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Improving value for money through better front-end management: An attempt to reduce costs and increase user benefits in the planning of a motorway project

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ABSTRACT

Low benefit-cost efficiency and cost escalation in transport projects is a challenge in many countries. If costs increase as projects are developed, and if decision-makers are unable to reject projects with a negative value for money, the result can be inefficient resource allocation and waste. In Norway, the government introduced a road reform in 2015 in which one of the key elements was the creation of a state-owned enterprise, Nye Veier AS (English trans. 'New Roads Ltd'), with responsibility for improving parts of the trunk road network through a portfolio of projects. The enterprise's main goal is to improve efficiency by reducing costs and increasing user benefits so that a larger proportion of the projects in its given portfolio have a positive net present value. This paper argues that project success depends heavily on choices made in the planning and design phase of the project before implementation. We use a motorway project on the southern coast of Norway as a case example of a project for which Nye Veier set out to improve efficiency through the development of a municipal sector plan that is necessary for final project approval before construction can start. Nye Veier introduced several efficiencyenhancing measures that could provide valuable lessons for other projects, but despite the use of innovative measures and systematically promoting efficiency, the motorway remains negative value for money. We conclude that it is difficult to turn an inefficient solution into an efficient project, especially if traffic levels are low, construction costs are high, and travel-time savings are limited. In this case the choice of a full-scale motorway project was already made by the government, although a 'do minimum' alternative would have been more efficient. The findings support the evidence that project selection is the most critical decision for benefit-cost efficiency, and that the potential for enhancing efficiency fades throughout the front-end phase.

1. Introduction

This paper explores the potential to improve a transport project's benefit-cost efficiency through efforts made in the design and planning phase of the project - the part of the front-end phase that follows project selection. Even if the academic literature has increasingly recognised the importance of front-end management for the success of projects, there is a lack of studies that have demonstrated the actions that project owners have taken during this crucial stage of project development. We use the example of a motorway project as a case study to examine whether it is possible to change a negative value for money to a positive value for money through improvements in the municipal planning process.

New and improved infrastructure can provide user benefits and lead to economic growth and development, locally and nationally. Better roads and railways reduce travel times for commuters and businesses, improve market access, and may lead to closer economic integration of regional economies. Governments around the world therefore spend large sums of money each year on new transport infrastructure. To gauge the economic merit of such infrastructure and to rank potential projects, most countries carry out cost-benefit analysis (CBA) prior to project selection. Transport planners and economists regard CBA as a useful tool in the ex-ante appraisal of projects due to its ability to aggregate benefits and costs into a single measure.

CBA has some weaknesses. It takes little account of distributional effects, and the consequences for the environment have little or no effect on value-for-money represented by the estimated net present value (NPV). Instead, investment decisions are often strongly influenced by political preferences (Gühneman et al., 2012). In Norway, with its

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mountainous physical geography, and low population density and traffic levels, which leads to a high proportion of road projects having a negative value for money, the political emphasis on CBA results has traditionally been low. The prominent centre-periphery dimension in Norwegian politics has led to the promotion of policies aimed at regional distribution and -development rather than economic efficiency. There is, however, a broad agreement that the CBA results at least give an indication of which projects should be implemented first. It is intuitively more sensible to carry out transport projects that provide higher levels of travel time savings and that lead to a reduction in the numbers of persons killed and seriously injured, rather than projects that do not provide any such effects. It may also make more sense to carry out projects where there are high traffic levels rather than low ones, and that the cost of implementation is not expected to be too high.

Despite the usefulness of CBA and its popularity among professionals, several studies have demonstrated that the net present value as estimated by the CBA has had varying impacts on actual project selection (Nilsson, 1991; Odeck, 1996, 2010; Fridstrøm and Elvik, 1997; Nellthorp and Mackie, 2000; Annema, 2013; Mouter, 2017). In Norway, the efficiency of selected road projects has been particularly poor. Eliasson et al. (2015) found that most of the projects in the Norwegian National Transport Plan for 2014–2023 had a negative NPV, and that a positive NPV did not increase the likelihood of a project being selected for implementation. In the current transport plan for the years 2018–2029, the NPV for the projects that were planned to start during the period was about minus EUR 16 billion. Halse and Fridstrøm (2019) showed that geographical factors may explain a substantial part of the variation in the benefit-cost ratio and the high proportion of projects with a negative value for money. There may also be a decreasing marginal benefit from road investment as 'the best' projects, i.e. the projects with the highest travel time savings and traffic safety effects, have already been realised. Compared to the large improvements that past transport investments delivered, the impacts of most projects today are marginal (Welde and Nyhus, 2019).

The purpose of this paper is not to study what political decisionmakers care about beyond the CBA, nor do we discuss why some countries have projects with lower benefit-cost efficiency, on average, than others. Instead we ask what project owners can do to improve benefit cost efficiency through efforts in the design and planning phase. The estimated poor value for money of Norwegian transport projects has been further worsened by a tendency for cost escalation between early project screening and final budget authorisation. Welde and Odeck (2017) demonstrated that the estimated cost of road projects on average increased by 40% from prioritisation in the National Transport Plan to budget authorisation. Cost escalations of this magnitude will further decrease the economic efficiency of a project portfolio and in practice they have caused much frustration among decision-makers. A related challenge has been the time-consuming processes and the delays experienced in the design and planning phase, which contributes to postponing the benefit flows.

This paper describes the efforts of the Norwegian Government to improve the efficiency of road projects by reorganising the road sector to reduce cost escalations and to improve value for money. Project selection is still a political choice, but a state-owned enterprise has been given a strong mandate and freedom to improve benefit-cost efficiency in the given portfolio. We use a motorway project in the southern part of the country as a case example, and we investigate whether transferring the responsibility for planning and construction to a state-owned enterprise can be a relevant measure for improving efficiency. The paper deals with a phase in the development of projects that is often ignored in the research literature, namely the front-end and the necessary activities to secure planning permission before construction can start. We discuss the incentives and actions of local stakeholders, as well as to what extent a project owner can create planning alliances that improve value for money.

The paper is organised as follows. Section 2 argues why the front-end

is important to project success and gives a brief description of the framework for planning Norwegian road projects. Section 3 describes the reform of the Norwegian road sector and the government's reason for implementing the reform. Section 4 describe the case project used in this paper and the research approach for investigating whether the project achieved its goals. Section 5 discusses the findings, and Section 6 presents the conclusions.

2. The front-end phase is crucial to project success

The efficiency of a road project is affected by choices made in all stages of the project development, from the first initiative, through planning and appraisal, and further to construction and operation. However, the project literature has increasingly recognised that project success mostly depends on choices made in the front-end of the projects. Doing the right project is more important than doing the project right, and several studies have shown that the reason projects fail is because of choices taken before actual project implementation (Williams and Samset, 2010; Morris, 2013, Williams et al., 2019).

The front-end represents a phase in project development when the flexibility to make changes is highest, while the cost of making changes is lowest, as shown in Fig. 1. As shown in the figure, the front-end phase can roughly be divided into two sub-phases, i) project selection and ii) design and planning, although the distinction is not always clear.

At the very earliest stage, when the project only exists as an idea, it can be changed or rejected at no cost. When the project is selected as part of a plan, it may be more difficult, formally or politically, to take it out of the portfolio, as by then stakeholders' expectations are likely to have become so high that decision-makers cannot change their mind because that would entail a high political cost. Once construction starts, it may be almost impossible to stop the project because the incurred costs have been sunk. For example, the HS2 rail line from London in the south of England to Birmingham and farther to Manchester and Leeds in the north has experienced significant cost increases since the budget was authorised by Parliament, and current estimates of the project's value for money indicate that the project has gone from delivering high value for money to low value, provided that costs do not increase further (Oakervee Review, 2019). Had decision-makers known the real costs at the time of the decision to build, they might have chosen to implement another project (or other projects) or not to carry it out at all. Drummond (2017) argued that once large projects gain traction, they are almost unstoppable. Once the investment decision has been taken, the scope for making changes is limited. Therefore, the choice of conceptual



Fig. 1. The opportunity to influence project success is greatest in the early phases.

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solution is the most crucial decision that a project owner makes (Volden, 2019). Throughout the planning phase, the project is designed and planned in more detail, and the opportunity for further choices becomes closed. In the case of a road project, choices regarding alignment, standard, location of bridges and tunnels, entry and exit ramps, among others, increasingly close the scope until the degrees of freedom are exhausted.

Fig. 2 illustrates the typical stages in a Norwegian road project. The first formal decision is carried out by the Ministry of Transport, when it gives the Norwegian Public Roads Administration (NPRA) a mandate to appraise different conceptual solutions to a problem. The conceptual appraisal includes an analysis of needs, a discussion of goals, and an economic assessment of different solutions. The conceptual appraisal is then scrutinised by external consultants (QA1) as part of the Ministry of Finance's quality assurance scheme (for a full description of the QA scheme, see Volden, 2019). If the concept is found to be viable and the business case sound, the Cabinet may allow the project to be developed further through a pre-project. For road projects, this involves a municipal sector plan and a local zoning plan. The former is a general plan for land use, which is legally binding and provides guidelines for more detailed planning work, and the latter is a detailed land use planning map with provisions for the use, protection and design of areas and physical surroundings.

The municipal sector plan sets out the final road alignment, and includes decisions such as the tunnel share, number of junctions, road standard, and other issues that affect the costs and benefits of the road. Both the municipal sector plan and the local zoning plan must be approved by the local municipalities that the roads runs through (even if it is a national trunk road), and this may cause 'perverse incentives' whereby local stakeholders have little to lose and everything to gain by requiring gold-plated solutions to a project that others are paying for (Volden, 2018). Traditionally, the process for road project selection in Norway has been characterised by regional horse-trading and the availability of strong state finances, which, according to Holmen (2020) may explain extensive malinvestment in road construction projects with low net benefits. Consequently, the estimated NPV and the costs in the conceptual appraisal and the QA1 may change considerably throughout the pre-project stage.

Before a budget can be approved by Parliament and construction can start, the project must pass another external quality assurance stage gate: QA2. In QA2, consultants review the cost estimate to ensure that the final budget is based on accurate assumptions and that necessary provisions for uncertainty have been made. However, there have not been any formal requirements for a last CBA at this stage. Rejection of projects does happen, but due to project lock-in, the expectations of stakeholders and decision-makers themselves are so high that few projects are rejected by Parliament after QA2. This means that developments in the pre-project stage are crucial for later project success or failure in benefit-cost terms.

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3. Norwegian road reform - Establishment of Nye Veier AS

Poor efficiency and cost escalation in the front-end of road projects were the main reasons for the Conservative-led government's road reform in 2015. The reform involved (among some other issues) the establishment in 2015 of a state-owned enterprise, Nye Veier AS (English trans. 'New Roads Ltd'), which was given responsibility for the construction and maintenance of 530 km of the trunk road network that needed upgrading. The projects were all in rural areas in the southern part of country, in locations that had an average annual daily traffic of c.7,000–15,000 vehicles at the time. The estimated total construction cost for all projects was EUR 12 billion in 2015 prices. Fig. 3 shows a map with the initial responsibility of Nye Veier.

The projects had been through QA1 and the government had decided to proceed with planning, but it was determined that the enterprise had



Fig. 3. Nye Veier's initial portfolio in 2016.



Fig. 2. The main stages in a Norwegian road project.

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to avoid the typical cost escalation experienced in other road projects and to improve the value for money in the enterprise's portfolio. The mandate was thus clear: reduce costs and increase social benefits.

A crucial part of the 2015 reform was to allow Nye Veier other degrees of freedom than those that the NPRA had (and still has). The enterprise is free to choose the order of implementation of the projects within its portfolio, based on the projects' value for money. This is a potentially powerful tool when bargaining with local municipalities. If a project becomes too expensive or the value for money is too low, Nye Veier may choose to implement a different project. That is, the enterprise must implement all projects in its portfolio within 20 years, but by implementing projects with high value for money first and deferring others, it may increase overall efficiency. Politically, Nye Veier differs from the NPRA in one important aspect. Once their portfolio of projects is selected, they are governed by a board of directors elected by the Minister of Transport. The NPRA is directly subordinate to the ministry and must adhere to political signals and directives. Nye Veier, on the other hand, operates according to a mandate set out in the charter of the enterprise. This ensures that the ministry is kept at arm's length.

Nye Veier also has more room to manoeuvre financially than the NPRA, which relies on annual state grants per project and has very limited opportunities for portfolio management and diversification of costs and benefits. Nye Veier receives an annual flat grant of EUR 500 million (2016-prices and adjusted for inflation thereafter), which combined with road tolls and project-specific government grants gives it enough liquidity to ensure efficient project implementation at its own chosen speed.

The road reform is consistent with what is often referred to as new public management (NPM). NPM is based on some core elements such as increased specialisation (single-purpose organisations), management by objectives, and making public agencies more accountable and independent of the political logics. NPM can be seen as a way of reforming the public sector or as a way of thinking when the intention is to change traditions and existing culture in the public bureaucracy, which can contribute to changed behaviour and increased efficiency and effectiveness (Christensen, 2007).

The NPRA continues to operate, but with less responsibility for sections of the trunk road network than it had before the reform. The idea is that the reform will result in a quasi-market where a state-owned enterprise will compete with a public agency, resulting in innovation and improved efficiency for both parties.

4. The case and research approach

The case selected for this study was the road project E18 Dørdal-Grimstad along the south-eastern coast of Norway. It was a pilot project in the sense that it was the first project (and at that time the only project), for which Nye Veier was given responsibility for developing a municipal sector plan.

Nye Veier set out to develop the plan in early 2018 and shortly thereafter tasked researchers from both the Norwegian University of Science and Technology and the research institute SINTEF to follow the process in order to extract learning points and evaluate the project's preliminary achievements. Thus, for the researchers, the choice of case project was a 'convenience sample': it was an opportunity to follow the particular project closely over time and learn what Nye Veier was doing to improve efficiency and value for money through front-end management.

According to Yin (2014), a case study approach is appropriate when (1) the main research questions are 'how' and 'why', (2) the researcher has little or no control over behavioural events, and (3) the focus of study is a contemporary (not historical) phenomenon in its real-world context. In the selected case, all three conditions were met. At a later stage, when Nye Veier has gained more experience and projects have been completed, quantitative data should be collected to determine its' achievements at project and portfolio level.

4.1. The road project

E18 Dørdal-Grimstad is a section of the European route E18 that runs from Craigavon in Northern Ireland to St. Petersburg in Russia. In Norway, the road is the main route from Kristiansand, the country's southernmost city, to the capital Oslo and farther on to Sweden. The distance from Dørdal to Grimstad is c.100 km, but the 20 km section between Arendal and Tvedestrand (Fig. 4) already has motorway standard. The area affected by the E18 Dørdal-Grimstad project has a combined population of c.110,000.

The road section was subject to a conceptual appraisal in 2008 and external QA1 in 2009. Most of the existing road was originally single carriageway, with a speed limit of 60–90 km/h; from 2001 to 2006 the numbers of persons killed and seriously injured was 13 per year. The average annual daily traffic was 10,000–22,000 vehicles. The municipalities through which the road passes had campaigned for dualling of the road for many years, and as road improvements to the north towards Oslo and south towards Kristiansand were realised, the government considered options for improving mobility along the corridor (Fig. 4).

The NPRA appraised the viability of six alternative concepts, ranging from a do-minimum alternative to minor improvements to selected sections, improved public transport, and two different motorway concepts. None of the concepts were estimated to deliver a positive NPV, but both the NPRA and the external consultants behind the QA1 report recommended that the road should be dualled and upgraded to motorway standard, due both to a need for improved traffic safety (Norway committed to Vision Zero in 1999) and a need for a uniform road standard for the entire stretch between Oslo and Kristiansand. The government agreed and instructed the NPRA to proceed with further planning based on a motorway concept in 2010.

In 2013 a Conservative-led government was elected. In its manifesto it had committed to a significant increase in spending on transport infrastructure, as well as reorganising both the road and rail sectors. After its establishment in 2015, Nye Veier AS took over formal responsibility for the E18 Dørdal-Grimstad project, as well as the other 21 projects in its portfolio.

A municipal sector plan for a motorway focuses on land use elements and the starting point is a planning programme that sets out the intended results of the plan. In this case, Nye Veier put a lot of effort into creating a common understanding among all stakeholders that a positive NPV was a condition for project approval. The municipalities organised in an intermunicipal planning board, which might have given them a stronger position in their bargaining with Nye Veier, but it also created a more holistic perspective and made the process more efficient than if Nye Veier had had to deal with eight different municipalities. The planning board hired a coordinator with a background from the NPRA, extensive experience from road planning, and an understanding of CBA that elected politicians often lack.

4.2. The research

Nye Veier has high ambitions but in 2018 it had no experience with developing municipal sector plans. However, it did recognise that any potential for improved efficiency had to be realised at that stage. Once construction starts, the scope for reducing costs and increasing benefits is limited. In order to learn from the experiences it gathered through the planning process, Nye Veier tasked a group of researchers with following the process (Ramstad et al., 2020). The researchers became involved in March 2018, just after the planning process had started, and they collected data until the municipal sector plans had been approved by all municipalities. Thus, the study can be considered a longitudinal case study. This type of research is often referred to as *trailing research*, meaning research that follows a phenomenon (in this case a road project) in real time and conducts continuous evaluation of it. The model integrates formative and summative evaluation in a planned learning process coupled with producing knowledge for the scientific community



Fig. 4. Municipalities affected by the E18 Dørdal-Grimstad project.

(Finne et al., 1995). Trailing researchers may use any kind of evaluation design and methods for data collection and analysis, but the approach is normally qualitative or mixed rather than quantitative.

The purpose of the research was to assess whether Nye Veier and its hired consultant were able to improve the efficiency of the project in accordance with the enterprise's mandate, and if so, why or why not. The goals for that phase of the project were:

- To complete the process within 1.5 years, so that Nye Veier could decide on whether or not to start construction
- To reduce the estimated costs by 30%
- To turn the project's NPV from negative to positive.

Table 1 shows the programme theory for the planning project. A programme theory is the overarching theory or model of how an intervention is expected to work (Maden et al., 2017). The 'theory' in a programme theory describes how a range of measures are planned to act together in a cause-effect link to achieve an intended outcome. It should explain the causal processes that activates change.

The measures could be described partly as innovative and partly as representing best practice. The strong emphasis on value for money and alignment of goals with local municipalities was uncommon, and an intermunicipal planning process had never been used in the planning of roads before. Digital tools are becoming more and more common throughout the transport sector and Nye Veier is the first to use Best Value Procurement (BVP) as a contract strategy for hiring consultants. The ability to prioritise projects without government approval is a framework condition that gives Nye Veier other opportunities than the NPRA.

The trailing research involved extensive data collection from both qualitative and quantitative sources, from the spring of 2018 to October 2019, when the municipalities approved the recommended plan. We followed all relevant actors in the process: Nye Veier, its hired consultant, the eight municipalities (on a political and administrative level),

Table 1

Programme theory for the planning project.

Measure	Outcome	Purpose
Alignment of goals: Nye Veier and affected municipalities Intermunicipal planning process Extensive use of digital planning tools Contract with consultant based on Best Value Procurement (BVP)	Planning permission in all municipalities by 1 September 2019 Reduce construction costs by 30%	Positive value for money
Portfolio management of projects	Road alignment that maximises time savings and traffic safety	

and regional and government authorities. We applied a broad and exploratory approach to data collection, whereby we searched for all types of data that could help us to understand whether and how the measures used in the planning project contributed to the intended outcome and purpose (i.e. whether the planning project's programme theory matched the realities).

A combination of different types of data collection methods was used: observation, personal interviews, focus group interviews and an evaluation seminar. We attended 76 meetings and conducted almost 30 in-depth interviews. Most of the interviews were unstructured and openended, and our intention was to describe the processes as well as their results, from the perspective of different actors. The quantitative material consisted of various screening reports with estimates of costs and benefits of different road alignment alternatives (produced before and during the planning process), the final recommendation for a sector plan when Nye Veier invited the affected municipalities to approve the plan, and stakeholders' written feedback on the plan as part of the process.

The data were analysed by coding pieces of information (e.g. observations, the interviewees' different statements, quantitative data) and subsequently by clustering similar pieces of information. Using data from multiple sources and combining methodologies are means for triangulation, which is important for validation and hence strengthens a study's trustworthiness (Creswell, 2014).

5. Results and discussion

In this section we present the results of our trailing research. Specifically, we discuss whether the implementation and organisation of the sector plan was efficient, and whether Nye Veier managed to achieve reduced costs and increased benefits so that the E18 Dørdal-Grimstad project could deliver a positive NPV.

5.1. Strong emphasis on efficiency

The planning process was characterised by a strong emphasis on benefit-cost efficiency, in line with the intention. Nye Veier made it clear to all stakeholders from the outset that unless the road could deliver a positive NPV, it risked being downgraded. These ambitions were strongly institutionalised among all Nye Veier's employees and were understood and accepted by other stakeholders. This situation may seem self-evident to representatives of countries with a strong emphasis on CBA results, but it has been uncommon in the Norwegian road sector (Eliasson et al., 2015). In line with the fundamental principles of CBA, the focus was on social benefits for society at large rather than on local effects. Nye Veier's autonomy and freedom to choose the order of implementation of its projects was a key explanatory factor. This reduced the ability of local authorities and local stakeholders to 'blackmail' Nye Veier into overinvesting in elements that wouldn't add

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net value to the project.

Costs and benefits were estimated and re-estimated continuously throughout the planning process. The screening and evaluation of different road alignment alternatives was an iterative process in which alternatives with the poorest value for money were rejected.

5.2. Several innovative measures

In line with NPM thinking, Nye Veier was free to decide *how* to achieve its goals. The enterprise took two innovative steps to promote efficiency.

First, as Nye Veier is small organisation with a limited number of employees, it has a strategy to use outsourcing and turnkey contracts extensively. When hiring a consultant to develop the plan, it used best value procurement (BVP) to find the best consultant, based on a combination of price, quality and expertise. The contract gave the consultant strong incentives for time and cost efficiency. The use of an external consultant to carry out the planning work helped to strengthen the incentives for efficiency and created additional distance between the analytical work and politics. However, it might have created some uncertainty about who was in charge – Nye Veier or the consultant.

Second, Nye Veier committed the eight municipalities to forming an intermunicipal planning collaboration to develop a joint sector plan for all eight to approve. This led to a more time and cost-efficient process with a holistic perspective.

5.3. Major planning time savings

The project had an ambitious goal: to complete the municipal sector plan process within 1.5 years, which is less than half the time that such processes normally take. The goal was largely achieved, as the process took just over 1.5 years. This is unusual for road projects in Norway, not least for a large project that involved eight municipalities. Included in the process was also municipal approval, as well as time spent on handling disagreements and objections from municipalities and other public authorities.

Nye Veier emphasised its goal from the beginning of the process and made it clear that achieving it would require a lot of effort from all those involved. The municipalities accepted this condition and gave the plan high priority, partly at the expense of other municipal matters. Early and strong involvement from the eight municipalities was also important, as they gained ownership of the goals and strategies, which might have helped to avoid conflicts later in the process.

The use of an external consultant, contractually motivated to deliver on time, was also important for the short time to obtain planning permission. The contract gave the consultant considerable room for manoeuvre in the planning process, which led to more direct contact with key players at the local level, and increased opportunities for input and rapid feedback, especially from local decision-makers. Thus, decision-relevant information was included early in the planning process based on direct communication.

We also found evidence of negative impacts, in terms of time pressure and a large workload for those involved, and very little time for the administrative bodies to respond to the material that was presented to them. Some local informants indicated that they would have preferred to have had more time to assess the local consequences of such a large road project as E18 Dørdal-Grimstad. We also saw signs of 'peer pressure' among the municipalities not to create problems for the process, for example, by submitting objections. Nevertheless, we have no indications that the quality of the plan suffered or that some municipalities approved it against their will.

5.4. Cost performance depends on the point of reference

Several studies have documented that cost overruns are a problem in the delivery of transport projects (Odeck, 2019), but the development of

cost estimates during the panning phase has rarely been studied. In Norway, most large road projects are completed below budget (Welde, 2017), but cost escalation during planning has been a persistent problem (Welde and Odeck, 2017). The government's instruction to Nye Veier was to avoid the typical increase in estimates during the front-end, but the enterprise had higher ambitions and set out to reduce estimates by an average of 20% from the formal handover of project responsibility in 2016. However, the cost performance (i.e. the increase or reduction in cost estimates) depends on the point of reference (i.e. the basis of comparison for current estimates). In our opinion, to measure the efficiency of project delivery, the final costs of projects should be compared with the formal budget approved by parliament after QA2 (see Fig. 2). However, as projects are developed, their scope and hence their costs and value for money will vary depending on the decisions made during the front-end. There are very few studies of variation in costs during that stage of project planning in the academic literature.

As is common for road projects in Norway, several cost estimates have been produced for E18 Dørdal-Grimstad. In the White Paper that outlines the government's road reform and the creation of Nye Veier (Meld. St. (2014–2015)), the construction cost was estimated at some EUR 2.15 billion in nominal 2015 prices. In 2016, when the enterprise formally took over the responsibility for the project portfolio, the estimate was EUR 1.95 billion. The most recent cost estimate, as recommended in the municipal sector plan, is EUR 1.55 in 2019 prices. Adjusted for the increase in the construction cost index for road construction (Statistics Norway, 2021), this implies a reduction in the estimate of 36% and 28% from 2015 and 2016 respectively. If this turns out be the result when the road is completed, the reduction would be remarkable and unusual. It is beyond the scope of this paper to document the precise reasons why the cost estimate has been reduced, but the large variation in estimates illustrates the uncertainties of estimates prepared in a stage of project development when knowledge of central parameters such as road alignment, and bridge and tunnel share is limited. The current cost estimate implies a cost per kilometre of about EUR 217,000, which is on the same level as the average cost of four-lane motorways constructed over the last decade.

However, the cost estimate has increased from when the road was first subject to conceptual appraisal and external QA1 in 2008 and 2009. Adjusted for inflation, the increase from these estimates have been in the region of 60% and 10% respectively. The development in cost estimates since 2008, in 2019 prices, is illustrated in Fig. 5.

Fig. 5 shows that even if Nye Veier achieved the goal that it set out when it announced its planning programme, the development in cost estimates since the conceptual appraisal and the QA1 has been the same as that for most other road projects. This illustrates the concern raised by Love et al. (2015), that the large differences between the results of studies of cost performance may be due to the differences in the point of reference from which the costs are measured.

Fig. 5 also illustrates the uncertainty of early estimates. In the academic literature, planners have been accused of deliberately underestimating costs of new infrastructure, although such claims have been strongly contested (Love and Ahiaga-Dagbui, 2018). In Norway, early estimates are expected to be within an accuracy range of +/- 40%, but Fig. 5 clearly illustrates that the range of project cost uncertainty is far higher than traditional targets. The first two estimates in Fig. 5 were based on a more modest concept than on what the government later decided. Furthermore, the first four estimates did not include information on either road alignment or the share of expensive structures such as tunnels and bridges.

5.5. Negative value for money

The most important criterion in the government's mandate to Nye Veier is to improve value for money in its project portfolio. In the case of the E18 Dørdal-Grimstad project, the enterprise emphasised that a positive NPV would be vital for final project approval, and the local



Fig. 5. Development of cost estimates.

municipalities would have to sacrifice a lot to support this goal. Traditionally, road planning in Norway has been based on broad coalitions, citizen participation, and mitigating measures as bargaining chips in negotiations in order to reach consensus, but Nye Veier has announced that it will prioritise efficiency over distributional and environmental issues.

Nevertheless, Nye Veier's goal was not achieved. The net present value for the recommended alternative was in the region of minus EUR 600 million, corresponding to a net benefit-cost ratio of -0.40. This is lower than the average performance of all projects in the National Transport Plan and it is lower than the estimated ratio in the QA1 report, which was -0.03. Comparing CBA results over time can be difficult, as assumptions regarding value of travel time, discount rate, among other matters, change, but during the last decade the framework for CBA has changed in a direction where almost all projects have become more profitable. For example, since the appraisal in the QA1, the discount rate has been reduced from 4.5% to 4.0% and the appraisal period has increased from 25 years to 40 years. Thus, Nye Veier clearly failed in its efforts to improve value for money.

In addition to the direct user effects as estimated in the CBA, Nye Veier also carried out a calculation of 'wider economic impacts'. These are secondary effects that can occur outside the transport market when companies and employees get closer to each other, and thereby trigger productivity effects that occur in addition to the direct user benefit that a road project can create. Due to great uncertainty and the risk of double counting, such effects have traditionally been excluded from CBAs (Holmgren and Merkel, 2017; Melia, 2018; Tveter, 2020). Most of the literature has focused on urban agglomeration economics where spatial concentration of economic activity is thought to increase productivity by three mechanisms: sharing of knowledge, matching the skills of employees with the needs of potential employers and learning (Duranton and Puga, 2004; Graham and Gibbons, 2019). In rural areas, research has shown that wider impacts are small (Tveter, 2018). Welde and Tveter (2022) showed than in most cases, even local development impacts from new roads were negligible in most cases. In this project, Nye Veier estimated that inclusion of wider benefits would improve the net benefit-cost ratio (BCR) by 0.1 to 0.3, depending on road alignment. This means that inclusion of these impacts would increase the BCR towards -0.1 for the preferred alternative (i.e., value for money would still be negative). This is in line with the conclusions of Holmen (2020) who studied the productivity impulses from other road projects along the E18 corridor. Holmen (2020) found only weak impulses through

commuting and possibly through industrial restructuring and concluded that the empirical evidence of productivity impulses from road investment in rural areas was weak.

High ambitions are not a guarantee of success. Even if the new road will lead to a reduction in the numbers of accidents and deliver travel time savings of c.15 min, the estimated benefits will be too small to justify a significant investment. The project illustrates that Nye Veier may learn what the NPRA has experienced for decades, namely that achieving a positive NPV may be difficult in a country with low population densities, low traffic levels, a demanding topography, and high construction costs.

5.6. Unclear whether alternative road concepts have been properly explored

The fact that none of the assessed road lines have a positive NPV raises the question of whether the right concept has been chosen. All the studied alternatives involved a four-lane motorway, in line with the government's decision in 2010.

From an economic perspective, the do-nothing alternative (i.e., no project) would have been the best alternative but is not in line with the government's decision taken ten years ago. This illustrates that CBA may not be the best tool for capturing the aspirations of decision-makers, and that some form of multicriteria analysis may be better for decision support. Based on the current plans, the road will meet the goals for reduced travel time and improved traffic safety, but the total user benefits as quantified in the CBA are below the total cost of implementation. This raises the question of whether the opportunity space has been properly explored. The planning was effectively based on appraising the effects of different versions of the same concept. Using large resources on the appraisal of different motorway alternatives could quickly end up as a solution looking for a problem rather than a problem looking for a solution.

6. Conclusions

The road sector in Norway has been characterised by low selection efficiency and an emphasis on local perspectives, which has been a concern of national politicians for several years. The creation of a stateowned limited enterprise, Nye Veier, in 2015 was a new move and in line with several other reforms in the public sector to promote efficiency and management by objectives. Nye Veier operates at arm's length from

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direct political control and is free to scrutinize the projects in their portfolio in order to improve their efficiency. Traditional road planning is based on projects being selected by government, but where actual implementation depends on local planning permission. As Nye Veier can prioritize their projects within a portfolio, this introduces a different balance of power compared to traditional planning arrangements. If a project becomes excessively expensive without benefits increasing at least in line with costs, it can be postponed indefinitely. This may reduce the local scope for gold plating and reduce planning inefficiencies.

In this paper we have reviewed the efforts of the enterprise to promote efficiency by reducing costs and increasing benefits, using a road project on the south coast of Norway as a case example. The results show that despite considerable efforts, the road remains unviable measured by the results of the CBA. The cost estimate has been reduced during the development of the municipal sector plan but has increased since the earliest appraisals were carried out in 2008 and 2009.

Cost estimation is not an exact science but there is solid empirical evidence that projects' scope and quality increase during their front-end to accommodate the needs of stakeholders, to mitigate adverse environmental effects, or both. Planners and estimators should account for this uncertainty by adding sufficient contingency to their estimates.

One of the main conclusions of the paper is that it is very difficult to turn an inefficient solution into an efficient project. Despite the use of innovative measures such as intermunicipal planning, hiring a planning consultant based on BVP, and systematic promotion of efficiency, Nye Veier failed. This finding supports the evidence that the earliest part of the front-end phase and selecting the right project is critical for benefitcost efficiency. Major issues such as agreement on the most effective solution to a problem and the choice of concept need to be dealt with as early as possible - later is too late. In the case project presented in this paper, alternative concepts based on widening the existing road would have been better in benefit-cost terms.

Nevertheless, the research that followed the planning of the project concluded that there is potential for improving efficiency during the development of a municipal sector plan. The time to develop the plan can be reduced considerably - in the studied case the plan took less than half the average time normally taken to develop similar plans. Furthermore, intermunicipal planning can be a powerful tool for creating alliances and developing a common understanding and acceptance of project goals. This gives local governments' a stake in the projects beyond what could be achieved by traditional state financing. However, the most important tool is Nye Veier's strong mandate and freedom to select and implement the project within its portfolio in the order that it chooses. Over time, these experiences may put pressure on Nye Veier's 'competitor', the NPRA, to adopt a similar focus on efficiency and require a similar mandate vis-à-vis local governments in their projects. It would be an interesting topic for future research to look for any 'spill-over effects' on the NPRA which is still responsible for most of the project in the road sector.

Given Nye Veier's strong emphasis on value for money, and the road project's negative NPV, it may be surprising that Nye Veier has decided to proceed with detailed planning of the northern section between Dørdal and Tvedestrand. The estimated NPV is somewhat higher than the section between Arendal and Grimstad, but most importantly there is a desire to have a uniform road standard along the whole length of the road between Oslo and Kristiansand. Even if developing accidentexposed single carriageways into motorways may be unprofitable in economic terms, the strategic case for linking regions together may be strong. This illustrates that targeting the planning process towards value for money alone may not be in line with the desires of decision makers and other stakeholders who may have wider aspirations. Economic efficiency alone may be a too narrow definition of project success. Both local and national stakeholders are normally concerned with the achievement of specific goals for accessibility, development impacts, the distribution of costs and benefits between groups and environmental issues. This should be reflected in both ex-ante appraisals and ex-post

evaluations.

Although Nye Veier failed in its efforts to improve value for money in the case project presented in this paper, it is their results at portfolio level that matter most. There will always be variations in value for money in a portfolio of projects and, as we argued in the introduction to this paper, there may be relevant arguments for road construction in a sparsely populated country. Despite the negative value for money in the project presented in this paper and in some other projects, the net present value of the projects in Nye Veier's portfolio increased by EUR 3.5 million from 2016 to 2019 (Nye Veier, 2019).

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This paper has provided the results of a trailing research project designed as a mid-term evaluation of planning processes and estimates. The real results and effects will only be revealed when or if the whole road is realised and has been in operation for some time. It will be highly relevant to use the extensive documentation produced in this study for further evaluation of this project.

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