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Evaluating Defence Projects – Success May Be a Multidimensional Measure. A Case Study of a Logistics Support Vessel

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Abstract: Armed forces worldwide face major investment needs, but past mistakes risk being repeated unless they can learn from completed projects. Using a case example, this paper illustrates the valuable lessons that can be learned from defence projects based on ex-post evaluation. The Norwegian Navy's logistics support vessel, HNoMS Maud, was delivered from its South Korean shipyard in 2018 after a turbulent construction period. We present an ex-post evaluation of the project based on an evaluation framework that aims to assess operational, tactical and strategic project success. Although the problems from the construction phase seem to have been overcome, and the vessel fits well with NATO needs, its national relevance in a small navy with limited ocean-going capabilities can be questioned. Several lessons can be drawn from ex-post evaluations of projects. We thus encourage defence research communities and armed forces to strengthen their evaluation efforts to improve future planning and delivery of projects.

Keywords: Projects, Defence acquisitions, Ex-post evaluation, Project success, Navy

1. Introduction

Acquisitions of armoured vehicles, road construction, the football World Cup, or a royal wedding all have in common that they are organised as projects. They require significant resources, extensive planning and quality assurance in advance and depend on collaboration across sectors and disciplines. Defence projects are no exception; some regard them as among the most challenging endeavours, representing a demanding bureaucratic process fraught with military, technological, economic, and political pitfalls (Hambleton et al. 2013).

Governments around the world are increasingly using projects as vehicles to promote growth, promote a fair and efficient distribution of resources and achieve specific goals. Some estimate that the world spends over $10 trillion annually on projects; in the UK alone, more than £250 billion (Williams et al. 2022). Since 2014, NATO guidelines have recommended that the allied countries should strive towards spending at least 2 per cent of their Gross Domestic Product (GDP) on military expenditure and committing at least 20 per cent of their military expenditure on major equipment (Alozious 2021). Since the Russian invasion of Ukraine in February 2022, most NATO countries have increased their defence expenditure. Worldwide, military spending grew to an all-time high in 2022 (Tian et al. 2023). In 2024, most NATO countries met the expenditure and investment guidelines (NATO 2024).

The problem for the defence sector and other parts of government is that many of the projects fail to meet time and cost targets. Furthermore, projects failing to deliver the agreed scope and quality (for example, by delivering fewer units of materiel) may jeopardise project value and defence capability. This is made more complex because there is no commonly held method or understanding of defence project value through contribution to national prosperity and social welfare (Black et al. 2021), which stands in contrast to the evaluation of, say,

transport infrastructure where guidelines for appraisal and cost-benefit analysis have existed for decades.

Defence projects may be challenging to plan and manage due to their complexity and unique requirements. Defence projects often involve cutting-edge research and development, integration of various systems, and compliance with strict regulations and security measures (Markowski and Hall 1997; de Rezende et al. 2022). Furthermore, defence projects are often subject to changing geopolitical landscapes, evolving threats, and shifting priorities, which can impact their outcomes. Budget constraints, political considerations, and the involvement of multiple stakeholders can also influence the success of defence projects. As most of the project information is classified, the potential for learning through research and evaluation may be more limited than for other sectors. According to the US Government Accountability Office, 96 major defence acquisition programmes from 2008 collectively ran $ 296 billion over budget and were, on average, 22 months behind schedule (Hofbauer et al. 2011). Roberts et al. (2016) and Johnson (2018) claimed that overruns and delays were the norm rather than the exception for U.S. Department of Defense major weapons programs. Hartley (2016) discussed why costs tended to escalate in defence projects in the UK and suggested that sector-specific defence inflation was a major cause. Hove and Lillekvelland (2017) discussed why inflation tends to be higher in the defence sector than in other sectors. They suggested that one reason was that the armed forces use a combination of input factors of production with a higher price growth than those of the general economy. Furthermore, productivity growth can be lower in the armed forces than in the general economy, for example, due to the need for a relatively large workforce to operate the advanced equipment.

Other projects fail completely, such as the Norwegian contract for NH90 helicopters (Olsen 2022). The British Army's Ajax programme is running more than ten years late (Brooke-Holland 2023). Powell (2023) suggested that a critical reason for the problems that large-

scale defence projects often encounter is the tendency for extensive modifications in the design phase after budget approval - coupled with a desire to innovate and customise.

Similar challenges exist in other sectors. Numerous studies from the transport sector (Odeck and Welde 2021) and ICT (Flyvbjerg and Budzier 2011) have documented that cost overruns and delays are widespread outside the defence sector.

However, despite many defence projects experiencing problems during their delivery phase, they may still be regarded as successful from a long-term strategic perspective. Many defence capabilities have very long life spans compared to other government assets. The F-16 fighter jet, for example, was first introduced in 1978, and over 2,800 aircraft are still in use by over 20 countries (Armstrong 2023). The M1 Abrams tank, currently in service with the US Army and other nations, initially faced significant issues during its development and testing phase. Reliability problems and design flaws plagued early prototypes. However, the US Army continued to support the project, which led to significant improvements and eventual success. Today, the M1 Abrams is one of the most formidable battle tanks in the world. Initial delays and overruns may thus be irrelevant to long-term strategic success (Shenhar et al. 2001).

Lack of learning is perhaps the main reason for the consistent underperformance of projects. Unless the armed forces of NATO countries can establish systems for learning within and between projects, we risk repeating past mistakes and delivering less value and defence capability for the planned increases in defence expenditure and investment. Although broad ex-ante evaluation models to support decision-making are relatively common, ex-post evaluation of completed projects is rare. Volden and Welde (2022) argued that there is a lack of systematic ex-post evaluation of public projects for learning purposes. There is a need to bridge the gap between what we think projects will achieve in terms of effectiveness and societal impacts and actual project performance. Therefore, this paper presents an ex-post

evaluation, first published in Welde et al. (2023) as part of the Concept Research Programme's[1] evaluation efforts, of a defence project – the acquisition of the Norwegian Navy's HNoMS[2] Maud (hereafter referred to as Maud) for the Royal Norwegian Navy. The paper's primary purpose is to provide lessons learned that could be useful in future projects and defence acquisitions. We do this by investigating different perspectives of success, illustrated by the evaluation of Maud. The paper aims to answer the following research questions:

1. How did this project perform in terms of operational, tactical, and strategic success using a goal-oriented evaluation methodology?
2. What lessons can be learned from the project to ensure successful appraisal, planning and implementation of future defence projects?

We first discuss what constitutes a successful defence project, and we argue that ex-post evaluation should play a crucial role in improving the performance of investment projects in armed forces worldwide. We then report the results from a recent evaluation of a project carried out by the Norwegian Defence Materiel Agency on behalf of the Norwegian Navy. Finally, we discuss the implications of our findings relevant to the evaluated project and future defence projects.

Ex-post evaluations of defence projects are rare, possibly due to the sensitive nature of these projects or a general lack of structured evaluation in project management. By examining the acquisition of Maud, this paper seeks to contribute to the field by offering insights that may support more effective appraisal, planning, and implementation of future projects.

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[1] https://www.ntnu.edu/concept

[2] His Norwegian Majesty's Ship

2. Measuring Project Success

Project success is a subject that can be both ambiguous and multidimensional. Its definition and measurement remain contentious, and it lacks consensus (Ika 2009).

Traditionally, the project management literature focused on the classic iron triangle of time, cost and quality when assessing project success (Atkinson 1999). However, narrow and short-term perspectives may be inadequate for government projects to realise value for various stakeholders and to achieve multiple purposes. Today, most scholars agree that project success is multidimensional. Therefore, the assessment of success should include dimensions such as user benefits, distributional impacts, sustainability, long-term impacts, and, of course, value for money (Shenhar et al. 2001; Joslin and Müller 2016; Ika and Pinto 2022). Samset (2010) argued that project success has several dimensions, from the immediate project, through user benefits, and to broader and longer-term societal impacts. Similarly, Williams (2022) suggested that the most basic level of success is tactical project management efficiency success, while various strategic success criteria cover longer-term aspects. This could be illustrated as in Figure 1.

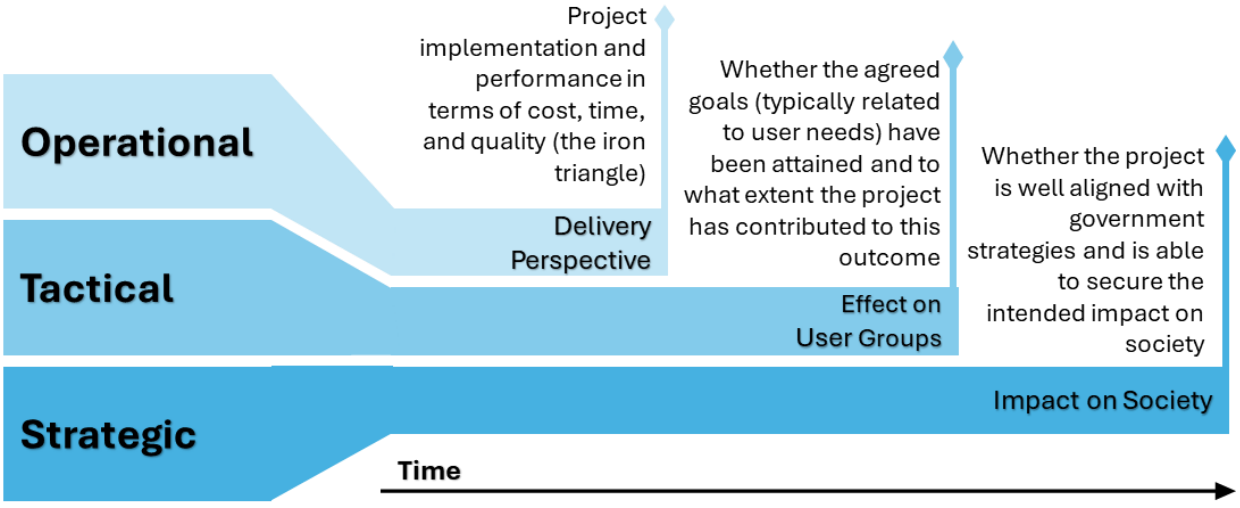

Figure 1: Different measures of success (reflecting the three levels of success as discussed in Samset (2010))

From a military perspective, the multidimensional view of success should be familiar. Strategy wins wars. Tactics win battles. Battles can be lost, but the war can still be won. The US Army uses three perspectives on warfare: strategic, operational and tactical. The strategic level involves national (or multinational) guidance, policy and resources to achieve long-term objectives. The operational level involves the planning and delivery of campaigns and major operations to achieve concrete military objectives. The tactical level involves the planning and delivery of battles and engagements to achieve combat objectives (Harvey 2021). A famous historical example is the Allied raid on the French port of Dieppe in August 1942, which was regarded as a catastrophic blunder at the time. Of the more than 6,000, primarily Canadian, troops that landed, 60 per cent were killed, wounded or captured within 12 hours. However, historians have later regarded the raid as a tactical failure but a strategic success. The experience from the raid proved vital for the Allied landings in Italy in 1943 and Normandy in 1944 (Schreiner 1973). It furthermore led the Germans to transfer forces to France that otherwise could have been employed in North Africa or on the Eastern Front (Glantz and House 2015).

Both researchers and the popular press tend to focus on short-term measures of success, and delays and cost overruns often cause public outcry. Williams and Samset (2010) used two examples to illustrate why project success should also incorporate short-term tactical and long-term strategic objectives. One project was the University Hospital in Oslo, completed in 2000. It was a year behind schedule, faced considerable cost overruns, received negative newspaper reports and was subject to a public inquiry. Although the cost overruns were significant from a monetary perspective, they only amounted to a few months of the hospital's operational expenditure. Today, the hospital is ranked among the 30 best hospitals in the world (Newsweek 2024), and the problems during its delivery phase have long since been forgotten. The other example by Williams and Samset (2010), and perhaps more

relevant from a military perspective, is that of the Malangen torpedo battery in northern Norway. That project succeeded in operational (project management) terms but failed strategically. It was completed in 2001 within both budget and schedule. It was closed down one week later by a Parliamentary decision. The project would have benefited from a better front-end assessment of long-term needs. This would probably have revealed that technological development had rendered such fixed installations obsolete before project approval.

The examples above illustrate that assessing project success, and defence project success in particular, may be far from straightforward. Although short-term metrics such as cost and time are relevant, the long-term performance, strategic alignment, and contribution to the overall mission and objectives determine whether a project has been successful.

3. Data and Methodology

The research was driven by the overarching objective of determining what constitutes a successful defence project and identifying the lessons learned from the acquisition of Maud. These lessons are intended to guide future defence projects. The evaluation conducted in this research is summative, which means assessing the outcome after the project has been completed. However, it also serves a formative purpose by aiming to improve future projects by providing actionable insights.

The evaluation (Welde et al. 2023) was conducted four years after the project was completed, to ensure that the benefits had time to materialize. The evaluators used a combination of document reviews, project accounts, and interviews and conversations with key people in and around the project. It also included an on-site inspection of the vessel at Haakonsvern Naval Base outside the city of Bergen. This allowed for triangulation between various data sources and methods of analysis (quantitative and qualitative) to ensure validity and reliability.

The project management literature differentiates between project management success and product success. Project management success focuses on the project process, particularly achieving cost, time, and quality objectives. In contrast, product success pertains to the impact of the project's final deliverable (Baccarini 1999). Together, these two components constitute project success (project success = project management success + product success). Therefore, when assessing or evaluating project success, it is essential to consider both perspectives. The evaluation model reflects this approach, incorporating operational (project management success), tactical, and strategic perspectives (product success). The evaluation was based on a six-criteria evaluation framework inspired by a model first developed by the OECD Development Assistance Committee (DAC), originally intended for use in international development assistance but now used widely across the public and private sectors (OECD 2019). A goal-oriented methodology maps actual outcomes with the goals formulated in the projects' business cases. The success levels and associated evaluation criteria are formulated in Table 1. For more information about the evaluation model and how the criteria should be operationalized in each case, see Volden (2018) or Volden and Welde (2022).

Table 1: Definitions of the six evaluation criteria.

Level of success	Evaluation criteria	Definition
Operational	Efficiency	Project implementation and performance in terms of cost, time, and quality.
Tactical	Effectiveness	Whether the agreed goals (typically for users) have been attained and to what extent the project has contributed to this outcome.
Strategic	Relevance	A project is relevant if there is a need for what the project delivers. Project relevance is assessed in relation to national political priorities and stakeholders' preferences.
	Sustainability	A project is sustainable if its benefits are likely to persist throughout its lifetime. The total impacts (financial, environmental, and social) should be acceptable in the long run.
	Other impacts	This includes all consequences beyond the agreed outcome that can be attributed to the project's result, positive and negative, short-term and long-term, for different stakeholders.
	Benefit-cost efficiency	Total willingness to pay for what the project delivers in relation to cost, as measured by the cost-benefit analysis.

Interviews with key persons were a central part of the data collection. Executing systematic sampling presented a challenge due to the project's prolonged timeline and the changes within and surrounding the project organisation. Instead, we adopted an approach aligned with Patton's (2002) concept of selecting informants from whom the researcher can learn about matters of central importance. Given the project's extensive duration and the scarcity of individuals engaged throughout its entire lifecycle, we focused on interviewing individuals who had participated in various project stages and represented different stakeholders. To identify interviewees, we relied on official records of individuals and agencies involved in the project and our network of contacts within the defence sector. Crucially, we obtained a mandate and support from the Ministry of Defence to evaluate the project, which also facilitated the identification of key personnel for interviews. This process was further enhanced by a 'snowball effect', whereby initial interviewees recommended additional individuals to include in the study. The interviews took place between February and May 2023. They were semi-structured – based on a generic interview guide as a starting point but with the freedom to explore any other issues that arose. The guide was structured in three parts. The first section covered the interviewee's background and connection to the project. The second part delved deeper into the project, including its history, goals, objectives and delivery process. The third section addressed the project's success based on the established evaluation criteria (operational, tactical and strategic perspectives). The informants' relationship to the project, the duration of the interviews and the length of transcripts are set out in Table 2.

Table 2: Interviews used in the evaluation

Role in the project	Interview length	Transcription (no. of words)
Former Chief of Defence, Norwegian Armed Forces	60 min.	3,555
Researchers (3) (Norwegian Naval Academy)	60 min.	2,900
Project owner	60 min.	6,622
Project organisation	90 min.	5,043
Project organisation	90 min.	5,520
Project organisation	90 min.	3,412
Project organisation	90 min.	6,620
User	90 min.	6,394
User	60 min.	4,361
Total	**11h 30 min.**	**44,427**

The analytical approach used in this study is similar to a case study analysis, as we conducted an in-depth examination of a single case (Maud). This approach can be understood as a deductive thematic analysis, whereby the predefined themes (based on the evaluation framework) structure the coding process. The focus was on interpreting and organising the data (from records, documents, and interviews) according to these established categories.

As with other projects with long life spans, the assessment of success relies on assumptions of future events and developments. In evaluation, there is a balance between access to information and knowledge of long-term impacts. Ideally, projects should be evaluated after they have been operational for a relatively long period, but this will come at the expense of access to information and informants. While some project metrics, such as time and cost, can be measured with high detail, others rely on a more qualitative approach. The evaluation team's assessments were unavoidably subjective but meticulously explained and documented. Therefore, the sum of data gave a comprehensive picture of project performance and success.

4. The Project's Background and Goals

Norway (pop. 5.5 million) guards NATO's northern flank. Until the East European states and then recently, Finland joined the alliance, Norway was the only NATO country with a border with Russia. Norway has the world's third longest coastline (app. 58,000 km), and it is perhaps not surprising that shipping is an important industry. With the world's seventh-biggest fleet ranked by the number of vessels and the tenth-biggest by tonnage (UNCTAD 2023), it is a maritime economic superpower. The same cannot be said of its naval capabilities. Despite the significant importance of the Barents Sea for Russia's Bastion Defence Strategy, the Norwegian Navy provides no match for its eastern neighbour. It comprises four frigates, six corvettes, six submarines, 15 Coast Guard vessels, six mine sweepers and a handful of assorted logistics and support vessels (Forsvaret 2023). Like most small countries, it relies on NATO, and specifically its closest allies, the USA and the UK, for its security. However, because of its geographical location, its reliance on NATO is more significant than most other small European countries.

This was the backdrop at the NATO summit in Prague in 2002, where the Alliance adopted the so-called Prague Capabilities Commitment (PCC). The decision stated, among other things, that the nations in NATO decided to improve their capabilities in deployable logistics support. Naval logistics are crucial for naval forces to operate away from home bases for longer periods (Russia's unprovoked invasion of Ukraine has since further emphasised the vital importance of logistics in warfare (Rowley 2022)). In 2002, the Norwegian Navy acquired five new frigates, which would be confined to coastal duties without logistical support that could make them more expeditionary. Therefore, a combination of NATO's and the Navy's needs translated into a desire to replace the two smaller supply vessels acquired in the 1980s. The supereminent objective of the project was to acquire a logistics and support capacity that would increase the endurance, flexibility and mobility of Norwegian naval

forces, also referred to as the Norwegian Task Group (NorTG). After considering different vessel alternatives, the Norwegian Parliament finally approved the project in 2009 with a maximum budget of EUR 180 million (including a contingency of EUR 25 million).

All projects must have explicit goals, and Norwegian government projects must have operational, tactical and strategic goals. In the business case drafted by the Norwegian Defence Materiel Agency, the goals were as described in Figure 2.

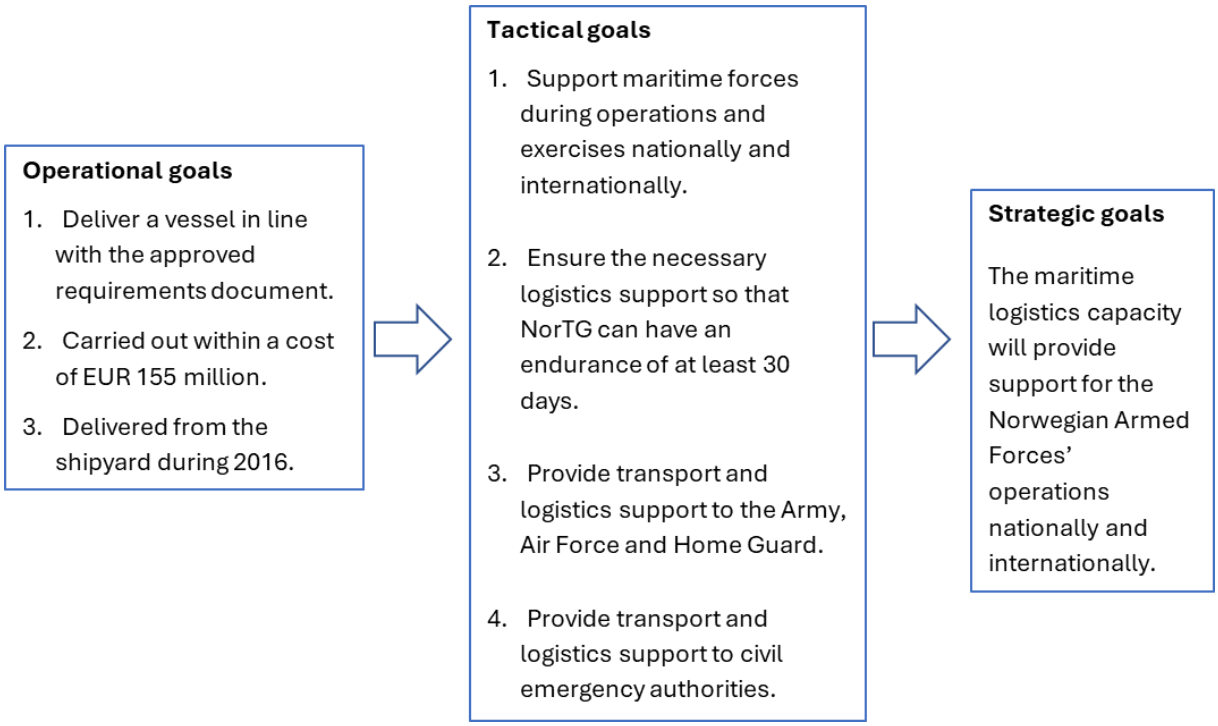

Figure 2: The project's formulated goals

As is often the case with large projects, the goals become more ambitious and perhaps fuzzier as they progress along the result chain. The goals may seem reasonable at first, but the theory of change (ToC) is weak. A ToC describes how change is assumed through intervention in a prevailing situation (UNDG 2018). The connection between the goals on different levels is not necessarily straightforward, including what prerequisites are necessary for goals on one level to lead to goal achievement on the next. Furthermore, the goals do not mention the vessel's intended contribution to NATO, an essential part of the project's background.

However, at least the Navy had goals and ambitions beyond delivering the vessel; conducting any meaningful project evaluation would be difficult without goals. The goals are the project's success criteria and the starting point for any ex-post evaluation.

Figure 3: HNoMS Maud is the Norwegian Navy's largest vessel, with a length of 183 metres and a width of 26 metres. In addition to delivering supplies to naval vessels, Maud has its own hospital. Photo: The Norwegian Armed Forces

5. Evaluation results

5.1 Operational success

The operational success assessment concerns the project's delivery or, more specifically, whether the project organisation has efficiently converted resources into results.

Delivery two years later than agreed in the contract

The construction of Maud was put out to tender twice. During the first round, none of the bidders could deliver the desired vessel within the set price range. Consequently, the list of requirements was revised to achieve a balance between quality and cost. The final tender, held in 2013, was awarded to the South Korean shipyard Daewoo Shipbuilding & Marine

Engineering (DSME). The contract was signed the same year, with the expected delivery set for September 2016.

A project office was established in South Korea to manage the delivery. The significant geographical separation and differing time zones between the project owner and the temporary project office created delivery-related challenges, leading to an increased workload for the project staff. Collaboration with the shipyard was generally good, but cultural differences, such as Korea's hierarchical decision-making structure versus the Norwegian horizontal and informal approach, led to difficulties. Language barriers further compounded these issues (Løhre et al. 2021). Preparatory efforts, including seminars and consultations with experts familiar with South Korean projects, were undertaken to mitigate these challenges.

The project operated under a traditional matrix structure, primarily drawing resources from the project owner's organisation. The project had a high turnover of project managers (five), but internal recruitment helped to maintain continuity. However, delivery progress was disrupted by external factors. Shortly after signing the contract, DSME encountered severe financial problems due to the oil crisis of 2014, rendering the company technically bankrupt. Adding to these difficulties, DSME's senior management faced corruption charges, leading to lengthy decision-making processes and loss of skilled personnel as their managing director was arrested and accused of embezzlement of US$ 4.69 billion and the company's finance director was also sentenced to six years in prison for the same circumstances (Dong-chan 2017). These financial and managerial setbacks significantly delayed progress.

The original handover date of September 2016 was not met, and the first sea test was carried out at the end of 2017 – approximately one year late. The vessel finally arrived in Norway in 2019. However, several faults and deficiencies were discovered upon delivery to the

Norwegian Navy. In December 2019, Maud was temporarily banned from sailing due to class deviation concerns. These issues, combined with a lack of a maintenance history from DSME, contributed to further delays before the vessel could be put into operational service.

After an extended period of correcting warranty errors, Maud's technical commissioning started in August 2020. However, additional defects were discovered in the Replenishment-at-Sea (RAS) rig two months later, causing further operational interruptions. Despite these setbacks, Maud eventually sailed for the first time as part of NATO's standing maritime forces (SNMG1) in the autumn of 2021. However, the vessel continued to experience technical problems, including issues with the IPMS (Integrated Platform Management System), requiring dock repairs in England. Following these repairs, Maud resumed her role in SNMG1 and redeployed as part of SNMG1 both a second and a third time in 2022 and 2024.

In summary, while the contract stipulated delivery in September 2016, Maud was delayed by over two years, with the Navy taking responsibility in 2019. The financial instability and managerial corruption at DSME, compounded by maintenance and technical challenges, profoundly impacted the project and its timeline adherence. Since then, considerable work has been required to meet the desired quality and standards. Thus, from a product perspective, the delay was even longer, as the vessel was not fully operational until 2020 and continued to face challenges in achieving full operational capacity. This illustrates that project delivery and project management success may be ambiguous and multi-dimensional. There can be discrepancies between delivery success regarding handover and success regarding functional readiness of the delivered product.

Within budget due to a generous exchange rate compensation mechanism

According to the project accounts, the total cost of the vessel is NOK 2.3 billion in 2023 prices, equivalent to some EUR 200 million according to today's exchange rate. This is more than 40 per cent higher than the approved budget at the time of the investment decision, measured in nominal values. However, meaningful comparisons of final costs to budget must rely on indexing budgets and costs to a common year of comparison. In addition, defence projects are compensated for changes in exchange rates. This may appear as a "generous" mechanism, but as a country that receives massive annual tax revenues from oil and gas exports, a depreciation against foreign currencies will increase export revenues. Had defence projects not been compensated for exchange rate fluctuations, the projects would need to factor in this risk in their cost estimates. Figure 4 illustrates that cost performance varies according to the index used to adjust the budget.

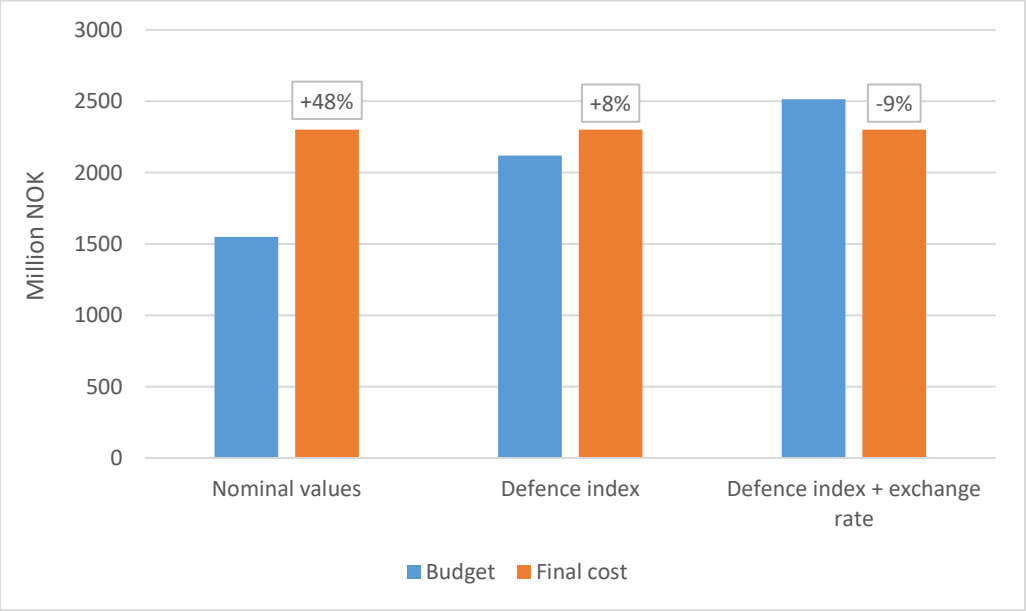

Figure 4: Final cost of Maud compared to budget

If we do not adjust for inflation, the final cost is 48 per cent above budget. If we adjust the budget according to the defence index (roughly similar to the consumer price index), the final cost is 8 per cent over budget. On the other hand, if we adjust the budget for both the changes

in the defence index and the change in the exchange rate to the US dollar, the final cost is 9 per cent lower than the maximum budget.

This illustrates, as other scholars have argued, that assessments of cost performance rely heavily not just on the point of comparison but also on the adjustment of budgets and annual expenditure through various indexes (Siemiatycki 2009; Invernizzi et al. 2017; Chapman 2021; Welde and Klakegg 2022).

In the years following the signing of the contract, the Norwegian krone weakened significantly against the USD. From June 2013 to June 2018, the krone weakened against the dollar from NOK 5.8 to 8.0 per dollar. Due to far higher currency exposure in the project than first assumed, the depreciation of the krone had significant economic consequences. The project was compensated for a total disagio of NOK 430 million.

Although the exchange rate was crucial in explaining budget compliance, it should also be noted that the project exercised strict control and good cost control throughout. Risks were updated along the way, and the project followed a change regime and documented all decisions, changes and agreements with the yard.

A well-functioning vessel, despite cuts to the original requirement specifications

The vessel was delivered from the shipyard over two years late but was not formally operational until 2021. From a delivery perspective, the quality was thus not as specified.

According to the business case prepared in 2009, quality was the highest priority in managing the project. However, after the first call for tenders, significant cuts were made to the list of requirements to strike a balance between cost and quality. The vessel, thus, has reduced performance relative to the aspirations in the business case.

The Navy nevertheless considers the quality of the vessel to be good. It is capable of solving the tasks it is intended to solve. However, several informants point out that certain aspects weaken the quality in the short term. These include, for example, poor material choices by the shipyard that now have been replaced, maintenance backlogs, and problems with various systems on board, such as the RAS rig and the Integrated Platform Management System (IPMS).

The IPMS has been a continuous challenge. IPMS is a sophisticated naval vessel control system that automates tasks that would otherwise have been done manually. It aims to maximise human-machine efficiency to minimise human workload and the possibility of error. A supplementary benefit of a working IPMS is reducing the ship crew and placing fewer lives at risk (MacLeod and Smeall 2001).

The UK Royal Navy has also experienced challenges with the IPMS systems on board their logistics vessels, which are built at the same shipyard and have the same IPMS supplier. However, the British have a staffing concept based on a relatively large crew and a relatively low degree of automation. This means they are not as dependent on complex and advanced IPMS as Maud, which is based on a small crew and a high degree of automation. If the IPMS on Maud does not work, there will not be a larger crew – it will just be a more complicated ship to operate. The IPMS issues remain unsolved, and replacing it is a potential worst-case scenario.

Apart from problems with the IPMS system, the Norwegian Navy is satisfied with the vessel. The vessel's design is described as very good, especially considering the number of capacities it has compared to similar ships in the Royal Navy. The vessel has many areas of use and can be used in various mission types.

5.2 Tactical success

Tactical success concerns the extent to which the project's goals have been, or are likely to be, achieved as a consequence of the construction and commissioning of the vessel.

A useful resource for operations nationally and internationally

Replenishing fuel for allied forces is considered one of Maud's key capabilities. This is accomplished through its RAS rigs. To ensure the efficient transfer of fuel, material and ammunition at sea, vessels must be dimensioned to make it possible to lie next to each other at relatively high speed without significant risk of damage to the vessels. This risk is affected by the water currents around a ship and the ship's hydrodynamic properties and depends on the size of the vessels in relation to each other. Maud is constructed according to NATO standards and is therefore compatible with the other vessels in the alliance. This makes transferring fuel, material and ammunition easier than if the vessels were not sized according to the same standard.

In 2021, 2022 and 2024, Maud deployed as part of NATO's standing maritime force, SNMG1, ensuring that the Maritime Group can maintain operational readiness and endurance without going to port. National and international forces are satisfied with how Maud operates. One of the informants stated that Norwegian and foreign forces prefer to get fuel supplies from Maud because of the crew's professionalism and the RAS rigs' efficiency. There is more demand for the vessel than it can meet. Initially, Maud had one crew, allowing for around 130 sailing days a year. The crew has since doubled, so the vessel can now sail for around 270 days.

A prerequisite for the Navy's long-term endurance

Informants assess that Maud can provide the necessary logistical support to ensure an endurance of 30 days. Maud has considerable capacity to store and transfer fuel. It can also

transport large quantities of food, materiel, ammunition and personnel to and from other vessels.

Maud is also designed to transport two helicopters and maintain them on board. Helicopters enable the reception and delivery of material, personnel, and other necessities, even in a fast-moving battle group. However, after the failure to acquire NH90 helicopters, neither the frigates nor Maud have helicopters. Without helicopters, the vessel's full potential is not fully met.

A potentially useful capacity for all branches of the Armed Forces

The vessel can support other branches of the Armed Forces, but not to the same extent as originally intended. After the first call for tenders, it was decided that cuts had to be made in the list of requirements. There is, for example, room for fewer people and less materiel than initially planned. Nevertheless, the loading capacity is large, and Maud can transport up to 60 containers on deck. It has a loading crane, which can lift containers on and off the deck.

Able to support civil emergency authorities

So far, Maud has not been used for civilian purposes, but this is possible. For example, the fully equipped hospital has an operating room, an isolation unit with negative and positive pressure, a recovery room, and several other facilities necessary to run a functional hospital. Preparations are also being made for an MRI machine on board. Maud can provide transport and logistics support for patients in a humanitarian crisis. However, this requires that the crisis is close enough to the coast for it to be appropriate to arrive by sea.

5.3 Strategic success

A project's strategic success depends on whether its results are relevant to the needs of its primary users today and will deliver benefits in the future. It should be aligned with the strategic purpose of the client organisation, and any side effects should be positive.

In line with political priorities for Norwegian security and defence

The Norwegian Armed Forces' main task is safeguarding Norwegian territorial integrity and sovereignty. A Navy with relevant organic logistics capacities contributes to this. In addition to the primary tasks within war prevention and deterrence, the Norwegian Armed Forces contribute to social security and other societal tasks within the total defence concept, based on mutual civil-military support and cooperation in the entire spectrum of crises. Civil society must contribute to the Armed Forces and vice versa when necessary. Maud represents a significant capacity that can support civil society when necessary. This is part of the Norwegian Total Defence concept, which builds on combined military defence efforts and broad civil emergency preparedness (Norwegian Ministry of Defence and Norwegian Ministry of Justice and Public Security 2018).

However, the Norwegian Navy is small. Therefore, the limited direct need for Maud in a national context raises the question of whether other defence spending, such as anti-aircraft defence or replenishing depleted stocks of ammunition and materiel, would have been more relevant.

Future relevance depends on continued commitment to offshore operations

The sustained benefit of Maud over time depends on many factors. It involves not only the vessel's day-to-day operations but also broader strategic considerations about the future of the Navy. Over time, the Navy's need for Maud will depend on two factors: i) whether the current frigates and coastal corvettes will be replaced by a new vessel class, and ii) whether the Navy will have the ability and willingness to operate the vessel in the future.

The original lifecycle cost estimate for the project assumed a much lower level of activity than is currently planned, and there is only one crew compared to today's two. Nevertheless, informants largely agree that the vessel has sufficient funding to sustain this increased

activity level. The future relevance of the vessel to the Norwegian Navy depends on a continued commitment to offshore operations (frigates), which is likely but not guaranteed. A shift toward only coastal operations would decrease the need for Maud. In other words, the future for Maud seems positive but will hinge on the long-term surface structure of the Navy.

Valuable lessons for future procurement from international suppliers

Maud represents a new element in the Norwegian Navy that has provided a development of expertise that enables it to contribute to international battlegroups differently than through frigates alone. Additionally, the challenges in the construction phase in South Korea may have led to a possibly unintended positive impact. The Navy has gained valuable lessons in large procurements from international suppliers. Most material procurement in the Armed Forces is from international suppliers. The challenges in South Korea have emphasised the importance of being prepared for and dealing with cultural differences.

Value for society primarily through the international dimension

Project value is traditionally mostly measured through cost-benefit analysis (CBA). However, CBA of defence projects is demanding as the benefits are difficult to quantify and value. A simple cost-effectiveness comparison of the costs of recent logistics vessels acquired for the US and UK navies indicates that the cost of Maud appears relatively low. Moreover, given that the Norwegian Navy needs to resupply fuel and supplies at sea, it is difficult to imagine any other way than a purpose-built logistics vessel.

From a broader perspective of value, for example, such as the one proposed by Black et al. (2021), Maud may have a role in 1) protecting the nation’s people, 2) providing insurance against an uncertain future, 3) contributing to global influence and international security. Therefore, it is through the international dimension that Maud primarily delivers value to

society. Maud probably represents a politically and financially acceptable cost for contributing to an alliance on which Norway depends.

6. Concluding remarks

In this paper, we have used a broad evaluation framework to illustrate the different dimensions of project success using the Norwegian Navy's logistics and supply vessel as a case example.

The evaluation revealed that while the project was delivered late but within budget (largely due to a generous exchange rate compensation mechanism), its long-term societal value depends on broader factors, such as fleet composition, operational roles, and strategic relevance. Our findings demonstrate the complexity of measuring success in defence projects, where immediate outcomes (project management success) must be assessed alongside their varied tactical, strategic, and societal impacts (product success).

Thus, success in defence projects is ultimately in the eye of the beholder and often hinges on more than just the successful delivery of a product. Tactical and strategic success for a vessel such as Maud relies on factors such as fleet composition, operational role within NATO, and long-term adaptability to evolving defence needs. While the project initially faced challenges during the troubled delivery, its subsequent international deployments have contributed to a perception of success. However, given that defence assets are designed for decades of use, we will not know for sure how successful the project has been until it reaches the end of its lifespan.- This illustrates one of the dilemmas of evaluation. The suitable time for evaluating a project is a trade-off between access to information on its delivery and knowledge of long-term impacts.

The project also highlights Norway's reliance on NATO's collective security and the importance of active contributions to alliance operations. The vessel's international

deployments underscore its strategic role in strengthening Norway's NATO profile and fulfilling its defence commitments. However, the project's success remains uncertain, as its long-term relevance depends on future defence strategies and priorities.

From this evaluation, we identified several key lessons for future defence acquisitions:

- **First**, using a theory of change to illustrate the logical chain from delivery to broader societal impacts (the programme theory) helps assess the realism of intended effects. Several prerequisites are necessary for achieving user effects and societal impacts. We recommend testing the logic by defining and visualising the results chain and highlighting the prerequisites for realising goals at the next level.
- **Second**, Maud had several goals that, in retrospect, may seem obvious but that were not addressed in the business case. For example, several informants point to the NATO summit in 2002 as decisive for the project coming on the agenda. However, none of the formulated goals were directly linked to NATO operations. So far, using Maud as part of NATO's standing maritime forces has been more important than in a national context. The project's business case should have better described the (strategic) NATO perspective.
- **Third**, conceptual appraisals in the defence sector must consider alternative ways of strengthening military capabilities. Here, the appraisal of what was to become the Maud acquisition only examined variants of a single concept.
- **Fourth**, cross-cultural considerations are crucial in international projects. In many areas, this project was a pioneer project in the Norwegian Armed Forces, as the first significant project to acquire materiel from South Korea. It experienced many intercultural and linguistic challenges. Future projects should acknowledge the importance of people and culture for project success.

- **Fifth**, from a project owner's perspective, payment profiles should reflect project risks with terms that incentivise timely, high-quality delivery. High-risk procurements should have terms of settlement that give the supplier an incentive to deliver at the right time and with the right quality.

The recommendations above follow a traditional timeline in large projects. Numbers 1-3 relate to the front end—the planning and appraisal stage—while numbers 4-5 relate to the delivery phase. This reflects the importance of actions taken before formal project approval and delivery for project success (Williams et al. 2019).

Although ex-post evaluations of defence projects are rare, they are vital for transparency, accountability, and organisational learning. As military investments increase in response to global instability, the risk of repeating past mistakes remains. Strengthening evaluation efforts can provide valuable insights, helping armed forces improve the planning and execution of future projects. Ex-post evaluations are not merely beneficial, but crucial for ensuring long-term success in defence initiatives. However, to gain broader learning from lessons, meta-evaluations are needed. Synthesising findings across multiple projects using consistent frameworks could allow us to draw more robust conclusions that are valid across projects (Volden and Welde 2022). We, therefore, urge defence research communities and armed forces to strengthen evaluation efforts to improve the planning and delivery of future projects.

References

Alozious, J. 2021. “NATO’s Two Percent Guideline: A Demand for Military Expenditure Perspective.” *Defence and Peace Economics* 3 (4): 475-488.

Armstrong, M. 2023. “The Countries That Use F-16 Fighter Jets”. Statista. Accessed 7 July 2023. https://www.statista.com/chart/30069/global-f16-fighter-jet-inventories/

Atkinson, R. 1999. “Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria.” *International Journal of Project Management* 17 (6): 337-342.

Baccarini, D. 1999. “The logical framework method for defining project success.” *Project Management Journal* 30 (4): 25-32.

Black, J., R. Flint, R., Harris, K. Galai, P. Paille, F. Quimbre and J. Plumridge. 2021. “Understanding the Value of Defence. Towards a Defence Value Proposition for the UK.” Accessed 2 January, 2025. https://www.rand.org/pubs/research_reports/RRA529-1.html

Brooke-Holland, L. 2023. “Ajax: The British Army's troubled armoured vehicle programme.” House of Commons Library. Accessed 7 July 2023. https://researchbriefings.files.parliament.uk/documents/CBP-9764/CBP-9764.pdf

Chapman, P. 2021. “Inflation Shopping: How Transport Infrastructure Project Cost Evaluation Is Affected by Choice of Inflation Index. *Engineering Project Organization Journal* 10 (2): doi: 10.25219/epoj.2021.00113

De Rezende, L.B., J. Denicol, P. Blackwell and H. Kimura. 2022. “The main project complexity factors and their interdependencies in defence projects.” *Project Leadership and Society* 3: 100050.

Dong-chan, J. 2017. “Supreme court sentences ex-DSME chief to 9 years in prison.” Accessed 26 July, 2023. http://www.koreatimes.co.kr/www/tech/2020/11/693_241385.html

Flyvbjerg, B., and A. Budzier. 2011. “Why your IT project may be riskier than you think.” *Harvard Business Review* 89 (9): 23–25.

Forsvaret. 2023. “The Royal Norwegian Navy”. Accessed 24 July 2023. https://www.forsvaret.no/en/organisation/navy

Glantz, D.M. and J.M. House. 2015. *When Titans Clashed How the Red Army Stopped Hitler*. Lawrence, KS: University Press of Kansas.

Hambleton, K., I. Holder and D. Kirkpatrick. 2013. Ten chronic challenges in UK defence acquisition. *Defence Studies*, 13(3), 361-371.

Hartley, K. 2016. “UK defence inflation and cost escalation.” *Defence and Peace Economics* 27 (2): 184-207.

Harvey, A.S. 2021. “The Levels of War as Levels of Analysis.” *Military Review* November-December: 75-81.

Hofbauer, J., G. Sanders, J. Ellman, and D. Morrow. 2011. “Cost and Time Overruns for Major Defense Acquisition Programs.” Washington DC: Center for Strategic and International Studies.

Hove, K.H. and T. Lillekvelland. 2017. *On growing operating costs in the Armed Forces – A refinement of concepts and estimates of growth in real output unit costs (GROUC) in the Norwegian Armed Forces*. FFI-rapport 17/17020.

Ika, L. A. 2009. Project success as a topic in project management journals. *Project management journal* 40 (4): 6-19.

Ika, L. and J. Pinto. 2022. “The “re-meaning” of project success: Updating and recalibrating for a modern project management.” *International Journal of Project Management* 40 (7): 835-848.

Invernizzi, D.C., G. Locatelli, and N.J. Brookes. 2017. “Cost overruns – helping to define what they really mean.” *Proceedings of the ICE - Civil Engineering* 171 (2): 85-90.

Johnson, J.C. 2018. “Cost Overruns, Schedule Slips: The Norm, Not the Exception.” National Defence. Accessed 27 July 2023. https://www.nationaldefensemagazine.org/articles/2018/5/1/cost-overruns-schedule-slips-the-norm-not-the-exception

Joslin, R. and R. Müller. 2016. “The relationship between project governance and project success.” *International Journal of Project Management*, 34 (4): 613-626.

MacLeod, I. and D. Smeall. 2001. “Integrated platform management system design for future naval warships.” In: *People in Control: Human factors in control room design*, edited by Jan Noyes and Matthew Bransby (Chapter 18). The Institution of Engineering and Technology.

Markowski, S. and P. Hall. 1997. “Challenges of defence procurement.”. *Defence and Peace Economics* 9: 3-37.

NATO. 2024. “Defence Expenditure of NATO Countries (2014-2024).” Accessed 29 October, 202. https://www.nato.int/cps/en/natohq/news_226465.htm

Newsweek. 2024. “World’s Best Hospitals.” Accessed 29 October 2024. https://www.newsweek.com/rankings/worlds-best-hospitals-2024

Norwegian Ministry of Defence and Norwegian Ministry of Justice and Public Security. 2018. “Support and Cooperation. A description of the total defence in Norway.” Oslo: Norwegian Government Security and Service Organisation.

Odeck, J. and M. Welde. 2021. “Cost overruns of transportation infrastructure projects.” In: *International Encyclopedia of Transportation*, edited by Roger Vickerman, 483-489. UK: Elsevier.

OECD. 2019. “Better Criteria for Better Evaluation. Revised Evaluation Criteria Definitions and Principles for Use.” OECD Publishing, Paris, https://doi.org/10.1787/15a9c26b-en.

Olsen, J.M. 2022. “Norway ends contract for NH90 helicopters, wants full refund.” Defense News. Accessed 7 July 2023. https://www.defensenews.com/industry/2022/06/10/norway-ends-contract-for-nh90-helicopters-wants-full-refund/

Patton, M.Q. 2002. “Qualitative research and evaluation methods”. Thousand Oaks. Cal.: Sage Publications, 4.

Powell, M. 2023. “Big defence projects are usually late and over budget – here’s what we can learn from the build-up to WW2.” The Conversation. Accessed 7 July 2023. https://theconversation.com/big-defence-projects-are-usually-late-and-over-budget-heres-what-we-can-learn-from-the-build-up-to-ww2-198608

Rowley, J. 2022. “Naval Logistics: Still A Compelling Need.” Naval News. Accessed 25 July 2023. https://www.navalnews.com/naval-news/2022/04/naval-logistics-still-a-compelling-need/

Roberts, B., T. Mazzuchi and S. Sarkani. 2016. “Engineered Resilience for Complex Systems as a Predictor for Cost Overruns.” *Systems Engineering* 19 (2): 111-132.

Samset, K. 2010. *Early Project Appraisal: Making the Initial Choices*. London: Palgrave Macmillan.

Siemiatycki, M. 2009. “Academics and auditors. comparing perspectives on transportation project cost overruns.” *Journal of Planning Education and Research* 29 (2): 142-156.

Shenhar, A., D. Dvir, O. Levy and A.C. Maltz. 2001. “Project Success: A Multidimensional Strategic Concept.” *Long Range Planning* 34 (6): 699-725.

Schreiner Jr., C.W. 1973. “THE DIEPPE RAID: ITS ORIGINS, AIMS, AND RESULTS.” *Naval War College Review* 25 (5): 83-97.

Tian, N., D. Lopes da Silva, L. Béraud-Sudreau, X. Liang, L. Scarazzato and A. Assis. 2023. “Developments in Military Expenditure and the Effects of the War in Ukraine.” *Defence and Peace Economics* 34 (5): 547-562.

UNCTAD. 2023. “Merchant fleet”. Accessed 29 October, 2024. https://hbs.unctad.org/merchant-fleet/

United Nations Development Group (UNDG). 2018. “Theory of Change. UNDAF Companion Guidance.” Accessed 26 July, 2023. https://unsdg.un.org/sites/default/files/UNDG-UNDAF-Companion-Pieces-7-Theory-of-Change.pdf

Volden, G.H. 2018. “Public project success as seen in a broad perspective. Lessons from a meta-evaluation of 20 infrastructure projects in Norway.” *Evaluation and Program Planning* 69: 109-117.

Volden, G.H. and M. Welde. 2022. “Public project success? Measuring the nuances of success through ex post evaluation.” *International Journal of Project Management* 40 (6): 703-714.

Welde, M. and O.J. Klakegg. 2022. Avoiding Cost Overrun Through Stochastic Cost Estimation and External Quality Assurance *IEEE Transactions on Engineering Management*, doi: 10.1109/TEM.2022.3173175.

Welde, M., G.H. Volden, A. Engebø, S. Gulichsen and F. Waage Prebensen. 2023. "Evaluering av Nytt logistikk- og støttefartøy (KNM Maud)." Trondheim: Norwegian University of Science and Technology.

Williams, T.M. 2022. "Project success." In: *The Front-End of Large Public Projects: Paradoxes and Ways Ahead,* edited by Terry Williams, Knut Samset, Gro Holst Volden,10-43. London/New York: Routledge.

Williams, T.M. and K. Samset. 2010. "Issues in Front-End Decision Making on Projects." *Project Management Journal* 41 (2): 38-49.

Williams, T.M., Hang Vo, K. Samset, and A. Edkins. 2019. "The front-end of projects: a systematic literature review and structuring." *Production Planning and Control* 30: 1137-1169.

Williams, T.M., K. Samset, and G.H. Volden. 2022. *The Front-end of Large Public Projects*. London/New York: Routledge.