

Response strategies to the cost escalation of defence equipment

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Executive Summary

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Executive summary

The growing costs of defence equipment acquisition programmes have been widely documented and are the subject of ongoing policy and industry discussions. In an era of declining defence budgets and increasingly expensive new generations of equipment, the mounting costs of major weapon systems raise concerns for policymakers. As defence equipment becomes more expensive and the ability of defence ministries and national militaries to pay for it more limited, defence inventories are expected to shrink, potentially harming the nation's overall defence capability.

This study examines response strategies to cost escalation in defence

Commissioned by the European Defence Agency (EDA) in September 2016, this study identifies approaches adopted by national ministries of defence, defence procurement agencies and a few civil sector industries to minimise the escalating cost of equipment. It focuses on *cost escalation*: the tendency for costs to increase over successive generations of defence equipment. It does not focus on *cost growth* (in which the costs of a specific project increase as it moves from the concept stage through development to production), although some strategies targeting cost growth may reduce production unit costs for the current generation of equipment, thus helping to reduce cost escalation across several generations in the long term. The core elements of this study include:

- Identification of the key principles in a defence acquisition framework that enable effective cost control, thus mitigating the negative consequences of cost escalation.
- Analysis of five national cost escalation response strategies from the United States, the United Kingdom, Sweden, Denmark and the Netherlands.
- Analysis of cost control strategies within selected civil sectors, including civil aerospace, oil and gas, infrastructure and space.
- Lessons learnt and recommendations for further member state action.

This study was conducted over a period of four months; it relied on a literature review and interviews with experts and stakeholders, including representatives of national defence procurement agencies, defence ministries, academia and independent audit offices.

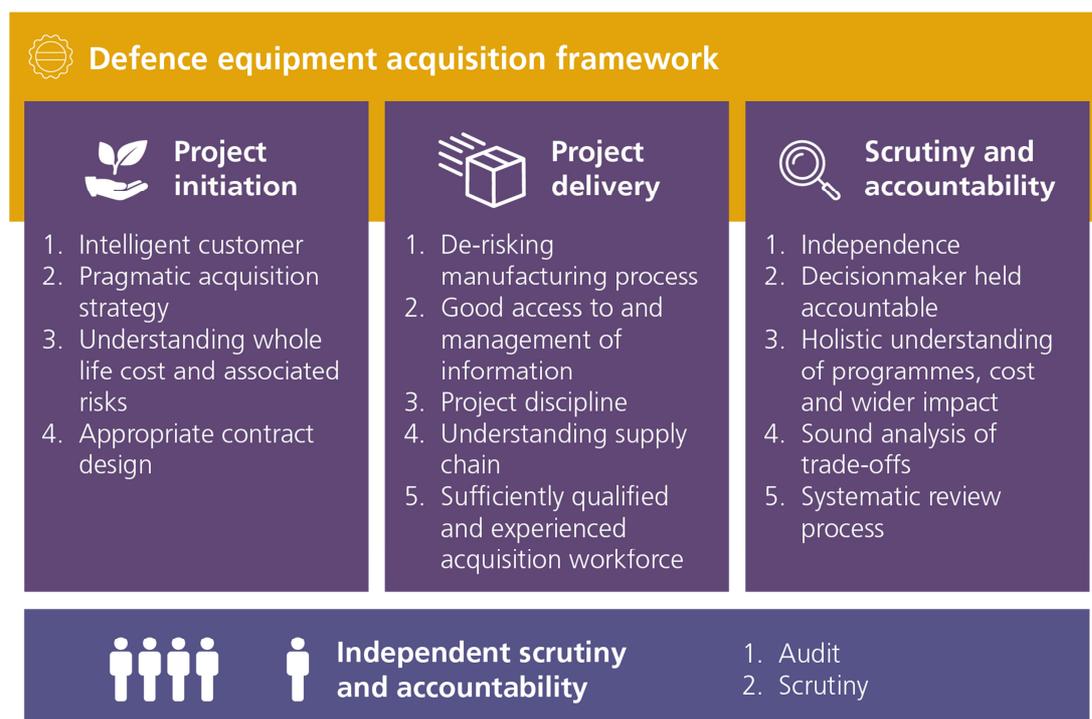
In this summary, we present key empirical principles for effective defence acquisition and outline the key research findings from our analysis of government and civil sector responses to cost escalation.

Identifying empirical principles makes it possible to respond to cost escalation

To address cost escalation effectively, a symphony of measures must be put in place to provide a strategic response. It is not enough to have appropriate organisational structures staffed by capable professionals who apply sound policies and procedures; crucially, decisionmakers need accurate assessments of the decisions to be made, as well as evidence-based advice on the consequences of various alternatives. Decisionmakers must have sufficient information to make informed decisions about the level of risk they are willing to accept at every stage of a project or programme, as these decisions will have an impact on the subsequent unit cost escalation.

As part of this study, we have developed a set of principles for developing a defence acquisition framework, capturing the key features of project initiation, which include project delivery and scrutiny and accountability functions that enable effective cost control. Figure 0.1 presents the key empirical principles needed for a strategic response to cost escalation.

Figure 0.1. Key principles needed for a strategic response to cost escalation



Source: RAND Europe analysis

To illustrate how past acquisition programmes have managed to bring unit production costs under control, this study presents two ‘vignettes’, describing the acquisition of the Danish *Iver Huitfeldt* class of frigates and the US *Virginia* class of nuclear submarines. These are presented in Boxes 1 and 2 on the following pages.

Box 1: Good practice example: the Danish *Iver Huitfeldt* class

During the post-Cold War era, the Royal Danish Navy (RDN) has undergone a marked shift in strategy, moving from a large ‘small ship’ force to a smaller ‘big ship’ navy that is capable of conducting enduring missions internationally. Part of this transformation has involved the acquisition of three *Iver Huitfeldt* class frigates, while successfully implementing several key measures to keep down unit production costs. These measures include:

- **Building on the previous class:** the hull form for the *Iver Huitfeldt* class is based on the Absalon class of support ships and fitted with (reportedly up to 80%) similar equipment. This has reduced training and MRO costs (e.g. for engines) as sailors have been able to receive training and maintenance practice on Absalon class vessels.
- **Outsourcing of production:** to enable economies of scale, the construction of blocks was outsourced by the prime shipyard (Odense Steel Shipyard) to the Baltija Shipyard in Klaipeda, Lithuania and Loksa Shipbuilding in Estonia.
- **Early identification of deficiencies** (early de-risking of production): the first-of-class *Iver Huitfeldt* was delivered in a ‘basic frigate’ configuration, with the intention of beginning sea trials as quickly as possible to identify deficiencies in the lead ship and address these in ships two and three prior to their delivery dates.
- **Acquisition strategy designed to save costs:** instead of commissioning a shipyard to deliver a fully equipped ship, the RDN commissioned the shipbuilder only to build the platform and to place the main engine and systems. The RDN itself took responsibility for all military installations, systems integration, tests and certification.
- **Re-use of modules:** the *Iver Huitfeldt* class reuses the interchangeable Standard Flex (Stanflex) weapon container modules that were procured for the previous class of frigates.
- **Maximising COTS and MOTS equipment:** the *Iver Huitfeldt* class uses the same anti air warfare (AAW) system as the German F 124 and Dutch De Zeven Provinciën class frigates, allowing the RDN to minimise risk, thanks to a tested system and AAW courses provided by Germany and the Netherlands, together with a collaborative approach to spare parts, maintenance, software and hardware upgrades.
- **Significant use of automation and innovative man-machine interfaces:** to enable a lean operation of the frigates, the *Iver Huitfeldt* class is characterised by extensive automation, enabling the RDN to cut crew numbers from 200 to 101.

Several key findings have emerged from this study

Based on an analysis of national response strategies and approaches to cost escalation adopted by civil sectors, the study team identified the following key findings:

1. **There is substantial evidence to prove the existence of cost escalation** between successive generations of defence equipment. However, cost escalation is frequently conflated with cost growth and the terms are used interchangeably, both in the literature and in conversations with government and industry stakeholders.
2. **An affordability challenge is shaping the defence acquisition environment in most Western countries**, highlighting governments’ ability to effectively manage the tradeoffs

between operational capability, force structures, budgets and schedules to provide warfighters with effective equipment.

Box 2. Good practice example: US Virginia class submarines

The 2006 Quadrennial Defense Review ordered the US Navy to 'return to a steady-state production rate of two Virginia class attack submarines per year no later than 2012, while achieving an average per hull procurement cost of \$2bn', in contrast to the prevailing \$2.4bn. If the programme did not succeed in cutting unit production costs, the size of the Navy's submarine fleet would fall significantly below requirements. In response to this cost challenge, the Program Office adopted the following three-pronged strategy:

- **Improve construction performance:** a key part of this process was the implementation of lean manufacturing techniques, reducing rework and improving the schedule for delivering government-provided equipment.
- **Redesign portions of the ship to enable more efficient production by reducing production labour and material costs:** design changes in ongoing programmes are generally associated with cost growth; however, the Virginia class cost reduction programme focused on feasible design modifications that had significant cost reduction potential and minimal disruptive impact.
- **Increased procurement rate and multi-year procurement contract:** in addition to spreading overhead costs over two (instead of one) submarines a year, additional efficiencies were gained by aligning the workload to make efficient use of trade and optimising the build plan. Additionally, a multi-year procurement contract for multiple boats allowed the Navy and its shipbuilders to place long-term contracts with suppliers, thus achieving economies of scale.

With help from external consultants, various changes to the construction processes, material and staff availability and design maturity were modelled in a complex simulation to determine the likely impact of these changes on overall cost and to identify approaches that would allow for the construction of two ships per year. A continuous feedback mechanism and system of reporting on the cost reduction strategy were implemented.

3. The nature and characteristics of national defence acquisition systems and **the response strategies to cost escalation differ between countries that are focused on developing equipment** (e.g. the United States, the United Kingdom, and to a certain extent Sweden) **as compared with countries that are more commercially focused** (particularly Denmark and the Netherlands). The former, with its developed defence industries, places greater emphasis on de-risking early manufacturing processes and understanding key cost drivers during the early stages of development.
4. **All countries under review have enabling structures and processes** in place which, if implemented as intended, have the potential to mitigate many of the negative consequences of cost escalation. The structure and level of institutionalisation may differ from country to country, depending on the resourcing available. Larger defence spenders have in place more structured acquisition processes and systems with designated responsibilities (e.g. the independent cost estimation function of the UK Cost Assurance and Analysis Service and the US Cost Assessment and Program Evaluation office). However, human biases, behaviours and changing national priorities often prevent effective implementation and execution.

5. **An understanding of the requirements is fundamental if a project or programme is to be effectively set up and successfully delivered.** This includes a detailed understanding of the readiness levels of all technologies involved and the rate of return for investment (i.e. what capability will be obtained at what cost and on what timetable).
6. **An effective response to cost escalation involves the ability to make effective tradeoff decisions while managing conflicting objectives** between the different elements of the acquisition system (the customer, delivery organisation and defence industry, as well as the wider government and national parliament). Within the procurement system, each organisation's awareness and management of behaviours and incentives is critical for developing an effective strategic response to cost escalation. Key enablers include the clear allocation of roles and responsibilities, exemplary leadership, effective project and programme management undertaken by sufficiently skilled and experienced personnel and enforcement of the instructions and guidelines.
7. **Due emphasis on whole lifecycle costs and portfolio management is a key to effective cost control,** often cited in strategic procurement documents and guidelines. However, several stakeholders interviewed in this study pointed out that, in practice, O&S costs and strategic portfolio management receive far less attention than they should, given their importance for cost control.
8. **It may never be possible to evaluate the effectiveness of specific cost escalation strategies and national approaches** because it is very difficult to assess direct causal linkages between strategies and outcomes. Limited data are captured; it is not always possible to analyse the implementation of strategies and cost control measures. In most cases, historical data are not available.

Five key lessons can be learned from the examples of good practices

In addition to assessing the national strategies and measures adopted within civil sectors to control costs, the research team identified several lessons that are transferrable from one country to another and from civil sectors to defence. These include:

1. **Independent scrutiny:** an independent scrutiny function that provides a 'second pair of eyes' on cost, schedule, risk and (where possible) technical assessments, as well as on the commercial acquisition strategy and project delivery, is crucial for achieving effective cost control.
2. **Effective project initiation:** getting 'things right' at the start makes it possible to successfully deliver a project on time and on budget. This requires an understanding of the requirements and associated technology, an appropriate acquisition strategy, reliable cost estimates that take into account uncertainty and risk, contracts that include appropriate incentives for each partner at each stage of the project and effective project management, decision analysis and monitoring of performance.
3. **Effective leadership:** respected, effective and exemplary leaders who can carry through change and lead by example are crucial when implementing strategic measures in response to cost escalation. Such leaders must maintain a balance between the levels of scrutiny, accountability,

delegated responsibility and decisionmaking in order to avoid overburdening project managers with reporting obligations and administrative duties.

4. **Constructive dialogue with the defence industry:** continuous and transparent dialogue with the defence industry can identify efficiency measures that will be effective in cutting costs and enabling a mutual understanding of requirements, available technologies and potential alternative solutions. Finally, a structured and open dialogue with industry can help national MODs diversify their supply chain and seek better, more cost-effective solutions. Constructive dialogue is needed throughout the whole acquisition process, although commercial sensitivities may limit the openness of the dialogue during the contract negotiation phase.
5. **Learning from experience:** learning from past projects and programmes and from historical data is a key approach when adopting an effective cost control strategy. Those responsible must gather and store reliable historical data, conduct international benchmarking and comparisons and analyse past programmes to identify the root causes of cost overruns. They must also include these datasets when generating cost and project estimates for new programmes.

The EDA and its member states have a role to play in responding effectively to cost escalation

In light of these research findings, the study team proposes the following recommendations for the EDA and its member states (MS):

1. The EDA can raise awareness among its member states of the existence of cost escalation, the difference between cost escalation and cost growth and the good practices identified and developed as benchmarks in this study, exemplified using concrete examples from a sample of member states.
2. Member states can use the outputs of this study, particularly the key empirical principles, as a framework against which to conduct an internal assessment of their own acquisition frameworks, identifying potential gaps that could impede the effective management of defence equipment costs.
3. In order to analyse the functioning and effectiveness of its national defence acquisition system, each member state should collect reliable data and metrics from past projects and programmes, including contract information, schedules and costs, the lifecycle costs for each generation and the results of industry engagement to determine the price breakdown, the identification of key cost drivers behind cost escalation and growth and the tracking of requirement changes.
4. To confront the challenge of declining defence procurement budgets, rising unit production costs and a changing threat environment that requires ever more advanced technologies, member states should seek ways of tackling cost escalation collectively. The EDA, in addition to encouraging states to collaborate in procuring equipment, could also help tackle the key drivers of cost escalation by creating a forum in which member states could share best practice in the area of cost estimation, discussing industrial relationships and ways of accounting for uncertainty and risk in cost estimation and project management. In addition, the EDA could facilitate an exchange of metrics and cost data on past programmes through a shared database, to which willing member states could contribute information.