ The report was published until 2017. Since then, it has only been published internally due to issues with suppliers using the rates as the basis of contract negotiations.

Current circumstances

Covid-19 and the public health measures put in place to contain its spread have disrupted international supply chains. In the short to medium-term, the closure of factories and general reduction in production of goods and services used in the Defence Industrial Base places upward pressure on defence inflation. Ultimately, the impact on defence inflation will depend on the magnitude of both supply and demand effects. The pandemic has highlighted the fragility of international supply chains, which are highly vulnerable to shocks. The long-term impacts on defence inflation are uncertain. If suppliers expect defence inflation to rise, they may be less willing to accept firm price contracts, thereby shifting inflation risk to the MOD if fixed price contracts are used instead.

Cost Growth

Cost growth is defined as the difference between actual and estimated costs. The amount of cost growth therefore indicates the quality of forecasts about the costs of future systems (*Arena et al, 2008*).

Cost growth beyond original estimates can be caused by factors that understate cost estimates, such as optimism bias, strategic misrepresentation and a failure to appropriately factor in risks or cost escalation. Cost growth can also result from decisions, such as slowing down production to favour affordability over efficiency. These factors are magnified due to the scale of many defence projects, which are often subject to specific complexities not seen elsewhere in major project literature. Data in support of the Defence Equipment Plan 2021 estimates that over 70% of major acquisition programmes will deliver within their expected cost to completion at the Full Business Case approval (*MOD, 2021a*), indicating that cost growth is more likely to occur in the early stages of the project lifecycle.

The driving factors behind cost growth are now explored in more detail.

Optimism Bias

Definition. The Treasury's 2020 Green Book defines optimism bias as the proven tendency for appraisers to be optimistically biased about key project parameters, including capital costs and operating costs, project duration, and resulting benefits delivery (*HMT, 2020*).

Context. Independent reports such as the Gray Review, the Levene Report and multiple NAO reports identified optimism bias as a key driver of cost growth in major defence projects, contributing to their unaffordability.

Causes. The following causes of optimism bias in defence have been identified in the literature:

- **Funding allocation process.** Some academic studies have identified the challenge of allocating a finite defence budget across armed services. This can result, they argue, in a situation where all three armed services rationally favour bids with optimistically low costs and high benefits because once projects are accepted into the programme they are less likely to be cut (*Hartley, 2016*). This could drive optimism bias and cost growth into procurement projects.
- **Accountability.** The frequent rotation of both military and civilian personnel between posts means that the original decision-makers rarely bear the consequence of subsequent cost growth and blame is shifted to others (*Hartley, 2016*).
- **Capability sponsor pressures.** The Gray Review identified the pressure faced by Defence Equipment and Support to deliver more for less and the difficulty in pushing back on unrealistic cost and schedule expectations from the capability sponsor. The result is frequent over-specification and underpricing at Initial Gate (*Gray, 2009*).
- **Moral Hazard.**⁶ Contractors have an incentive to underestimate costs to win contracts, knowing that once projects are underway, they are difficult to cancel due to political pressure, the risk of embarrassment, vested interests and the sunk cost fallacy⁷ (*Dorey et al, 2012*).

Some of the causes identified above may also relate to strategic misrepresentation. This occurs when costs are deliberately and systematically distorted for strategic purposes rather than mistakenly underestimated due to optimism (*Flyvbjerg, 2021*). Forecasters, planners and decision-makers can strategically misrepresent figures to make projects appear more beneficial and therefore more likely to be approved, leading to cost growth further down the line. Whilst there is no evidence of strategic misrepresentation within the department, the literature identifies it as the most significant behavioural bias in megaprojects.

⁶ The tendency for an entity to increase exposure to risk if it does not bear the full costs of that risk

⁷ Sunk Cost Fallacy is the tendency to follow through on an endeavour because time or money has already been invested into it, even though these historic factors are irrelevant to the decision. All that matters is how current and future costs compare to current and future benefits.

Optimism bias is not a phenomenon that is unique to defence. The problem affects the delivery of projects throughout both government and the private sector. The NAO has identified a number of general contributing factors (NAO, 2013b), summarised in figure 4 below.



Figure 4: Causes of optimism bias (NAO, 2013b)

Second-Wave Effects. As well as their direct consequences, optimism bias can also have subsequent or “second round” detrimental impacts on cost growth, for example:

- **Worsened economies of scale.** If an equipment programme underestimated costs due to optimism bias, the quantity procured may eventually be reduced to comply with budget cycles. This would prevent greater economies of scale and learning effects from being achieved.
- **Perpetuating moral hazard.** Equipment programmes may require additional funding if they experience cost growth due to optimism bias. Funds may be reallocated from uncommitted projects to committed ones during the annual budget cycle. If this negatively impacts ‘healthy’ projects, then it may encourage the strategic underestimation of costs as diligent teams are punished whilst less realistic ones are not.

Industry Incentives

In addition to optimism bias, which mainly impacts the initial cost estimate, industry may also lack the necessary incentives to deliver projects to target cost. If suppliers are shielded from the financial consequences of their actions, then they may not undertake the required steps to control costs.

Solutions. The following solutions have been proposed in the literature:

- **Reference class forecasting.** This is a well-documented method for adjusting cost estimates to account for optimism bias in projects. Reference class forecasting adopts an ‘outside view’ by using historic data as a predictor of the uncertainty and risk of a similar future project. A review of the method and its use across a wide range of projects has shown that it increases the probability of delivering a project on time and on budget compared to conventional methods (DfT, 2021). Nobel-laureate Daniel Kahneman goes further by saying Reference Class Forecasting is the single most effective technique planners can use to de-bias initial cost estimates and thereby reduce the magnitude of cost overruns (*Kahneman, 2011*).
- **Risk-driven contracts.** Properly designed incentive contracts can help to prevent optimism bias during the manufacturing phase by addressing both moral hazard and adverse selection.⁸ Apportioning the appropriate risk to suppliers discourages them from underestimating costs as they are exposed to

⁸ Adverse selection occurs when a market participant has more information than another, giving them an unfair advantage.

more cost risk. Additionally, it encourages suppliers to implement more cost control discipline and efficiency improvements over time which further restricts cost growth (*Dorey et al, 2012*).

Poor Understanding of Risk and Assumptions

Poor understanding of risk and assumptions can drive cost growth due to the following reasons:

- **Insufficient risk provision.** Whilst MOD guidance advises investment appraisals how to take proportionate account of risks, in reality risk provisions are not always sufficient (*NAO, 2021*), which drives future cost growth when risks materialise. This may be partly due to an information asymmetry, as contractors have significantly more information than the department on several key variables such as risk. Consequently, the MOD may be unable to correctly estimate risk if industry has not passed on all relevant information. This problem is exacerbated by the complexity of some defence procurements in which it may be impossible fully to assess all risk. Insufficient risk provision is also driven by cognitive biases such as ambiguity aversion, availability bias and framing bias⁹ (*Retter et al, 2021*).
- **Asymmetric risk sharing.** Effective risk sharing approaches should hold the contractor responsible for risks that are within its control; the government department should be responsible for risks that are outside of the contractor's control. According to the literature, the department often lacks the understanding to attribute risk (*Retter et al, 2021*), and therefore does not always pass appropriate costs onto contractors. Additionally, the department may not be able to enforce the contractual risk apportionment if it will result in significant financial harm to the contractor or if it prevents the delivery of an essential military good.
- **Unverified assumptions.** Cost estimates are based on a series of assumptions that are produced from modelling and estimation methods. If the department lacks the ability to verify these assumptions, then erroneous ones increase the probability of cost growth. To mitigate this, assumptions must be continuously tested with the latest data, and learning from experience must continue (*Retter et al, 2021*).

⁹ Ambiguity Aversion is the tendency to favour known risks over unknown risks. Availability bias arises from the use of readily available information rather than the most representative information. Framing bias is where the way data is presented can affect decision making.

Solutions. The following solutions have been identified in the literature:

- **Establish and embed effective scrutiny.** This involves continuous challenge and validation of assumptions, risks and estimates through acquisition best practice such as red teaming. Scrutiny will only be effective if scrutiny roles are established and allocated, and if project teams are responsive to these challenges which may require a cultural shift (*Retter et al 2021*). Historically, the NAO has found that scrutiny teams within MOD had the requisite levels of experience and skills to support effective decision-making (*NAO, 2012*), though it is not clear that the NAO has repeated this assessment in recent years.
- **Create a process to capture and share lessons learned.** The MOD has been criticised in the past for not implementing lessons from past programmes (*Retter et al 2021*). As part of a continuous evaluation process, a mechanism should be established whereby lessons learned from previous projects can be logged and filtered to inform future decisions. By making this part of the scrutiny process, rather than relying on ad hoc arrangements and individuals' willingness, poor understanding of risks and assumptions can be mitigated. This may involve conducting ex-post analysis and inviting senior experts for independent validation.
- **Progressive assurance.** Episodic or snapshot-based assurance creates issues by allowing risks and issues to accumulate over time. A process of continuous independent assurance that uses real-time data will facilitate evidence-based decision-making to deal with these risks in a timely and effective manner. The use of leading indicators over lagging indicators will further improve the timeliness of these decisions.

Workforce Challenges

Internal and external workforce issues can drive cost growth into programmes:

- **Suppliers.** Large acquisition programmes often require a rapid build-up of a workforce which may involve using inexperienced workers. This can result in costly re-work due to poor quality assurance and the failure to realise planned production efficiencies due to low workforce productivity or problems with the recruitment, training and security clearance pipeline (*Retter et al, 2021*).
- **Department.** MOD faces sharp competition for key acquisition skills and often cannot compete with the financial and non-financial benefits provided by private sector companies. Consequently, within the department there may be sub-optimal numbers of individuals with the required skills sets that are vital to successful programme delivery, which could result in risk, assumptions and cost estimating errors (*NAO, 2020a*). This issue is perpetuated by the lack of a

periodic review of the defence acquisition workforce; gaps in the workforce may not be identified in time (*Retter et al, 2021*).

Solutions. The following solution has been identified in the literature:

- **Professionalise and reinforce cost assurance functions.** A comprehensive audit of acquisition skillsets would enable shortfalls to be identified and addressed. Repeating this assessment regularly would also allow the effectiveness of shortfall-addressing initiatives to be evaluated (*Retter et al 2021*).

Part 2: Ongoing Work to Address Known Issues

The literature review has identified several theoretical solutions and mitigations to cost growth and cost escalation. There is ongoing work within the department to address these issues. Relevant work areas include:

Cost Growth

Evaluation. A central evaluation team was established in the analysis directorate in November 2020 in response to a Comprehensive Spending Review 2020 commitment to improve the quantity, quality and materiality of evaluation evidence supporting decision making in defence. The team has led on and supported several evaluation work strands including:

- **Monitoring and evaluation frameworks.** Working with project teams to develop these frameworks which help programmes to assess whether they are meeting objectives and what lessons can be learned. This reduces risk and uncertainty by not repeating avoidable mistakes, and therefore mitigates cost growth.
- **Evaluating policies and programmes.** The evaluation team are applying Magenta Book guidance in leading on a handful of evaluations for internal customers to further understand the impact of policies and what works for whom and when. This includes getting to the root cause of issues found in programmes and making actionable recommendations for improvement.
- **Reference class forecasting.** Researching and promoting the use of this method to reduce cost growth by de-biasing initial cost estimates, including working with leading academics in the field to peer review internal estimates of cost growth and developing defence-specific reference classes with external experts. Further details on the theory are provided in the Optimism Bias and Industry Incentives section in Part 1.
- **Data mapping.** The Project Delivery Function plans to sponsor data-mapping experiments on two major projects in early FY22-23. These experiments will use unique analytical tools to map all the different sets of data that collectively explain a project's cost and schedule performance.

- **Creating a process to capture and share lessons learned.** The MOD's establishment of a central register of Learning From Experience (LFE) in 2020 was a vital first step toward enabling lessons learned from previous projects to be logged and filtered into future ones. The evaluation team are working with the project delivery function LFE team to ensure information is disseminated to mitigate against poor understanding of risks and assumptions (*PAC, 2021b*).

Risk. The MOD is responsible for some of the most complex and high-risk programmes in government. Consequently, the department has taken several steps to improve its risk forecasts and reduce risk materialisation, for example:

- **Risk reduction through workstreaming.** The Strategic Partnering Programme was established to develop partnerships with suppliers to unlock mutual benefit and deliver value to taxpayers. One way it does this is through workstreaming whereby evidence on systematic, strategic or operational problems are analysed to provide a platform for operationally led resolutions to be implemented through empowered collaborative teams. This enables programme delivery risks to be reduced in severity or retired altogether.
- **Risk costing pilot.** New guidance on the use of standardised methodologies for calculating risk are being tested as part of a pilot study. Improving the reliability and credibility of risk forecasts will not only help set more realistic budgets, lending itself to reduced cost growth against a baseline, but also promote the requirement for mature risk management practices. This in turn can help to identify, assess, plan, respond and monitor these risks in an improved way to reduce the department's need to use contingency funding.
- **Forward contracting.** The MOD limits the impact of short-term foreign exchange variation by purchasing a proportion of demand up to three years in advance at fixed prices using services provided by the Bank of England and HM Treasury. This mechanism helps mitigate cost growth in procurements with spending in foreign currencies when exchange rates change.

Skills and expertise. The MOD has undertaken several actions to improve the quantity and quality of its workforce, as well as its ability to deliver. These include:

- **Training and qualifications.** Improving the provision of training and ensuring personnel involved in delivering the Equipment Plan – such as finance, commercial and project management – have the appropriate qualifications to work effectively. This includes mandatory finance training for all finance personnel, a commitment to over 60% of finance staff being formally qualified, a Commercial Licensing process to test and accredit commercial staff and a

Project Delivery Profession Accreditation to recognise project delivery professionals' knowledge, skills and experience.

- **Recruitment and retention.** Initiatives such as the commercial market skills allowance and project delivery's common employee value proposition are helping to both recruit and retain these professionals. Additionally, bulk recruitment is being investigated to fill resource gaps in project delivery.
- **Bolstering Senior Responsible Owners.** As the overall leader of a project, Senior Responsible Owners (SROs) play a crucial role in project delivery. Therefore, significant focus has been placed on ensuring they have the capacity and capability to deliver. Plans are being progressed to ensure SROs commit at least 50% of their time to Government Major Projects Portfolio projects. Additionally, methods are being explored to increase the tenure of SROs on projects or to align SRO turnover with appropriate phases of the project to minimise disruption. Finally, recruitment is being standardised and a "bench" is being created to ensure the MOD has access to the SROs it requires.
- **Identifying skill gaps.** A skills audit is being conducted to assess project delivery capability gaps in the SRO community and develop tailored development plans, with another planned for project directors. Similarly, a Commercial Strategic Workforce Plan will forecast the number of commercial staff required to deliver a pipeline of activity over the next 5 years. Identifying gaps and increasing the quantity and quality of personnel vital to successful programme delivery will enable risk, assumptions and costs to be more accurately assessed, thereby mitigating cost growth.

The approvals process. The department's 3-stage investment approvals process ensures that these decisions are based on sound justification and strong evidence to the greatest extent possible. The scrutiny community helps achieve this by providing expert independent analysis and advice to the approving authority, ensuring that there is challenge applied as the programme develops, and that the decisions that guide the programme are not inadvertently biased or ill-thought out. Specific examples of mitigations within the approvals process include:

- **CAAS annual costing review.** The MOD's independent Cost Assurance and Analysis Service (CAAS) runs an annual process to review a sample of delivery teams' costings, which tends to focus on riskier projects in the Equipment Plan. These independent cost estimates mitigate biases and therefore provide a more accurate cost estimate.
- **Firm price contracts.** The MOD's guidance on investment appraisals, Joint Strategic Publication 507, and Commercial Policy advises contracts costs to be

“firm” if they last up to 5 years and “fixed”¹⁰ to a general measure of output prices for longer contracts. This reduces risk materialisation and therefore mitigates cost growth.

Effective acquisition behaviours. The MOD is working to embed effective acquisition behaviours with a focus on setting programmes up for success through early engagement of relevant experts to identify and address areas of highest risk and complexity.

Improved management information. Automating the generation of financial management information and enhancing its quality through forecasting tools, software and dashboards has improved the accuracy and timeliness of data used to inform decision-making.

Assurance. Integrated Assurance Reviews are undertaken at key points of major projects’ lifecycles following the Infrastructure and Projects Authority framework. These reviews assess the health of projects and produce action plans to address issues early. Additionally, the Project Delivery Function undertakes maturity assessments of each Top Level Budget against the Axelos Portfolio, Programme, and Project Management Maturity Model (P3M3). These assessments enable the department to identify areas for improvement in its project delivery capability.

Cost Escalation

Improved procurement stability. The Defence and Security Industrial Strategy (DSIS) states that the MOD will improve the communication of its longer-term priorities and requirements through the publication of pipelines and development of roadmaps; for example, the National Shipbuilding Office plans to publish a 30-year shipbuilding pipeline of planned procurement (*MOD, 2021b*).

Addressing skills shortages. DSIS has identified several interventions to address skills shortages in the department and industry. The Enterprise Approach project will encourage collaboration with industry and academia to share skills better; for example, by making it easier to move between the MOD and industry. Additionally, the Pan-Defence Skills framework will align existing frameworks and externally recognised bodies further to facilitate movement of people between government and industry (*MOD, 2021b*).

¹⁰ Firm refers to a set current price, whilst fixed refers to a price adjusted for annual inflation or exchange rates

Acquisition and approvals transformation. The department is delivering a range of initiatives aimed at driving pace and agility into the acquisition system. Improvements such as streamlined processes based on programme risk and complexity, new approaches to enable faster pull-through of emerging technology and implementation of pan-defence Category Management have the potential to deliver greater efficiency and financial savings and therefore mitigate cost escalation.

New approach to industrial policy. The 2021 DSIS may help to control costs over time by strengthening supply chains and improving productivity in the UK defence industry. The strategy also aims to establish a closer, strategic relationship between government and the defence industry where competition is not viable or desirable, for example through the use of long-term strategic partnerships. In addition, DSIS includes a package of legislative reform, policy changes and internal transformation that will improve the speed and simplicity of procurement, which could mitigate defence cost escalation (MOD, 2021b).

Maintaining value for money in the absence of competition. The Single Source Regulations Office (SSRO) was established in 2014 to ensure that value for money is obtained in government expenditure on non-competitive qualifying defence contracts. The provision of guidance and regulations, such as driving out unnecessary cost from contracts and setting baseline profit rates, mitigates against cost escalation in single source contracts.

Category management. The MOD has started to use category management to identify requirements across multiple customers in the department. Taking a more holistic approach to requirements prevents duplication of effort and enables standardisation, consolidation and leveraging to reduce overall through life costs.

Further Areas to Explore

The department is currently undertaking several measures and processes to mitigate cost escalation and cost growth. The report identifies other areas MOD could explore to further mitigate cost growth and cost escalation. These include:

- **Embedding the use of reference class forecasting.** This technique has been applied in some projects across the department and there are plans to research and promote its use as set out in Part 2. The MOD could consider improving the frequency and consistency of its use once defence-specific reference classes have been developed to support project teams to de-bias initial cost estimates.

- **Increasing competition where appropriate.** In general, the greater the level of competition, the greater the value attained for a good or service as firms drive down costs to win the contract. However, procurement strategies must also consider impacts on national security, the industrial base, and longer-term effects on the market in line with DSIS Sector Strategies, before concluding that competition is the most appropriate option.
- **Increasing use of risk-driven contracts.** Properly designed incentive contracts can help prevent optimism bias during the manufacturing phase by holding contractors accountable for their cost estimates, unlike cost-plus contracts. They also limit potential losses to contractors, unlike fixed-price contracts, thereby sustaining competition. Therefore, the utilisation of such contracts could be increased across the department where appropriate and commercially viable.
- **Professionalise and reinforce cost assurance functions.** Whilst a skills audit is planned for project delivery personnel, this could be expanded to all professions involved in the acquisition process. Repeating this assessment regularly would allow the effectiveness of shortfall-addressing initiatives to be evaluated.

Part 3: Compilation of Existing Research

The MOD has investigated cost growth and cost escalation to varying degrees in the past. These examples, which have been used extensively throughout the report, include:

- **Defence inflation.** As mentioned in Part 1, the Price Indices team within Defence Economics produces an annual report on defence inflation. It is consequently one of the better understood areas of cost escalation in the MOD.
- **Intergenerational cost escalation in defence equipment.** In 2012, Defence Economics published a research paper on intergenerational equipment cost escalation which included a review of the relevant literature and analysis of cost data to update cost escalation estimates (Davies et al 2012).
- **Equipment plan.** Cost growth within specific projects is mentioned in the department's annual Equipment Plan.¹¹ The NAO's annual report¹² on the Equipment Plan discusses reasons behind defence cost growth, such as over-optimism.

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¹¹ [Defence equipment plan reports - GOV.UK \(www.gov.uk\)](http://www.gov.uk)

¹² [The Equipment Plan 2020-2030 - National Audit Office \(NAO\) Report](#)

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