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# Procurement strategy in major infrastructure projects: Piloting a new approach in Norway

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# Piloting a new approach in Norway

# Abstract

Infrastructure investment has been at the forefront of the political debate for more than two decades. Despite decades of theoretical study and experimentation in practice, “how to” actually procure infrastructure still lacks a complete and evidence-based guide, relying heavily on subjective perception and judgement. Procurement strategy mistakes can substantially increase the cost of infrastructure, delay its delivery, or reduce its quality and value to the public.

The OECD has trialled a new evidence- based tool to inform procurement decisions on major projects called Support Tool for Effective Procurement Strategy or STEPS. The tool was applied toon two major road projects in Norway. STEPS can improve the efficiency and effectiveness of public procurement of infrastructure and beyond.

It should improve the Value for Money propositions of both traditional and privately financed infrastructure projects. It is also an effective tool against bid rigging, the effects of abnormally low bids, and corruption in public procurement. Because the procurement choices of the public sector impact the market structure of the infrastructure supplier market, it could be considered an instrument of implicit market regulation, working against market concentration. STEPS thus supports a range of OECD recommendations and G20 positions on infrastructure governance, private investment in infrastructure, and procurement in general.

# Foreword

Infrastructure investment and value for money consistently capture the attention of public decision makers. Making the right decisions begins by deciding on which project to invest and on how to deliver or procure that particular project. This report presents the application of a ground-breaking new tool for informing procurement choices in major infrastructure projects.

The procurement of infrastructure projects (or procurement in general) provides public decision makers with numerous choices which importantly define procurement outcomes. The wrong procurement strategy can lead to cost overruns, delays, high total cost or time of delivery, quality issues or lack of innovation. Despite national and international efforts to date, most of the decisions in procurement are still based on expert judgement or tools which address only a particular aspect of procurement such as risk allocation. The absence of holistic and evidence-based tools therefore raises serious concerns that infrastructure procurement around the world often leads to suboptimal outcomes.

Since 1999, professor Adrian Bridge at the Queensland University of Technology (QUT) has been working on a tool to comprehensively address the procurement strategy of a project. After several pilots, supported by Infrastructure Australia, the OECD joined forces with QUT to further evolve and trial the new approach outside Australia. Nye Veier A/S, the Norwegian motorway company (hereinafter: Nie Veyer) came forward as a first mover in Europe.

Nye Veier AS (hereinafter Nye Veier) received a mandate from the government to try to reduce the cost, improve the speed, and quality of infrastructure delivery. Nye Veier set itself a target to reduce the infrastructure cost by 20% against the outline cost estimate[1]. In the hope of achieving that goal, Nye Veier was designed as a lean organisation (with currently around 170 employees) with a EUR16 billion portfolio of road investments to be executed by 2036. In the hope of achieving the targeted savings, Nye Veier chose the Design and Build (hereinafter: DB) contract as its workhorse delivery model and experimented also with Early Contractor Involvement.

The adoption of STEPS is expected to significantly upgrade Nye Veier's capabilities in ensuring that available funding is spent as efficiently as possible.

[1] As infrastructure projects mature, so does the level of their design. While design stages in different countries bear different names, the outline design is the first level of detail developed. It would serve as a base on which cost estimates are built to be used in the cost benefit analysis.

# Acknowledgements

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For more information on STEPS or its application please contact the Infrastructure and Public Procurement Division, Public Governance Directorate:

Edwin Lau, Head of Division: edwin.lau@oecd.org

Dejan Makovšek, Procurement Strategy Lead: dejan.makovsek@oecd.org

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# List of abbreviations

| Acronym | Description |
|---|---|
| DBB | Design-Bid-Build delivery model |
| DB | Design and Build delivery model |
| EPC | Engineering- Procurement-Construction delivery model |
| STEPS | Support Tool for Effective Procurement Strategy |
| ECI | Early Contractor Involvement |
| USD | United States Dollar |
| EUR | The Euro |
| QUT | Queensland University of Technology |
| TCE | Transaction Cost Economics (theory) |
| RBT | Resource Based Theory |
| OECD | Organisation for Economic Cooperation and Development |
| IMF | International Monetary Fund |

# Executive summary

1. **Infrastructure investment has been at the forefront of the political debate for more than two decades.** Especially in post-crisis times, it is seen as a tool to stimulate economic activity. Various assessments of prospective infrastructure needs across developed and developing nations add up to trillions of USD.

2. **Despite decades of theoretical study and experimentation in practice, "how to" actually procure infrastructure still lacks a complete and evidence-based guide, relying heavily on subjective perception and judgement.** Sufficient evidence is now available to conclude that mistakes in the procurement strategy of a project can lead to infrastructure that is too costly and/or does not bring the expected quality/value. Moreover, delivery on-time and on-budget, while important, is not necessarily a sign that a procurement is going well.

3. **The OECD has trialled a new evidence-based tool to inform procurement decisions on major projects called Support Tool for Effective Procurement Strategy or STEPS.** The tool was applied to two major road projects in Norway which were already procured. The objective was to determine whether STEPS would suggest a different procurement strategy from the one actually chosen. In one case STEPS validated the original procurement approach, though room for improvement was found. In the other case STEPS proposed a fundamentally different approach from the one originally pursued. Though difficult to quantify exactly, the application of STEPS would have delivered substantial savings.

4. **STEPS can improve the efficiency and effectiveness of public procurement of infrastructure and beyond and thus supports a range of OECD recommendations and G20 positions** (OECD, 2009[1]; OECD, 2012[2]; G20/OECD, 2013[3]; OECD, 2015[4]; G20, 2019[5]; OECD, 2020[6]; OECD, 2020[7])**.** For example, STEPS should improve the Value for Money propositions of both traditional and privately financed infrastructure projects. It is also an effective tool against bid rigging, the effects of abnormally low bids, and corruption in public procurement. Because the procurement choices of the public sector impact the market structure of the infrastructure supplier market, it could be considered an instrument of implicit market regulation, working against market concentration.

5. **In the most advanced economies, which score highest in evaluations of public investment management (e.g. Public Investment Management Assessment) the current conceptualisation of a procurement strategy rests on two steps.** The first step is bidder selection, where the practice is grounded in science and enshrined in legislation (e.g. the European Union [hereinafter EU] procurement directives). The second step is the choice of the delivery model, which to a large extent concerns also risk allocation. The delivery model defines whether the procurement of the design and construction should be bundled or not, whether low price competition should be the predominate criteria or whether negotiation and collaboration are more appropriate, and so forth. This step also determines the power of incentives to deliver on budget or on time. Approaches were also developed to help guide the delivery model choice.

6. **Building on the most recent evidence and insights to date, this paper argues that the existing concept of procurement strategy is too narrow.** Two decisions preceding bidder selection are the make-or-buy question and the bundling or contract scoping question.

7. **The make-or-buy question concerns the boundary between the procuring entity and its market.** What should that entity buy from the market (outsource) and which capabilities should it retain in-house?

8. **The contract scoping question asks whether contracts should bundle also project life-cycle phases like design and build or more?** Should the project be procured through a single contract or through several contracts? If there are several contracts, where should the boundaries between them lie?

9. **Both the make-or-buy and bundling decisions can importantly predetermine the outcomes of procurement before one even starts considering the bidder selection processes and delivery models.** Disregarding these questions can embed problems in the subsequent steps, like causing a competition failure with too few bidders interested, or applying a single delivery model (and risk allocation framework) on a large project, where several different delivery models should have been applied on different parts of the project.

10. **A comprehensive procurement strategy should capture all the key questions and answer them.** To date, some authorities have acknowledged these questions (e.g. Infrastructure and Project Authority in the UK), but none have produced an evidence based tool that would tell the user how to answer them.

11. **Almost 20 years ago, the Queensland University of Technology in Australia [hereinafter QUT] started developing a tool grounded in economic theories, to inform a procurement strategy that covers core procurement decisions, including the two above.** In its approach the tool first breaks projects down into technologically distinct and financially non trivial activities. Using economic theory these activities are then evaluated to detect those which may lead to problems such as competition and/or risk allocation failures. The subsequent process then seeks to create contract and delivery model solutions that avoid failures to which "problematic" activities would lead. To date, the QUT trialled the tool in Australia on six major projects – three motorways and three hospitals. For four of those, it also received the support of the Australian Research Council.

12. **The OECD reviewed the theoretical underpinnings of the tool and revised it to accommodate the latest evidence and theoretical insights, branding it the Support Tool for Effective Procurement Strategy - STEPS.** Partnering with the QUT, the OECD then applied STEPS to two road projects in Norway, the E6 and E18, each valued at more than EUR200 million, to demonstrate its effectiveness. E18 was already concluded so a full counterfactual was built, while the E6 was just completing the design stage.

13. **The results of the analysis shows that the procurement strategy in the case of E18 was appropriate, although a few improvements were still possible.** The project was procured via a single Design and Build delivery model in a best value competition. Both competition and risk allocation failures were successfully avoided.

14. **In the case of E6, a collaborative procurement approach was used called Early Contractor Involvement.** In this case a low price competition is abandoned and the best bidder is selected based on their capabilities and past references. In a co-located manner, the client and the contractor then jointly work on a solution, maximising the exchange of information between the two in the hope of finding superior engineering solutions and reducing problems in terms of the design errors and omissions. The permissible budget for the project is set in advance and re-assessed over a series of project development milestones. In this case, the analysis found that the E6 was not complex enough for this particular procurement approach. STEPS therefore advised that abandoning a delivery model based on low price (or best value) competition would lead to a high infrastructure cost. As the design is nearly complete with about 90% of the engineering complete, STEPS suggested to conclude the collaboration and proceed with a competitive

procurement of a Design and Build contract. In September 2021 Nye Veier used its option to terminate the Early Contractor Involvement contract and decided to tender a Design and Build contract in 2022.

15. **STEPS also yielded an insight for the organisational structure of Nye Veier, which was originally devised as a lean organisation with 70 employees.** The original idea was to transfer as much responsibility as possible to the private sector with the Design & Build contract as their workhorse and the simplest contractual model. Nye Veier's experience has shown that even under this vision, the number of experts in the organisation had to more than double in order for Nye Veier to effectively manage its suppliers in recent years. Given the nature of projects – a motorway programme that Nye Veier will be procuring, however, the analysis suggests that Design & Build will not necessarily always be the best choice. The OECD therefore recommends that Nye Veier build up its capabilities to be able to also handle large traditional Design-Bid-Build contracts, where the design is procured separately from the construction.

# 1 Infrastructure Investment: The Problem with the Existing Approach to Procurement Strategy

16. Infrastructure investment remains one of the key political priorities for advanced and emerging economies alike. The deliberate suppression of economic activity to manage the spread of the COVID-19 created an opportunity to use infrastructure investment as a means to stimulate economic recovery in the short to medium term, while reducing the infrastructure investment gap.

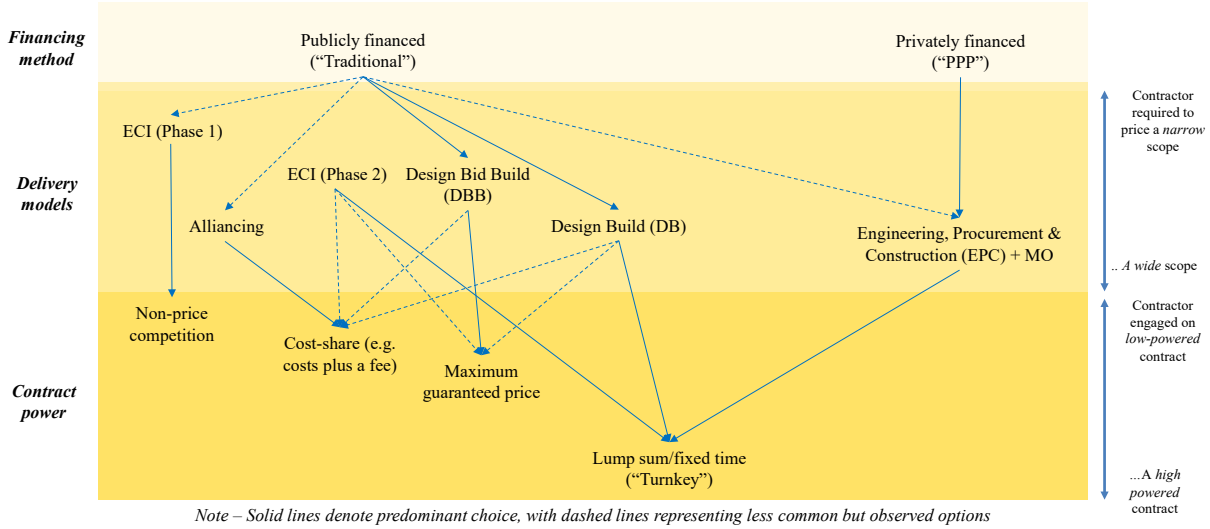
17. New public infrastructure commitments alone will not be sufficient to meet diverse infrastructure needs. Improving the efficiency of both new and existing investment is necessary to ensure value for money. The IMF has estimated that countries lose on average up to one-third of public investment due to poor infrastructure governance (Schwartz et al., 2020[8]). In addition, public policy makers are concerned about bid rigging, abnormally low tenders, corruption, market concentration in the infrastructure supply market to name but a few areas addressed in OECD and G20 recommendations (OECD, 2009[1]; OECD, 2012[2]; G20/OECD, 2013[3]; OECD, 2015[4]; G20, 2019[5]; OECD, 2020[6]; OECD, 2020[7]). Choices made in infrastructure procurement touch on all these points.

18. One of the key challenges in ensuring that money on infrastructure is well spent is how the infrastructure is procured – the procurement strategy. The focus in the most advanced economies in the world today is on the choice of the delivery model and in relation to that, risk allocation. Figure 1.1 illustrates some of the main delivery models in use to date, the details of which can be found in Kennedy et al. (2018[9]). "Scope" concerns whether several phases of the project development are included (e.g., design and construction versus the separate procurement of each). Whereas "contract power" is about the payment mechanism, which represents an added layer of strictness with which risk is transferred to the contractor[2]. The choice of a particular delivery model to a large extent determines the appropriate bidding procedures and payment mechanisms.

19. In our illustration, the delivery models range from the Early Contractor Involvement (ECI) to the Engineering Procurement Construction (EPC) contract as two opposite extremes. In the ECI, the contractor is selected based on their past experience and is expected to work with the client through a negotiated process to eventually deliver the project. The idea here is that the collaboration between the client and the contractor will yield superior solutions already in the design phase and thus improve the outcomes of the project. Once the solution is chosen, the ECI approach dilutes the incentives to execute the construction

[2] For example Design-Build (DB) and Engineering-Procurement-Construction (EPC) contracts use the lump-sum payment mechanism as a default option. Both options differ mainly in the sense that in the first an outline design can be made available by the client, whereas in the second only the functional (output) specification exist (*i.e.* design needs to be developed completely). Errors and omissions in the design are typically the top two direct reasons for cost overruns in projects, even if the root causes may lie elsewhere (e.g. optimism bias). The transfer of responsibility for both the design and construction to the contractor strongly reduce their capability to claim additional payments from the client. These contract characteristics however are not without trade-offs (Makovsek and Bridge, 2021[12]).

## Figure 1.1. Select project delivery models and payment mechanisms




*Note – Solid lines denote predominant choice, with dashed lines representing less common but observed options*

Source: (Kennedy et al., 2018[9]).

20. Regarding how delivery models are selected, two main approaches are currently in use. The most basic one is a set of simple descriptions of the pros and cons of various delivery models. A more sophisticated approach involves the weighing of perceived attributes of individual approaches in pursuing project objectives (quality, being on time, cost…). This method is called the multi-attribute utility approach – MAUA, often termed as Procurement Options Analysis (Department of Infrastructure and Regional Development, 2008[10]; Molenaar, Harper and Yugar-Arias, 2014[11]). MAUA begins with subjective weightings applied to a range of attributes of desired project outcomes that the client considers important (e.g. speed of delivery, cost certainty…). These weightings are then, generally, multiplied by a utility factor representing the extent to which a procurement option satisfies each attribute. The most desirable procurement is the option with the highest score. The projects too can be subject to straightforward characterizations (e.g. complex, simple) and procurement models designated as to which is best to match which type of project. An illustration is provided in Table 1.1.

## Table 1.1. A simplified illustration of a matrix for the selection of a project delivery model

| Objectives | Importance of Objectives in Rows | DBB | DB | DBOM (PPP) | ECI |
|---|---|---|---|---|---|
| Speed of delivery | 0.2 | + | +++ | + | ++ |
| On time delivery | 0.2 | + | ++ | +++ | + |
| On Budget delivery | 0.3 | + | ++ | +++ | + |
| Innovation potential | 0.2 | + | ++ | + | +++ |
| Suited for complex projects | 0.1 | + | ++ | ++ | +++ |

Note: The values entered are for illustration purposes only and do not necessary reflect relative delivery model performance.

21. The first major issue of the approach above is the lack of evidence how choices on the bidding process delivery model and payment mechanisms affect procurement outcomes. Most of the robust empirical evidence concerns cost overruns, delays, and speed of delivery. There is much less clarity about the cost per physical unit that different delivery models and related procurement choices deliver (Makovsek and Bridge, 2021[12]). Hence, decision makers do not have a robust view of the trade-offs.

22. Even if we did have a full overview of the trade-offs between different procurement choices, a fundamental weakness of MAUA is that it does not provide objective grounds or support for the decision on the delivery model. For example, the choice of a collaborative approach (such as ECI) may rest on qualifying a project as "complex". But a project's complexity will still to a large extent depend on the preceding decisions. The public authority may simply define a too large project scope that needs to be procured through a single contract, which will make a project complex. Furthermore, in a MAUA approach the cause (the chosen mode of procurement) is expressed in the same terms as the effect (the desired outcome of the project). Thus, if one puts a high weighting on one objective (for example on-time delivery in Table 1.1), the model which promises the best performance in that dimension automatically wins. That is a tautology as essentially the same thing is said twice in different words. In consequence the choice of delivery model for the project is driven by one or two of the most desired outcomes. However, two key preceding questions - the make-or-buy decision and the contract scoping decision -- are ignored.

23. What, for example, is the contract scope and into how many contracts should a particular project will be broken down? A first obvious answer is size. If a contract is too large, this will automatically reduce the numbers of bidders that are able to bid. However, there are more sophisticated reasons why contract scoping matters. For example, if among several dozens of project activities two activities would only have two contractors that could deliver them, bundling these two activities in the same contract as the others would reduce the number of bidders to two consortia. This is because the rest of the contractors would organize around these two. Major projects also aren't necessarily sets of homogenous activities in terms of riskiness or complexity (Denicol, Davies and Krystallis, 2020[13]; Denicol et al., 2021[14]). Hence, applying a single delivery model and/or risk allocation mechanism to the entire project may be suboptimal. These are but illustrations. A full treatment of the relevance of make-or-buy and contract scoping decisions will be outlined in the next chapter.

24. Because it does not address these major issues, the discussion between the construction industry and policy makers is currently focussed on whether delivery models based on collaboration are more suitable for the delivery of major projects than those based on (low price) competition[3]. The basis for this has been the promise of superior value for money expected from collaborative approaches to procurement, as opposed to those primarily based on the competition for the lowest price. While this proposition is not new (DETR, 1998[15]), its prominence rose with the recent developments in the PPP market, with contractors beginning to refuse major risk transfers from the public sector after several incurred high financial losses[4]. The use of lump sum contracts in major projects, especially PPPs, exposes contractors

[3] See for example: https://www.weforum.org/projects/collaborative-delivery-initiative

[4] The major infrastructure and PPP market was already characterized by limited competition, where only a few large contractors were willing to accept fixed date/fixed price (EPC) contracts (Roumboutsos, 2019[49]), absorbing large amounts of risks. These contracts are also the default option in PPPs, insulating the investors by requiring de facto insurance from the contractors that nothing will go wrong in construction or operation/maintenance of infrastructure. Because the construction risk has a distribution, which is asymmetric to the left with a tail to the right, the contractors absorbing it are exposed to low probability, high impact risk events. Recently there have been reports of reduced contractor appetite for PPP projects and major contractor exits from the PPP market after bearing large financial losses (Moseley, 2020). The contractors cannot price these efficiently, leading to an occasional winner's curse problem.

to low-probability high-impact risk events, which the contractors cannot predict or price efficiently. In consequence, the industry has called for the rebalancing of the risk allocation. In the industry's view, the governments should continue procuring very large contracts which only a few firms can deliver, while it is the delivery model and its risk allocation that should change in the public procurement of infrastructure in general. In the case of PPPs, a rebalancing of risk allocation would no longer allow governments to push PPP projects off the (public debt) balance sheet, so it is unclear how the governments will respond to these developments in the case of privately financed infrastructure.

25. Without considering the preceding key decisions of make-or-buy and contract scoping in a procurement strategy, a discussion about which delivery model should prevail in major projects is moot. Major projects are huge multiannual endeavours and the nature of the activities involved unlikely favours a single preferred delivery model or risk allocation approach. In the subsequent chapters a solution to this challenge will be presented and demonstrated on two case studies of real projects.

Moreover, major PPP contractors operate as aggregators, which subcontract most of their work to smaller subcontractors (again through fixed price/date contracts). As a result, the current situation is one where the aggregators are exposed to losses, while subcontractors are making good money, making the whole model expensive and unsustainable.

# 2 A new tool for informing procurement strategy

26. The preceding chapter and problem definition have illustrated the need for a comprehensive approach to infrastructure procurement strategy. What such an approach might entail can be informed by economic theory. Until recently, the insights of economists have not yet been operationalized. In the past years, however, professor Adrian Bridge at the QUT has been developing an approach that would connect the insights from economic theory into a structured process. The OECD as well has produced a large body of work on the role of uncertainty in contracts (ITF, 2018[16]), that will importantly affect some parts of the theory and therefore also procurement strategy. Chapter 5 explains the theoretical background of the QUT approach and where the OECD has made adjustments to accommodate recent insights from its work and economic theory. In this chapter we illustrate how the improved approach works. The OECD and QUT have agreed to call the new approach Support Tool for Effective Procurement Strategy or STEPS.

27. The "Support" aspect signifies that the tool is meant to inform the procurement decision as all projects do not necessarily need to follow a single outcome or objective. The default objective of the tool is to seek an appropriate procurement strategy which will deliver the project at the lowest life-cycle cost. If the user of the tool needs to pursue other primary objectives, e.g., greater speed of delivery or the greatest on-time/on-budget performance across the board, the tool will identify the trade-offs of alternative decisions.

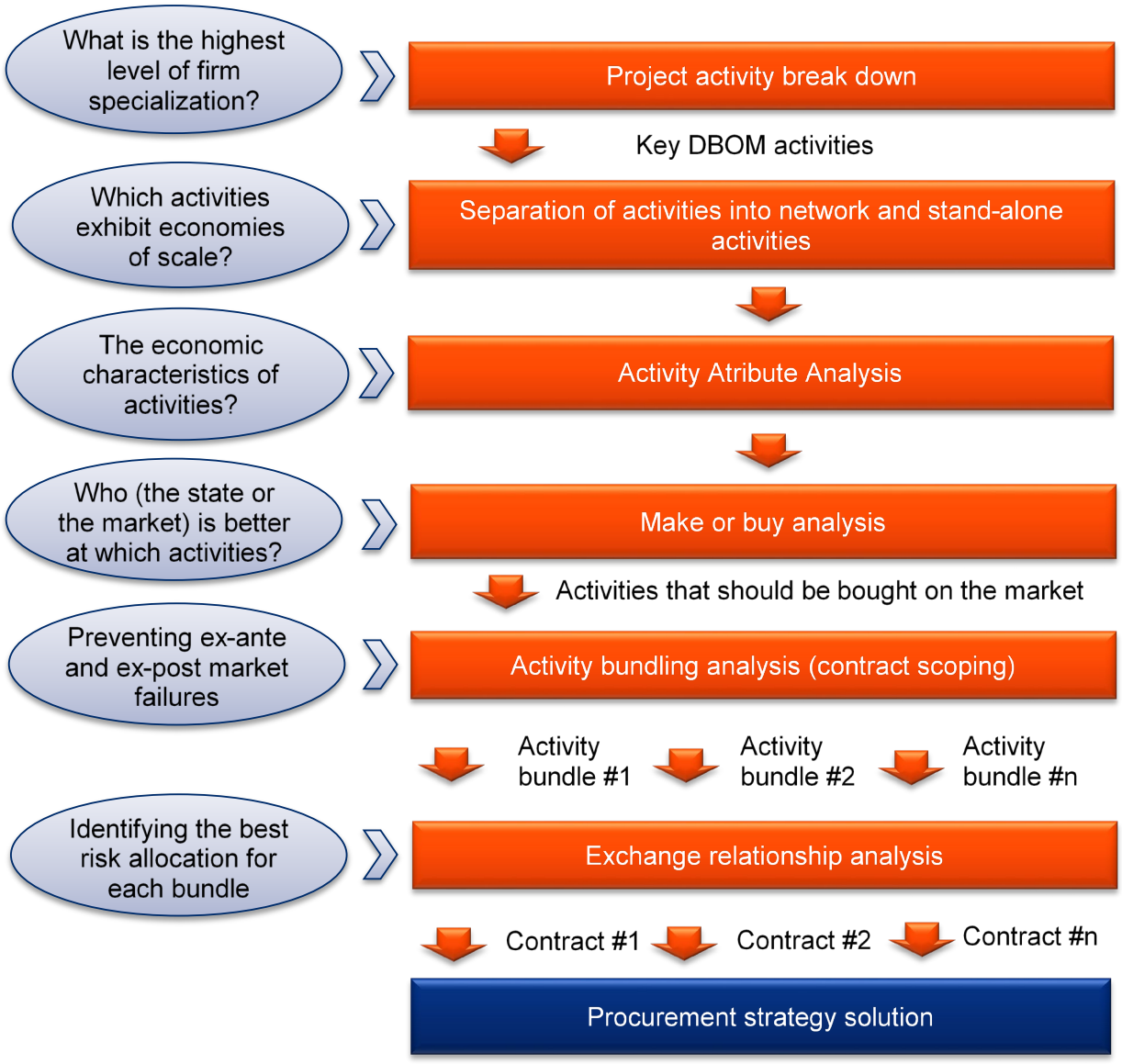
28. STEPS is a structured analytical process, which consists of six steps. The first three prepare the inputs for the analysis, while the last three address a different layer of the procurement strategy in each step. Figure 2.1 outlines the six steps, with subheadings below providing more details about each step.

29. A necessary prerequisite for the use of STEPS is that at least an outline/schematic design is available for the project to be procured as that will make it possible to identify basic design, build, operate/maintain activities (i.e., 10-15% of the engineering complete). Alternatively, though more challenging, a start with only a functional specification could be possible as well. A good understanding of the structure of the market will also be necessary. In terms of the project development cycle, STEPS would be used to plan a procurement strategy immediately after a formal decision to build has been made, i.e., after the project appraisal stage and before any decisions are made on contracting or procurement. STEPS was specifically developed to aid in the procurement of services or objects (including infrastructure) that are:

- Bespoke, i.e., custom made and cannot be "bought off the shelf"; and
- Not trivial in terms of capital spending, i.e., it will not make much sense using STEPS on smaller projects, where dozens of potential contractors exist that could deliver the project. What is "small" must of course be taken in the context of the country where the analysis would take place.

30. Lastly, STEPS considers the existing capacities of the procuring entity as well as the existing structure of the market. However, it is also forward looking in the sense that it can inform what capacities or capabilities a procuring entity should build, given the frequencies at which it is pursuing particular services or products.

**Figure 2.1. The sequence of analysis in STEPS**




## 2.1. Preparing the inputs for the analysis

31. In the first step, the project is broken down into activities on which the analysis in the remaining steps will be performed. The activity breakdown needs to be performed by an expert practitioner, who understands the supply chain of the works involved in the project well. Activities should be technologically bounded[5] in the sense that each activity represents the highest level of firm specialization for a trade on the market. For example, if firms exist on the market that specialize in excavation works, then that would

[5] This is also in line with the Transaction Cost Economics (TCE) theory, whereby a transaction cost occurs when goods or services are transferred across a technologically separable interface with distinct technology and distinct knowledge or skill sets (Williamson, 1985[48]).

be a separate activity. It is also important that defined activities are not financially trivial to keep the analysis practical.

32. In the second step, it is determined whether any maintenance and operation activities have a network character or are from the client's perspective standalone activities in their project. Network activities are those, which are both recurring and similar to already occurring activities on other assets of the same type. They are to be treated separately in the analysis. For example, a public client may procure a new road section in a road network. If they are considering bundling the maintenance of the road with the design and construction with the contractor, they must consider the trade-offs of not entrusting the maintenance of the section to contractors already managing their existing network. The same would apply in a situation of school building maintenance for example. This question, among others, concerns, for example, economies of scale in this instance.

33. Before engaging in setting up the procurement strategy, each activity is analysed to determine its economic attributes. This is the role of the third step. The attributes are outlined in Box 2.1 and are based on two economic theories - Transaction Cost Economics (TCE) and Resource Based Theory (RBT). The attributes represent insights of economists in terms of what drives firms to insource or outsource activities and/or how to bundle them in contracts. In the TCE view, insourcing occurs primarily to avoid opportunistic behaviour by the contractors after the contract has been signed. The TCE can help us understand problems that can occur after the contract has been signed. In the RBT view, firms insource to secure a temporary or sustainable competitive advantage. The attribute of a sustainable competitive advantage implies market structure, i.e., there can only be one or a few firms that can have a sustainable competitive advantage relative to others. Hence, the RBT can help us understand issues pre-contract, such as when we can expect issues with low competition for the contract.

34. The model treats the two theoretical views as complementary, depending on the context (see Chapter 5 for details). The economic attributes of activities are determined through a questionnaire that leads to clear answers in a semi-structured interview. This could also be supported by a market structure/supply chain (e.g. a Structure Conduct Performance) analysis procured from a consultancy.

### Box 2.1. Economic attributes of activities used in STEPS

Asset specificity – Refers directly to investment. It reflects the extent to which an investment is durable and transaction specific, and thus cannot be *redeployed* without sacrifice of productive value should the transaction be terminated prematurely (Williamson, 1985[17]). So asset specificity reflects the value of a particular investment (in an asset, physical or intangible, like knowledge) in alternative transactions (uses). If a value of an asset is highly dependent on a particular transaction, then the asset specificity is high.

A common example for public infrastructure clients is temporal asset specificity, which occurs when one contractual party faces a hard time constraint. There are five more types of asset specificity. Asset specificity is a concept that is to be strictly considered in terms of investments in assets or circumstances after the contract has been signed.

Uncertainty – Transaction Cost Economics (TCE) distinguishes between two types of uncertainty. The first is exogenous and relates to unexpected events outside the influence of contractual parties. Endogenous uncertainty on the other hand has to do with the behaviour of contractual parties. In TCE, uncertainty is a driver of the need for renegotiations after the contract has been signed, because all eventualities could not be foreseen in the contract. In conjunction with asset specificity and opportunistic behaviour hold-up results. In practice, this can manifest in contract renegotiations, leading to delays or cost overruns. The key OECD amendment here is that uncertainty also matters as a driver of inefficient risk pricing during the tendering stage, which has major implications when considering delivery models that bundle project phases or payment mechanisms with strong incentives (e.g., lump sum with penalties for delays).

Frequency – This attribute concerns how often a particular non-trivial activity (in terms of cost) is required by the buyer (the pipeline). It is not meant as an absolute measure. Instead, frequency should be considered relative to the leading firms on the market, which implies they are also the most efficient and effective. Those firms will have attained certain economies of scale and experience (learning economies - learning to deliver at an activity more efficiently if done often). Very serious reasons would need to exist to make insourcing a preferred option for a public client, even if with a high frequency of demand. This is because state ownership is subject to weaker incentives for efficiency than the private market. A key consideration here is thus, whether the public client requires an activity very often (high frequency), whether that particular activity regularly leads to competition failures or contract execution issues. Another key aspect is the level of investment (in time and money) needed on the side of the public client to insource a particular activity or build expertise.

Rarity – As long as an asset (or capability) that allows a particular activity is less than the number of firms needed to generate perfect competition (i.e. a situation in which all firms are price takers), that asset is considered rare.

Costly to imitate – Assets (or capabilities) that lead to a competitive advantage may be tangible (e.g. specialized equipment) or intangible (e.g. knowledge/expertise, firm culture). Regardless, some may require relatively higher investment in terms of time and money to develop than others.

If an asset is considered both rare and costly to imitate (requires a lot of time/effort/money to develop), very few firms on the market will likely possess both characteristics, suggesting there is a risk of competition failure when procuring such activities.

## 2.2. The make-or-buy analysis

35. Once the activities have been identified in the fourth step of the tool, the actual analysis of the procurement strategy begins. The first determination to be made is which activities should be delivered in-house and which should be bought on the market. In principle, most of the activities for which a market exists will be outsourced. In particular circumstances, however, an activity is better executed in-house. A simple example is provided in Box 2.2.

### Box 2.2. City transport infrastructure design services in Tallinn

Activities which are frequently needed but for which no real competition has formed in the market can provide a case for insourcing. As an extreme example, the Tallinn City Authorities recently entered a third consecutive seven-year contract with a private company that handles the cities' infrastructure design and procurement (ITF, 2020[18]). This is a core function is needed by the city on an ongoing basis. If the services were specific and the scale of demand small, there was no case to pursue an establishment of a competitive market. If the firm was predominantly dependent on the income from the city, the city could use that as leverage to buy the firm. Alternatively, if the knowledge and capabilities that the firm possessed could be rebuilt within a relatively short amount of time, the city could build its own department to handle such activities.

36. The basic mechanics (in terms of project delivery efficiency!) behind the make or buy decision for a public client are no different from those observed in private firms when they decide whether to subcontract or develop a particular capability themselves. In the public sector however in the presence of multiple political interests and/or objectives, delivering a project at the lowest life-cycle cost may not be the only concern. STEPS does not treat political economy considerations and, focusing purely on project delivery efficiency. Research literature reviews have determined that in competitive markets public ownership and governance are known to exhibit weaker incentives for efficiency (Megginson and Netter, 2001[19]). Accordingly, STEPS seeks to outsource activities by default when a competitive market is available (and the frequency variable is low). With this however it does not force the public decision maker into an overly narrow definition of his objectives. If the tool would identify activities, which in terms of characteristics should be bought from the market, the buyer would have to provide some high-powered political economy arguments, why they would insource regardless and that would have to be documented. So in that sense this is one example how STEPS increases the transparency of the decision-making process.

37. Two key issues that the tool is trying to avoid in the make-or-buy and activity bundling (i.e. contract scoping) stages are pre- and post-contract failures. Pre-contract failures relate to the creation of bundles of activities, or contracts that will attract very limited competition. Post-contract failures refer to hold-up. A brief description and examples of the two cases are provided in Box 2.3. The tool addresses these two challenges by recognizing which are the types of activities that could lead to reduced competition or hold-up, and excludes them (provided this is physically practical) from bundles with other activities, where effective competition without hold-up is expected.

### Box 2.3. Competition failures and hold-up

When contracts are reasonably well-defined (i.e., complete), economic theory proposes that up to a point more competition or more bidders is generally a good thing (Bulow and Klemperer, 1996[20]; Bulow and Klemperer, 2002[21]). This is not to say that the benefits of additional bidders improve the result in a linear fashion, but it is obvious enough that five bidders are better than two.

If contracts cannot be complete a lot of bidder interest is not necessary a good sign[6]. Large bidder interest can also signal that the potential contractors have sensed weakness in the tendering documentation that create ample space for renegotiations after the contract has been signed. And these in turn allow for additional revenue for the contractor. While it is relatively easy to spot weak competition, it is not possible to easily empirically determine when the level of competition is too good to be true.

Weaknesses could be, for example, errors and omissions in design documentation, which is a common and the second most important direct reason in road infrastructure that leads to cost overruns in Design-Bid-Build projects (Makovšek, 2013[21]). The extent of cost overruns and/or delays will, however, strongly depend on the context and nature of activities involved in the execution of the project, i.e., the bargaining power of the parties to the contract after it has been signed.

If a contract cannot include every eventuality that might occur (which is true for most infrastructure related contracts), and if either contractual party made a prior commitment from which it cannot back out (asset specificity) without great loss, then a hold-up situation will emerge.

The hold-up problem is a situation where the bargaining position of parties after contract signature can change due to a prior commitment already made by one of the parties. It requires two ingredients: 1) uncertainty, in the sense that all eventualities cannot be captured in the contract (i.e., the contract is not complete), and 2) asset specificity (already described in Box 2.1). If an event occurs after the signature of the contract that was not pre-defined by the contract, a renegotiation is necessary and then the shift in bargaining power due to asset specificity leads to a hold-up.

The formal reason for the renegotiation (e.g. unexpected geological conditions) is less relevant; it is the asset specificity or prior commitment that drives the bargaining power. Changes per se will lead to some variation claims/cost increases, but it is the hold-up that represents a top-up to these claims due to bargaining power.

For example, let's say the government is building a major new sports stadium as part of the preparations to host the Olympic games. Many contractors bid and the government has signed a contract. Midway through the contract execution, unexpected issues arise that were not foreseen in the contract and that could lead to a significant delay. If this was any other stadium, this would not be a major issue and a contractor could share the responsibility for the issue or negotiate some extra payment. But since the contractor knows the government would be exposed to major international embarrassment if the stadium's completion were late, the bargaining power shifts to the contractor as soon as the contract is signed. In any negotiation, the payoff for the contractor will be much higher than in a case where hold-up does not exist.

And a different example with physical asset specificity this time, let's say the government is purchasing submarines, which it wants to customize. If the customisation cannot be fully decided in advance of construction and the changes involve proprietary knowledge/solutions by the supplier, the government will effectively be in a hold-up situation. Getting out of this situation/switching the supplier could be extremely costly, especially if the proprietary solutions are critical to the functioning of the submarine or are incompatible with the solutions of other suppliers. Effectively, once the construction begins, the bargaining power of the supplier could be very high.

38. Going through a dedicated questionnaire allows the economic attributes of each activity to be determined, and it will become apparent that each activity can be assigned to one of six attribute patterns as seen in Table 2.1. The patterns help aggregate or translate the economic attributes into procurement strategy decisions and are, in turn, described below.

### Table 2.1. Six patterns of economic attributes, which lead to outsourcing

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Make-or-Buy) |
|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | Low or High | Low or High | High | High | High or Low | Internal |
| 2 | The buyer is better | Low or High | Low | High | Low | Low | Internal |
| 3 | The buyer is just as good, hold-up managed through insourcing | High | High | High | Low | Low | Internal |
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | External |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | External |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | Low or High | External |

Source: Adapted based on (Bridge, 2008[23])+ (Bridge and Tisdell, 2004[23]).

39. The matrix is built so that the patterns one to three, and three to six represent diametrically opposite positions in terms of the capability to deliver a particular activity - a capability spectrum. For the buyer to reach the level of capability that exists in pattern six, they would have to invest substantial resources and time to reach the level of capability and/or efficiency of firms on the market. Box 2.4 illustrates why the capabilities of the buyer matter.

[6] This proposition stands separately of the winners curse problem, which in infrastructure procurement can be well managed by a competent procuring entity. Winners curse occurs because of two reasons. One, because the contractor has underestimated the true cost of the project due to uncertainty. And two, because the contractor is in financial difficulties and is looking to secure an additional cash flow at any cost, hopping that with more time he can resolve his issues. The first can be resolved by a decent unit price database system and a fully costed reference design, which provides a benchmark about the true cost of the project (this is something the tool already proposes as a measure to reduce pre-contract uncertainty). Bidders who depart substantially from this benchmark without a good explanation (a novel technology or solution) can be disqualified. The second is successfully dealt with through bidder pre-selection and financial guarantees.

### Box 2.4. An illustrative example of differences in capabilities and insourcing decision

Let's take a jurisdiction (e.g. country, region or municipality) that currently only manages contracts and has some in-house capability to perform engineering supervision. If it decides to build its own tunnel boring machines, of which it currently has practically no knowledge, it would have to make a substantial investment in time and effort to develop the necessary knowledge. To even consider such a decision, the amount of tunnelling of the jurisdiction every year would need to be considerable, i.e., such that the knowledge, experience, and the resulting cost efficiency, could eventually come close to the leading firms on the market. State ownership, however, brings with itself weaker efficiency incentives. Thus, even if the amount of tunnelling required every year were considerable (high frequency), the insourcing decision in this example would only make sense if the jurisdiction identified a persistent competition (market) failure that could not be addressed through market regulation and/or it was at risk of hold-up.

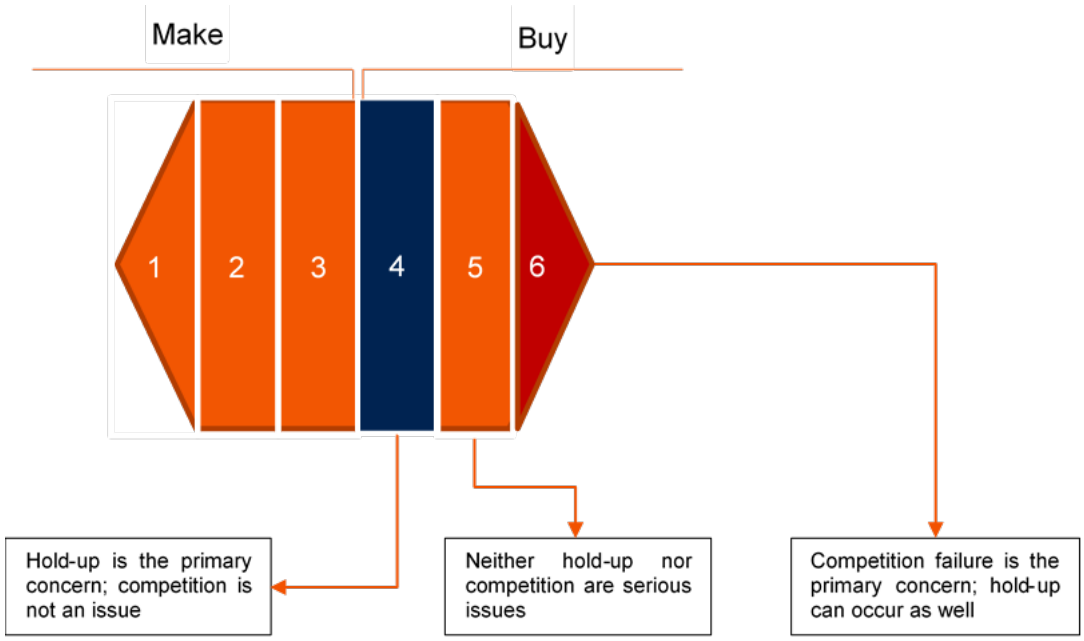
40. In patterns six (and one), the RBT variables (rarity and costly to imitate) dominate. If an activity falls in pattern six, the first issue to be considered is the competition failure, and only after the possible existence of hold-up. This is because the RBT variables also suggest the market structure. For example, a firm that produces an activity that is rare and at the same time costly to imitate, is likely to be a market leader or there will not be many firms that have that capability. A good level of competition is expected at patterns four and five, where all firms are price takers earning normal returns.

41. For activities that fall into patterns three or four, the competition failure is no longer a primary issue. As these activities do not involve any capabilities that are rare or costly to imitate, there will be many firms that are able to produce them and a desired level of competition present. However, they have characteristics that will lead to hold-up of the buyer (recall temporal specificity and the sports stadium example).

42. If the economic attributes of a particular activity suggest it is a better match with pattern 1-3, then that activity should be insourced by the public client. The patterns which imply it is best to buy the activity on the market are marked 4 to 6. This is reflected by the "Governance" column. A key prerequisite for this decision is frequency.

43. Figure 2.1 summarizes the expected market structure across the patterns with the height of each pattern illustrating, whether we can expect to find many or few firms (on the right-hand side). It also summarizes in which patterns we expect to find procurement failures.

**Figure 2.2. Market structure and the patterns in the tool**




## 2.3. Activity bundling (contract scoping) analysis

44. The bundling analysis is conducted using the outcomes of the previous step i.e., which activities were assigned to what pattern and considering the life-cycle interdependence of activities. The original QUT approach relies on the standard predictions of economic theory, whereby bundling of activities across project phases leads to more complete contracts with less need for renegotiations and is compatible with high powered incentives, such as lump sum price and fixed date of delivery. Bundling also allows synergies such as greater opportunities for innovation (when bundling the design and build phase) or in terms of life-cycle cost optimisation (when bundling design, build, operations, and maintenance phases).

45. More recent findings highlighted in Chapter 5, however, show that bundling (or long-term contracts) is subject to serious trade-offs as well and may lead to high infrastructure cost. Bundling across project phases increases the exposure of bidders to uncertainty during the bidding phase. Designs in the bidding process will not be completed when they are priced, while the default lump-sum payment mechanism increases the pressure on the contractor. The presence of uncertainty makes competition outcomes less efficient and can lead to disproportionately higher cost of infrastructure.

46. In the context of STEPS the OECD thus conservatively recommends the use of bundled delivery models only if two pre-conditions can be fulfilled. Firstly, a targeted effort is needed to reduce pre-contract uncertainty. Second, the client pursuing a bundled delivery model must strongly expect superior improvements (e.g. superior engineering solutions) in the project that would otherwise not be achievable. Box 2.5 provides more details. A full exposition can be found in Chapter 5.

### Box 2.5. Bundling across the life cycle – two key considerations

To reduce pre-contract uncertainty, recent research revealed a targeted effort by the procurement authority is possible. This will include the pursuit of a joint risk register; detailed and fully costed design with degrees of freedom where innovation is desired… (Kennedy et al., 2018[24]). These measures are now part of STEPS in the form of a checklist (Annex A) with questions that should be addressed in all contracts that bundle activities across the project delivery phases. These measures though are not necessarily sufficient in themselves to resolve the challenge of bundled delivery models.

Available evidence (Makovšek and Bridge, 2021[25]) indicates that the average cost overruns themselves in DBB projects are too low to justify a cost premium arising from DB or EPC contracts. Significant improvements above and beyond the DBB (with a value engineering) approach would have to be found as well. At present, STEPS is not equipped to help objectivise that decision. Nye Veier believes that an experienced client can make such a determination effectively itself.

47. Adopting the caveats above, the starting principle of STEPS is to bundle activities to reduce the number of interfaces across many contracts. Where the client has sufficient in-house capabilities, STEPS will also seek to bundle across phases (i.e. DB and where required DBOM variants). For activities that would create pre- or post-contract failures, several solutions are offered, such as an exclusion of an activity into a separate contract or if that is not possible a tri-partite agreement, with a nominated supplier. In the latter case for example the procuring entity enters a direct negotiation with a pattern 6 supplier to negotiate a price. That supplier is then becomes a nominated supplier at the pre-agreed price in the contract of (non-problematic) pattern 5 activities, for which a separate competition was organised.

48. For procurement authorities that do not use bundled formats at all e.g., no DB or DBOM contracts and rely on DBB contracts only, STEPS will still avoid the creation of bundles that mix pattern 5 activities with those that lead to hold-up or competition failures.

49. For every created bundle of pattern 5 activities, a check is made whether we have not made a contract that is too big, thereby inducing a competition failure. Should that be the case, another iteration will be necessary, creating more than one pattern 5 bundle.

50. Concluding the bundling section, we note that the implications of PPPs (e.g., DBOM contracts) go beyond the focus in this phase of STEPS. The ITF at the OECD recently concluded one of the largest investigations into the rationale of PPPs or DBOM contracts. Box 2.6 summarizes some of the key points on the role private investment can play in infrastructure and the boundary conditions, in which PPPs might deliver value for money.

### Box 2.6. International Transport Forum work on PPPs

In 2018, the International Transport Forum at the OECD (ITF) completed one of the largest projects in terms of experts and countries involved on the role and the economics behind private investment in infrastructure, involving more than 30 experts, academics and practitioners, from 13 countries. It was determined that PPPs, which are based on the competition for the contract, cannot improve project selection (prevent white elephant projects), do not create additional budgetary space for governments, and can offer superior productive efficiency only in specific circumstances.

The existing evidence indicates that a single competition for a long-term contract is unlikely to deliver Value for Money for at least two reasons.

First, the construction and maintenance contracts in PPPs must rely on fixed date and fix price delivery requirements. Recent evidence also covered in Chapter 5 indicates that this increases the uncertainty contractors face in the bidding process and leads to excessive contingencies, driving project cost above and beyond the traditional procurement approaches even before the added cost of financing are brought into the discussion.

Second, the rigidity of these long-term contracts implies that there will be no further incentives for efficiency (other than the initial competition and agreed performance indicators), which in a changing environment will invariably require renegotiations. In any renegotiations in mature institutional environments, the public client will suffer from severe information asymmetry, where the private operator will have the bargaining power.

The ITF concluded that PPPs would be expected to yield superior value for money only in circumstances where continuous pressure for efficiency was present. For example, sea and airports which are serving the same catchment area are effectively competing with the quality of their service for demand. A key precondition is that the demand must be strongly endogenous, i.e., strongly responsive to service quality.

In all cases where continuous pressure for efficiency cannot be assured (e.g., social infrastructure, road PPPs…) the ITF proposed the regulatory asset based (RAB) model as the preferred option, if private investment is to be pursued. RAB models are commonly used in the regulation of privatized utilities. In the case of RAB, a specialised agency (a regulator) is set-up, which is supposed to continuously benchmark and measure the performance of the private operator. Periodic price reviews (renegotiations) are built in the contract with the private operator (a license), which provides a much better negotiation position for the public sector as well as the continuous incentives for efficiency, missing in a PPP. Moreover, conversely to PPPs in a RAB it is the nature of the capital projects that drives the choice of the contracting arrangement with the suppliers (procurement strategy) and not the choice of the financing model.

Source: (ITF, 2018[16]).

## 2.4. Exchange relationship analysis

51. With activity bundles prepared the next step is to determine, what should be the exchange relationship or the incentive principle governing each bundle. In standard economics, the key driver of exchange relationship decisions is whether in competitive procurement a reasonably complete contract can be created, i.e., a contract in which there will be little or no need for renegotiations. As the uncertainty involved in the delivery of the project increases, creating/writing a complete contract becomes ever more

costly and complicated. Contractual solutions in competitive procurement first try to accommodate uncertainty until its extent is such that low price/best value competitive procurement must be abandoned.

52. The STEPS does not go into the details of exchange relationship (payment mechanism incentives) to be proposed but assigns one of the three broad options:

a) Input- or rate-based, includes mechanisms to manage uncertainty over one or a few dimensions. This is the most used type of contract, where the works can be reasonably estimated, but not the exact quantities. In a bill of quantity approach, the bidders offer unit prices against a list of works and the respective estimated quantities. If these turn out to be different during the project execution, the quantity for a particular task is adjusted and priced at the agreed unit price. In tunnel construction for example, more complex mechanisms can be applied, which accommodate uncertainty over multiple dimensions (as in the Austrian "matrix" method or ÖNORM B 2203-1 standard).

b) If works considered are relatively simple or uncertainty during delivery can be managed by bundling across project phases, the most elementary approach are outcome-based lump-sum contracts. A fixed price for the entire project is defined in advance. In larger contracts these can be accompanied by strong threats for non-performance (e.g., larger performance bonds, liquidated damages…).

c) If uncertainty in the project is too great to manage by adaptive mechanisms or bundling, then low price/best value competition must be abandoned in favour of collaborative approaches. Various variants of collaboration exist. The payment mechanism in this case will involve a fair amount of risk sharing and will typically involve a pain/gain mechanism such as the target price.

53. Following the recommendations outlined in Chapter 5, STEPS would apply incentive mechanisms as illustrated in the Table 2.2 below.

### Table 2.2. Which exchange relationship for which pattern

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Exchange relationship |
|---|---|---|---|---|---|---|---|
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | Collaborative contracting/target price |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | Context dependant: Lump sum/best value competition, or Rate based |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | High or Low | Rate-based competition in all cases |

Source: Adapted based on (Bridge, 2008[23])+ (Bridge and Tisdell, 2004[23]).

54. Under the standard bundling assumptions, collaborative contracting would only be used for pattern four because uncertainty is very high and competition would not yield any significant benefits due to post contract hold-up. At the same time, the competences of the buyer and supplier are similar, so the public client can effectively collaborate with the private contractor. The primary logic here is that hold-up leads to an inefficient exchange, which competition cannot resolve. The use of collaborative contracting also requires strong in-house capabilities.

55. In pattern five, there are many firms so competition isn't an issue and uncertainty is low. In chapter 5 we lay bare the empirical evidence which suggests that bundled delivery models (DB, EPC, ECI) should only be used, where the public client has a very strong expectation (especially if applying collaboration) that significant superior engineering solutions will be found above and beyond the DBB approach. Due to low uncertainty, there is no case for collaborative approaches in construction as reasonably complete contracts can be made.

56. In pattern 6 activities, a competition failure is expected (very few bidders), which may be accompanied by hold-up. Rate-based competition is advised here. Collaboration cannot be an option, because pattern six implies the existence of one or very few firms with highly specific knowledge/resources on which their competitive advantage is built. STEPS assumes this level of competence is too far ahead of the buyer/the public client to effectively engage in collaboration.

### *2.4.1. Implications of systematic use of STEPS*

57. Once a STEPS application has been applied on a few cases there is no need to repeat the whole data collection and analysis on the next similar project in the same project portfolio that speaks to the same market (e.g. a road programme). If the activities are the same and speaking to the same market/supply chain, the RBT evaluation will turn out practically the same. What may not necessarily be the same are asset specificity and uncertainty as these may be different depending on the project and context in which it is procured. If there is a shift in the market structure, then RBT variables should be revaluated as well.

58. Ideally, the use of STEPS should be mandatory on projects above certain value threshold. This could be for example EUR100 million in mature markets like in the EU. It could also be a lot less in cases where the top ten contractors are companies, which are much smaller than the top players in EU. Irespective of the value the nature of the projects will also matter. If the projects are novel or complex or requiring a number of activities, which are not broadly produced by the available firms on the market, the application of STEPS may also make sense.

59. In the long-term and pending sufficient international adoption of STEPS, a network of practitioners could be established to exchange best practices and resolve issues encountered in the use of the tool. A systematic adoption of STEPS would also work towards a range of public policy objectives highlighted in the OECD Recommendations of the Council on Public Procurement (OECD, 2015[4]), Recommendations on Infrastructure Governance (OECD, 2020[7]), G20 Principles for Quality Infrastructure Investment (G20, 2019[5]), Recommendation of the Council on Fighting Bid Rigging in Public Procurement (OECD, 2012[2]), OECD Principles for Integrity in Public Procurement (OECD, 2009[1]), G20/OECD High-Level Principles of Long-Term Investment Financing by Institutional Investors (G20/OECD, 2013[3]) Quality infrastructure compendium (OECD, 2020[6]), and other recommendations or tools. Below are specific examples how STEPS matters for broader public policy objectives:

a) STEPS improves the Value for Money propositions of both traditional and privately-financed infrastructure projects, by avoiding competition failures, hold-up, and risk allocation/exchange relationship failures.
b) Through improved Value for Money and a transparent procurement strategy, STEPS would effectively improve the political viability of privately-financed infrastructure projects.
c) STEPS works against corruption in public procurement. It does so by introducing a replicable analytical procedure, substantially reducing subjective decisions in procurement, in effect allowing an audit. This implies a greatly increased transparency. In addition, as is now the case with Cost Benefit Analysis in France, eventually projects could become subject to external quality assurance (audit) to ensure public organisations are using the tool and doing so effectively.

d) STEPS works against bid rigging, by avoiding procurement failures, e.g., a small number of bidders, which would make it easier for them to coordinate. Where competition failures are unavoidable, their impact is limited to specific project activities that cause them.

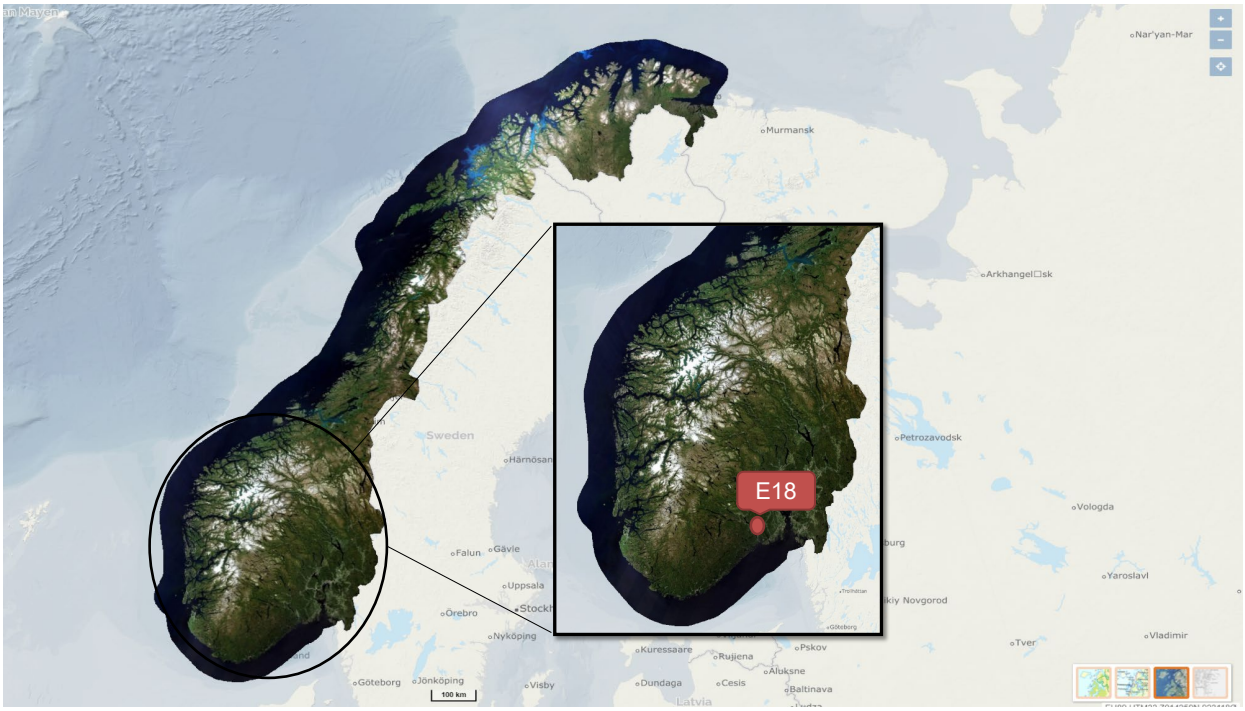
e) STEPS works against the effects of abnormally low bids. A successful abnormal bid assumes that the bargaining power after the contract signature will allow the contractor to renegotiate the contract. STEPS can help contain the impact of abnormally low bids by avoiding or insulating the cases of activities where hold-up arises.

f) STEPS helps make the choice for the procurement of collaborative delivery models more objective, thus identifying cost-effective opportunities to promote innovation.

g) Because the procurement choices of the public sector impact the market structure of the infrastructure supplier market, STEPS could also be considered an instrument of implicit market regulation, working against excessive market concentration.

# 3 Application of the tool - The case of E18 Rugtvedt - Dørdal

60. The E18 was the first of the two roads that were proposed by Nye Veier for analysis and construction of a counterfactual. The E18 is a 16.5 km section of 2x2 lane motorway. The project included the construction of 27 structures, including 15 bridges. Following a competitive process with negotiations, a DB contract was signed on the 10th May 2017 and the road became operational on the 2nd December 2019.




Source: www.norgeskart.no.

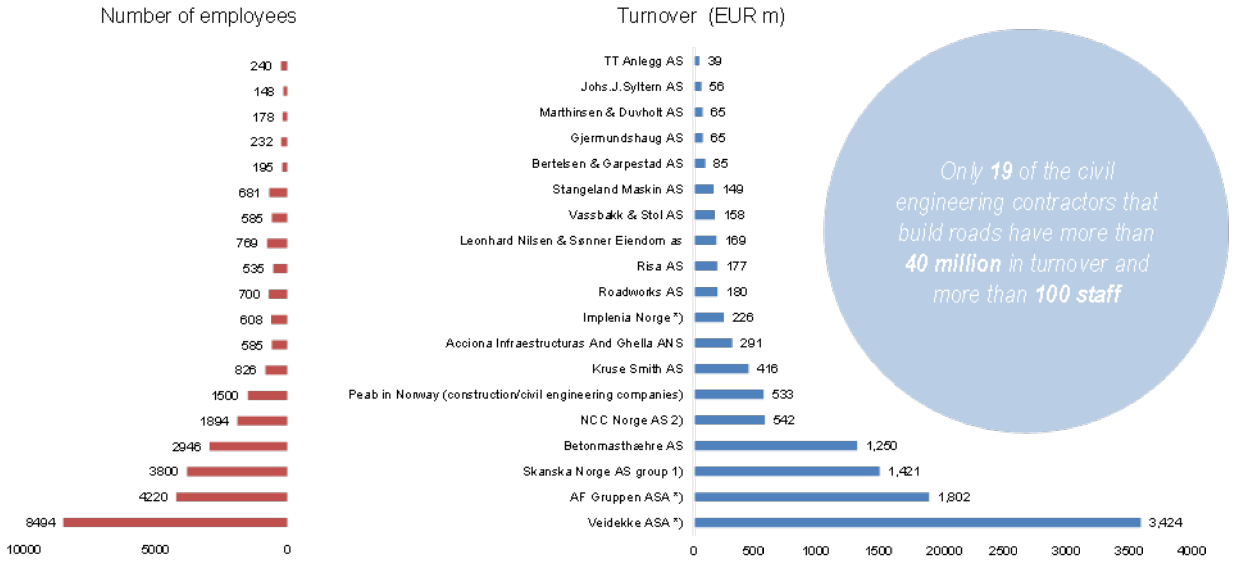
61. In the subsequent sections we will briefly outline the market context in which the E18 was procured, general information about the procurement process including efforts by Nye Veier to reduce pre-contract uncertainty, and the results of the STEPS.

## 3.1. The relevant procurement market for the E18

62. Nye Veier performed a market analysis to identify the maximum contract size that could avoid competition failures both in terms of too few bidders as well as contractor financial failure. Nye Veier found out that that there are 19 civil engineering contractors in Norway (Figure 3.2) that engage in on road construction and have a turnover of more than EUR40 million (NOK 400 million). To manage the risk of the potential financial failure of contractors, Nye Veier decided that:

- the annual turnover of a contractor over the last three years should be at least 1/3 of the value of the contract
- equity should be at least 1/8 of the value of the contract
- liabilities should not be larger than 7x the value of equity

### Figure 3.2. Top 19 Norwegian contractors who are active in road construction




Source: Nye Veier A/S.

63. Based on these criteria and the continuous participation of several foreign bidders, Nye Veier decided that contracts with an average value of about EUR250 million should not adversely affect competition. The assumption here was that the contractors were not operating at capacity, i.e. could actually engage if extra work became available.

64. While no separate analysis documentation was made available regarding the design bureau market in Norway, interviews with Nye Veier revealed that a significant number of design bureaus are active in Norway on a national scale. Competition would only become an issue if for whatever reason potential bidders would need to be local.

## 3.2. The procurement process and reduction of pre-contract uncertainty

65. The choice of the bidder selection process is the most well-grounded part of the procurement strategies and effectively represents auction theory insights operationalized in law. It is commonly enshrined in the legislation (as in the EU directives) and is subject to extensive additional guidance when

a particular selection process is more or less appropriate. What has to-date received insufficient attention, is the subject of pre-contract uncertainty and how this can be mitigated through this process.

66. For the E18 Nye Veier chose the following procurement process:

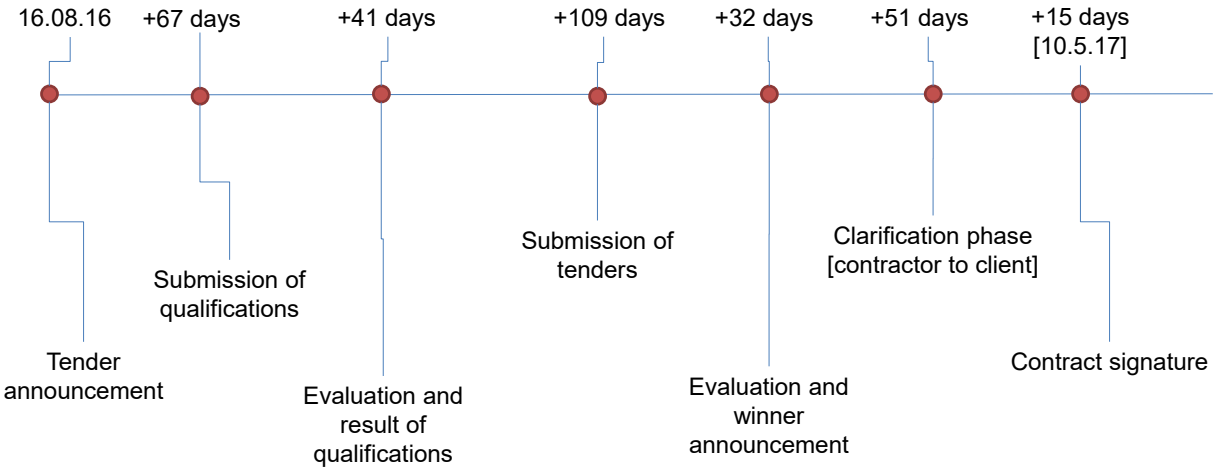
a) A pre-selection is made following the qualifying conditions outlined in the market analysis section, including further qualitative aspects (standards pertaining to social responsibility, safety, security, environment, quality, and risk management in general e.g., ISO9001, 14001, 31000) were used.
b) The maximum number of bidders that would be invited to compete and the process of elimination were all transparently revealed in the tendering documentation (an evaluation is made based on clear criteria to select those bidders whose references are closest to the project being tendered).
c) The winning bidder was selected through “competition with negotiation”. According to Nye Veier though, the “negotiation” (dialogue to facilitate an increased pre-contract exchange of information) in this case was not used, since the projects were deemed too simple.
d) The criteria for the selection of the best bidder were grounded in best value. Price had a weight of 25%.
e) Standard financial guarantees were included in the contract (10% performance guarantee).
f) A maintenance option was initially included in the tender, but was then not used by Nye Veier.

67. With regard to the pre-contract preparation, de-risking, i.e., reducing the uncertainty for the bidders in a targeted fashion (as proposed by (Kennedy et al., 2018[24]) is essential for ensuring an efficient outcome of competition. This is especially important in any competitive process, where the bidders have yet to develop a design before they can price it. The OECD has discussed the measures undertaken by Nye Veier and concluded that the approach taken is very close to best practice (see 5.3.2.Annex A).

68. In particular, Nye Veier checked the box on several key points. For example, they produced a fully-costed design with a default zoning plan, leaving the bidders the freedom to make changes only where they saw an opportunity for improvement. For the bidders invited to compete, a partial compensation for the design work was provided to all bidders that submitted a complete bid and lost[7]. This should have represented an additional stimulus to bid aggressively and focus on design improvements. A reasonable tendering schedule was also put in place with more than 3 months for the bidders to work on their designs (Figure 3.3).

[7] Nye Veier estimates that the compensation of about EUR200 000 amounted to less than 1/2 of the cost actually incurred (the winner was not compensated).

**Figure 3.3. Key milestones in the E18 tendering process**




Source: Nye Veier.

69. In the procurement process, 9 firms expressed an interest in qualifying, 1 firm was disqualified, 4 were invited to tender, and 3 tenders were submitted with 1 firm not submitting a tender due to lack of capacity. Hence, there was effectively 7 firms that were willing and able to express an interest in this competition. The in-house estimate of the project was EUR240 million. The winning bid amounted to EUR170 million. The second bidder bid was EUR221 and the third bidder bid was EUR239 million. The winner was a Norwegian incumbent with a Polish specialist subcontractor for bridge building. Nye Veier could not fully explain the substantial difference between the in-house estimate and the winning bidder (e.g., whether the estimate was less robust or whether the Polish subcontractor bid low to enter the market).

## 3.3. The application of STEPS

70. Having reviewed the market context in which road projects in Norway were procured and the setup of the procurement process, the application of STEPS could begin. Based on the description of the tasks in the project and following a machine translation, an activity analysis was first performed by the OECD with the help of a QUT civil engineer. Further data was collected through in-depth semi-structured interviews over the course of two weeks, with video interviews about three times per week, lasting a few hours each time. All the intermediate and the final results were reviewed by Nye Veier to prevent any misunderstandings in terms of language or local context.

### *3.3.1. Activity analysis*

71. The activity analysis (the process of which was described in the preceding chapter) yielded 78 activities across the design, construction, operation, and maintenance phases (Table 3.1). These broadly represent the highest level of specialisation on the market Nye Veier generally expects to find.

## Table 3.1. Activity analysis for the E18

| 28 x Design Activities<br>*(Project Specific Activities)* | 26 x Construction Activities<br>*(Project Specific Activities)* | 11 x Operations Activities<br>*(Network Activities)* | 15 x Maintenance Activities<br>*(Network Activities)* |
|---|---|---|---|
| • Environmental studies (remaining)<br>• Engineering survey (remaining)<br>• Geotechnical design (remaining)<br>• Structural design<br>• Fire engineering<br>• Hydraulic engineering<br>• Drainage design<br>• Inspection and maintenance design<br>• Blasting design<br>• Road safety design<br>• Geometric Road design<br>• Pavement design<br>• Landscaping design<br>• Road lighting design<br>• Noise treatment design<br>• Bridge design<br>• Dust management plan<br>• Services design<br>• Culvert design<br>• Intersection design; Ramp entrance and exits design; Provisions for pedestrians and cyclists<br>• Demolition plan<br>• Traffic management; Signals; Signs design<br>• Tunnel activities (x6) | • Site establishment and site clearance<br>• Piling<br>• Pile cap<br>• Bridge Substructure (piers, abutments, wing walls, backwalls)<br>• Bridge Superstructure<br>• Earthwork<br>• Guardrail and handrail and road furniture<br>• Bridge sign installation<br>• Services installation<br>• Trenches/Drainage<br>• Stabilising agent<br>• Pavement construction (Subgrade, Subbase, Base, surfacing)<br>• Road marking<br>• Culverts<br>• Signs<br>• Traffic signal equipment<br>• Landscaping<br>• Demolition works<br>• Noise treatments<br>• Tunnel activities (x7) | • Traffic management services<br>• Network control services<br>• Operation liaison with police and other emergency services<br>• Clearing of pavement (includes snow)<br>• Clearing of ditches and culverts<br>• Removal of debris or obstacles<br>• Tunnel activities (x5) | • Inspections<br>• Mowing and plants<br>• Pothole patching and crack sealing and resealing<br>• Repair of sealants and expansion joints of bridges<br>• Traffic signs and road markings<br>• Repair of damage caused by traffic accidents<br>• Repair of cut and fill slopes<br>• Resealing/surface dressing<br>• Tunnel activities (x7) |

### *3.3.2. Networking activities*

72. Next, activities were split along project specific and network type activities. Project specific activities are non-recurrent activities that are new and a one-off addition to Norway's existing network of public roads (managed by Nye Veier and its sister organisation Statens vegvesen). Operations and maintenance activities are considered recurring activities. STEPS will make this distinction in case the procuring entity is intent on using a PPP (which would involve bundling the DB and OM stages).

73. Nye Veier was not intent on using PPPs; hence operations and maintenance activities were excluded from further analysis. In the opposite case, STEPS would check for life-cycle interactions between DB and OM activities and consider potential competition and hold-up issues. A necessary additional consideration would also be economies of scale, i.e., what is the minimum efficient scale of separate maintenance and operations arrangements that would not lead to too much fragmentation of the existing network (e.g., recurrent activities of sufficient scale will require maintenance/traffic management bases next to the highway for rapid response).

74. At the time of writing, Nye Veier completely outsources maintenance and operations activities through one large contract, the funding of which is stable and predictable so maintenance can be planned efficiently. The E18 will be integrated in this contract. Only the planning, supervision, and procurement roles in-house. The relevant market for maintenance and operations are both Norway and Sweden in which 5-6 large contractors operate, with a very vibrant market of smaller subcontractors.

75. Lastly, Nye Veier also reported that the current system with construction contractor quality warranties and work supervision works well. No significant post construction issues with quality were experienced to date.

### *3.3.3. Economic attributes of activities*

76. The economic attributes of activities were informed with a set of guiding questions, which required answers to each activity. In the beginning, much of the time in the interviews was spent clarifying the

meaning behind the economic terminology used, so that Nye Veier understood the question. Once the question was understood, the evaluation of activities was performed within a few hours.

77. The full questionnaire used to guide the interview is included in Annex B. For illustration purposes an excerpt from the results table is presented in Table 3.2. Q11c question in the table below is for example refers to the resource-based theory:

***Resource-Based Theory (market structure and capabilities)***

*Supplier/Market Capability and Capacity*

c) How much was there likely to be a sufficient supply (5 or more market firms) a) locally/headquartered within the Eastern region of Norway; b) nationally/headquartered in Norway; and c) internationally/headquartered outside Norway) capable of delivering the activity across the entire project and likely to apply for qualification. Please insert in the activity's row:
   - "Yes (Sufficient/5 or more - locally)" or "No (Insufficient/4 or less)"
   - "Yes (Sufficient/5 or more - nationally)" or "No (Insufficient/4 or less)"
   - "Yes (Sufficient/5 or more - internationally)" or "No (Insufficient/4 or less)"

**Table 3.2. Response excerpt on RBT variables**

| **Road structures activities E18 (all bridges; carriage ways; diversion road; and crossings)** | **Q11a Yes? (Capable)** | **Q11b Yes? (Capacity)** | **Q11c Yes? (=5) Local** | **Q11cd Yes? (=5) Nat'l** | **Q11ce Yes? (=5) Inter'l** |
|---|---|---|---|---|---|
| Design | | | | | |
| Geotechnical design (remaining) | No | No | No | Yes | Yes |
| Structural design | Yes | No | No | Yes | Yes |
| Fire engineering | No | No | No | Yes | Yes |
| Hydraulic engineering | No | No | No | Yes | Yes |
| Drainage design | No | No | No | Yes | Yes |
| Traffic management design | Yes | No | No | Yes | Yes |
| Inspection and maintenance (design of requirements for programmed works and reactive/routine works – **excluding** rehabilitation work) | Yes | No | No | Yes | Yes |
| Blasting design | Yes | No | No | Yes | Yes |
| Road safety design | Yes | No | No | Yes | Yes |
| Geometric Road design (including design of any collector-distributor roads and integrations) | Yes | No | No | Yes | Yes |
| Pavement design | Yes | No | No | Yes | Yes |
| Landscaping design | No | No | Yes | Yes | Yes |
| Road lighting design | Yes | No | Yes | Yes | Yes |
| Traffic Signs design | No | No | Yes | Yes | Yes |
| Noise treatment design (including fencing and noise wall strategies) | Yes | No | Yes | Yes | Yes |

### *3.3.4. Make or buy*

78. Once all design and construction activities were evaluated, they were allocated to one of the six patterns in the STEPS matrix based on their characteristics. All the activities that Nye Veier aims to buy within the E18 scope turned out to be non-problematic either from the viewpoint of competition failures or hold-up. In plain terms, this means that for each activity Nye Veier can hope to find at least 5 or more bidders expressing interest in their execution. The subcontractor/supply chain was also considered in the

interviews[8]. An important point here is that the relevant market in this case is the international market. Had Norway limited bidder participation to the national scale, competition failures would have occurred. For example, at the time of writing (for unclear historical reasons), there is a single local company in Norway that is able to engage in complex bridges. Internationally though, there are multiple companies. Given the high level of preparation for the activities completed by Nye Veier, the fact that the permit process was effectively completed by the time of the contract signature, and the E18 is considered to be a relatively simple/standard project, no opportunities for hold-up were detected.

**Table 3.3. Make-or-buy analysis**

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Make-or-Buy) |
|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | Low or High | Low or High | High | High | High or Low | Internal |
| 2 | The buyer is better | Low or High | Low | High | Low | Low | Internal |
| 3 | The buyer is just as good, hold-up managed through insourcing | High | High | High | Low | Low | Internal |
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | External |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | External |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | Low or High | External |

### *3.3.5. Activity bundling (contract scoping)*

79. Given that all activities in the E18 are pattern 5, when considering bundling, the key question is whether bundling would lead to any competition failures because of the contract size. Noting the initial market analysis and past experience of Nye Veier, the answer was not to expect any competition failures, so a DB contract was possible. With hindsight, the fact that effectively seven firms expressed an interest in qualifying is an ex-post validation of this point. In a forward looking application, if STEPS predicted no competition issues and then a competition failure would nevertheless occur, the key point for the procurement entity would be perform an analysis (engage the potential bidders) to determine, what caused the failure, so that this insight can be used to modify the questions or answers used to inform the variables.

[8] For example, one potential issue might arise when a local contractor that may be interested in bidding for this project were vertically integrated with any potential resources that could be relevant for the construction of the road (e.g., gravel pits).

## Table 3.4. Bundling analysis

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Bundling) |
|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | Low or High | Low or High | High | High | High or Low | Internal |
| 2 | The buyer is better | Low or High | Low | High | Low | Low | Internal |
| 3 | The buyer is just as good, hold-up managed through insourcing | High | High | High | Low | Low | Internal |
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | External |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | External |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | High or Low | External |

### *3.3.6. Exchange relationship analysis*

80. The lack of potential competition failures, hold-up opportunities across the contract scope, and limited complexity lends itself to a price/best value competition. Following standard economic theory, bundling would also produce a complete contract and would therefore be compatible with high-powered incentives for efficiency, i.e., a lump-sum payment mechanism.

## Table 3.5. Exchange relationship analysis

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Exchange relationship) |
|---|---|---|---|---|---|---|---|
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | Collaborative contracting |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | Lump sum/best value competition |
| | | | | | | | Rate based |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | High | Rate-based competition |

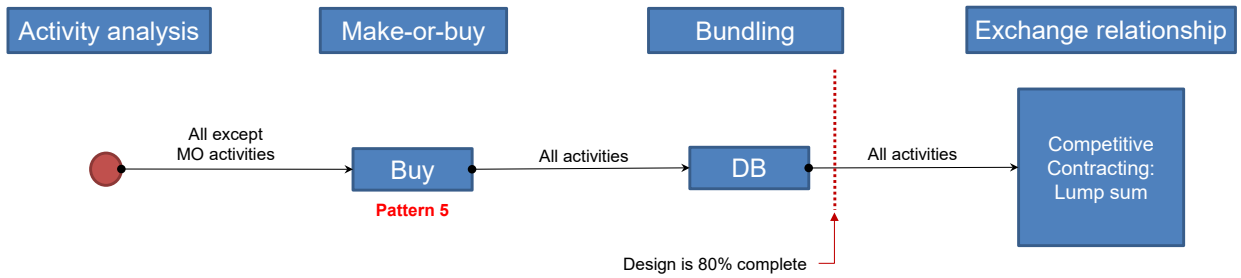
81. Given more recent empirical findings and the need to update the existing theoretical recommendations discussed in Chapter 5, the use of lump-sum payment mechanisms represents an issue because bundled delivery models that rely on price/best value competition also increase pre-contract uncertainty for the bidders, increasing risk pricing inefficiency (i.e., the level of their internal contingencies). This matters if the key objective for the public client is the best price/value combination, rather than say speed of delivery (i.e., because the DB delivers infrastructure substantially faster than alternative models). In consequence, the OECD's recommendation is that DB or EPC delivery models, where the default payment mechanism is the lump-sum be only used, when the potential to deliver significant improvements (e.g. innovative engineering solutions) is high (see Chapter 5 for details). Thus, if a major improvement is

found that otherwise would not occur following a DBB and value engineering route, are DB or EPC models likely to lead to superior price/value combination[9].

82. At present there is no objective mechanism to help determine, in what types of projects DB, EPC, or collaborative delivery models are more likely to lead to a superior engineering solution and with that superior value for money outcome. According to Nye Veier, this determination is subject to sufficient experience of the procuring entity. In the case of E18, a superior engineering solution was indeed found, ultimately leading to shorter bridges than initially planned. The OECD nevertheless recommends, that Nye Veier systematically conduct ex-post analysis to determine in what types of projects DB did, in fact, yield significant improvements and evaluate them in terms of potential cost savings or value improvements. It is likely that no great improvements would be possible in projects that are too simple, meaning that a DBB procurement route would yield a better result. A further recommendation is therefore that Nye Veier build also the capacity to be able to handle major DBB contracts, which implies its further growth.

83. The Figure 3.4 represents the summary of the whole analysis and outcomes, where with the benefit of hindsight, both the success of the competition as well as justification (the bridge shortening) for the use of DB in the E18 were identified.

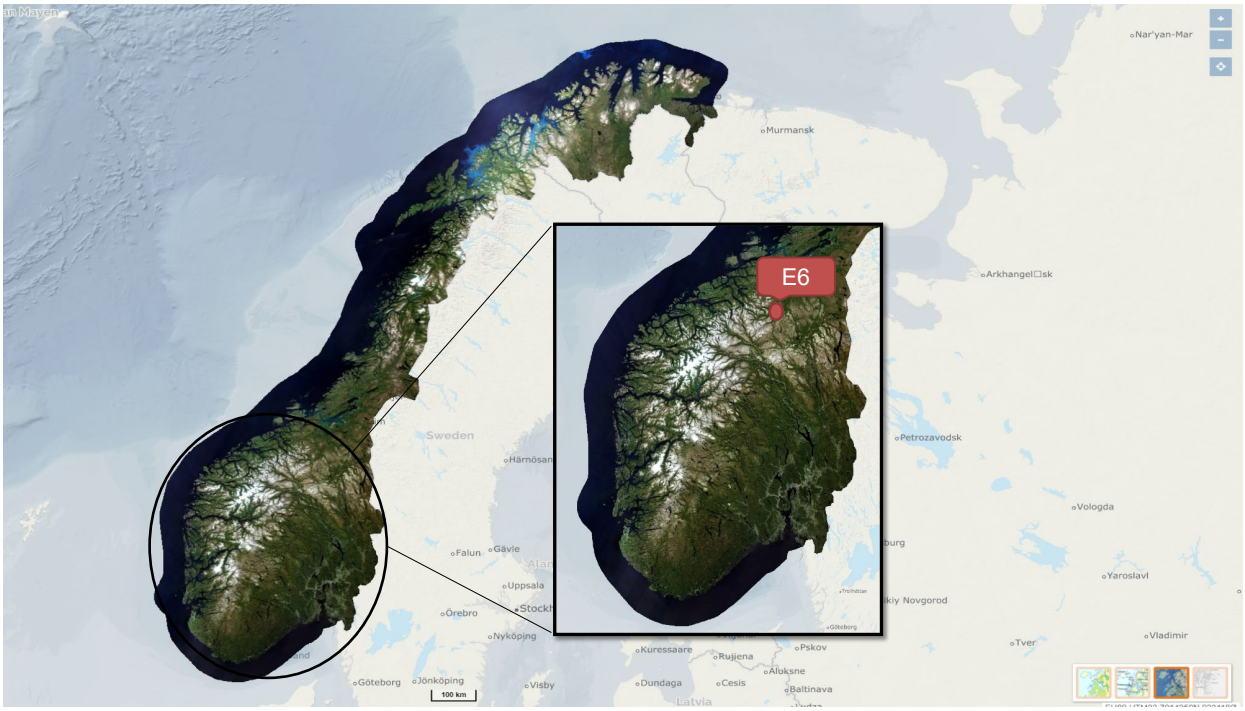
### Figure 3.4. A summary of the proposed procurement strategy for E18




[9] For collaborative approaches, this expectation would be even higher, since they completely abandon price based competition which is why STEPS only considers these in pattern four.

# 4 Application of the tool - The case of E6 Ulsberg - Vindåsliene

84. The E6 is a 25 km section of 2x2 lane motorway. The project included the construction of over 30 objects, including 2 main intersections and 2 tunnels, 1.5 and 2 km long. Following a competitive process with negotiations, an EIC contract was signed on the 18th November 2019. Phase 1 (design) is completed and, at the time of the analysis, a decision has to be made whether to continue in construction with the ECI or to stop here and continue with a different delivery model.




Source: www.norgeskart.no.

85. Since the market situation was already covered in the case of E18, in the case of E6 only those sections are covered, where the E6 departs from the E18.

## 4.1. The procurement process and reduction of pre-contract uncertainty

86. For the E6, Nye Veier chose the following procurement process:

a) A pre-selection was made following the qualifying conditions outlined in the market analysis section, including further qualitative aspects (standards pertaining to social responsibility, safety, security, environment, quality, and risk management in general (e.g. ISO9001, 14001, 31000) were used. A maximum target price (the budget of Nye Veier for this project, i.e., the max in-house estimate) was also revealed.

b) The maximum number of bidders that would be invited to compete (four) and the process of elimination were all transparently revealed in the tendering documentation (an evaluation is made based on clear criteria to select those bidders whose references are closest to the project being tendered).

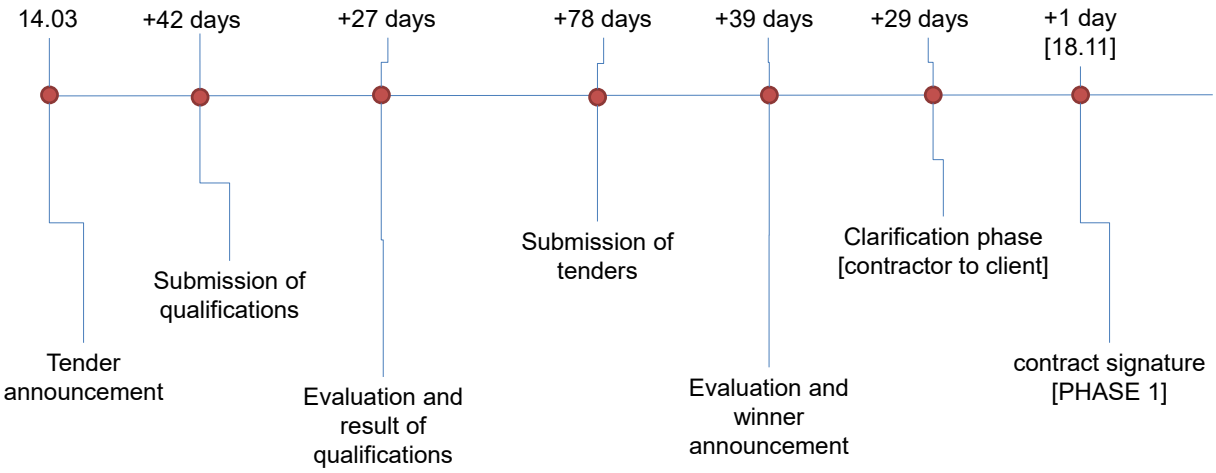
c) The winning bidder was selected through "competition with negotiation". According to Nye Veier though, the "negotiation" (dialogue to facilitate an increased pre-contract exchange of information) in this case was not used.

d) The criteria for the selection of the best bidder were grounded in best value. Price (since this was a target price arrangement, the "price" was the contractor's mark-up on the costs of the project and the hourly rates for the work done on the project) had a weight of 30%.

e) Standard financial guarantees were included in the contract.

87. With regard to pre-contract de-risking, Nye Veier checked the box on the same points as in the case of E18, with the difference that the reference design was less developed (Nye Veier estimates that it was at 30%), but nevertheless also fully costed. Since, the purpose of the EIC is collaboration from early on, no significant design work was expected from the bidders, as the selection process is primarily about mark-ups, hourly rates, and demonstration of competence. A reasonable tendering schedule was also put in place with more than 2 months for the bidders to prepare their case (Figure 4.2).

**Figure 4.2. Key milestones in the E6 tendering process**




Source: Nye Veier.

88. In the procurement process 6 firms expressed an interest in qualifying, 4 were invited to tender, and 4 tenders were submitted. Two bids were disqualified because the bidders would not accept the proposed target price on the grounds that it was too low or because they had other reservations. Hence, the effective number of firms willing and able to give an expression of interest was maximum of 4 (assuming that the 2 firms who were not invited to tender would have submitted a viable tender had they been invited to tender).

89. The in-house estimate of the project or the maximum target price was EUR240 million. The winning bid accepted the maximum target price, hence EUR240 million. In the evaluation, the first bidder scored 100 points and the second 80. The winner was a Spanish company.

## 4.2. The application of STEPS

90. The same process was followed as in the E18. The activity analysis in this case yielded 80 activities over the design, construction, operations, and maintenance phases, with 54 pertaining only to the design and construction. Networking activities were excluded from further analysis on the same grounds as in the E18. Following the establishment of economic attributes of activities the following subsections go straight into the results of the STEPS application for the E6. Nye Veier at this point asked us to develop two scenarios:

a) The hypothetical counterfactual: the design is 30% complete, where do we go from here?

b) The current state of affairs: ECI Step I has been completed and the design has been brought to 90%. Do we continue ECI into construction (ECI Step II) or change our approach?

### *4.2.1. Make-or-buy*

91. For all activities (given that same supplier market is in question as in the case of E18), more than five contractors were expected to express interest. No competition failures or hold-up situations were detected.

**Table 4.1. Make-or-buy analysis**

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Make-or-Buy) |
|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | Low or High | Low or High | High | High | High or Low | Internal |
| 2 | The buyer is better | Low or High | Low | High | Low | Low | Internal |
| 3 | The buyer is just as good, hold-up managed through insourcing | High | High | High | Low | Low | Internal |
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | External |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | External |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | High or Low | External |

### *4.2.2. Activity bundling (contract scoping)*

92. As in the E18, bundling across project phases would not yield any competition failures. Hence in both scenarios a) and b), a bundled delivery model (i.e. DB or ECI contract) was possible.

## Table 4.2. Bundling analysis

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Bundling) |
|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | Low or High | Low or High | High | High | Low or High | Internal |
| 2 | The buyer is better | Low | Low or High | High | Low | Low | Internal |
| 3 | The buyer is just as good, hold-up managed through insourcing | High | High | High | Low | Low | Internal |
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | External |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | External |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | Low or High | External |

### *4.2.3. Exchange relationship analysis*

93. The lack of potential competition failures as well as hold-up opportunities (triggered through a combination of asset specificity and uncertainty) leaves the question whether through bundling, substantial improvements in engineering solutions could be expected over and above the DBB. If the answer is yes, then the nature of the project (lack of uncertainty and asset specificity during construction) lends itself to a lump-sum/best value competition in a DB contract. If the uncertainty and expectation of superior engineering solutions is very high, ECI would be an option. Uncertainty turned out not to be very high (E6 is a relatively standard project).

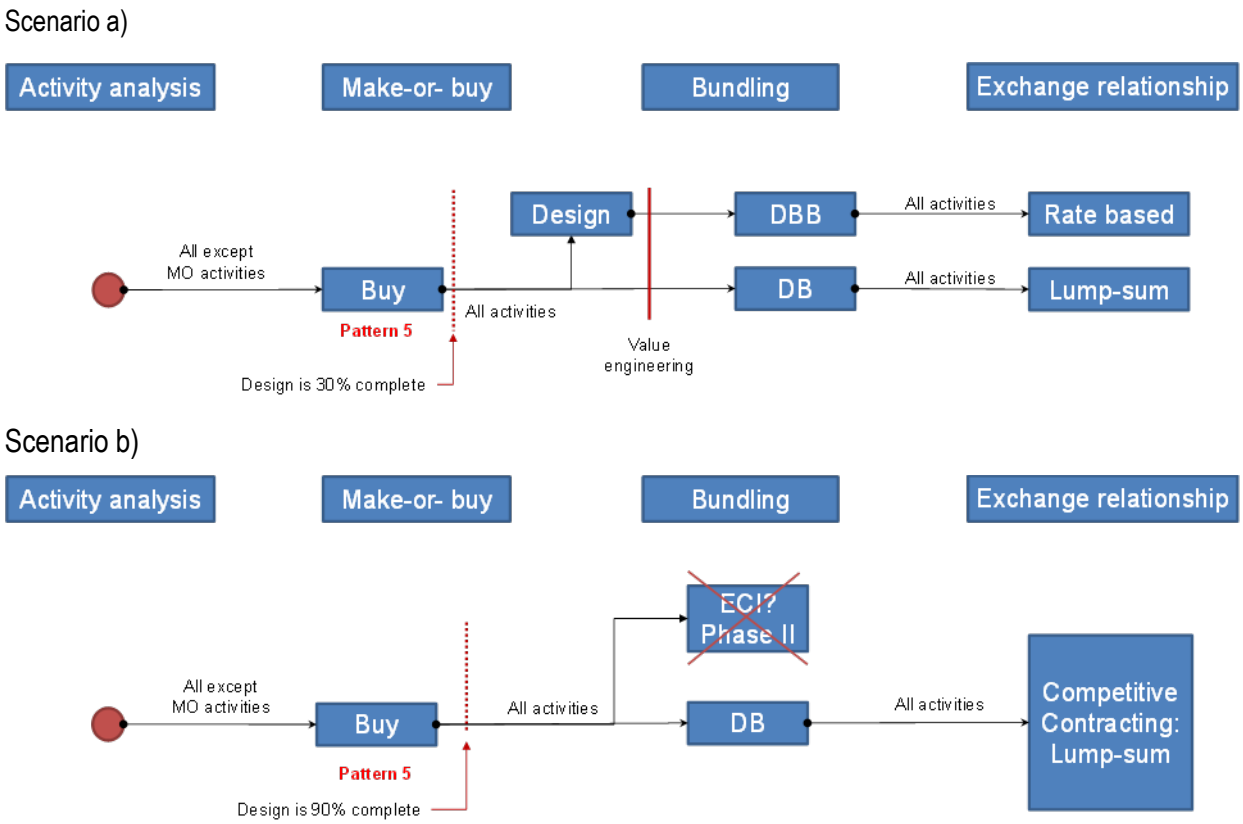
## Table 4.3. Exchange relationship analysis

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Exchange relationship) |
|---|---|---|---|---|---|---|---|
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | Collaborative contracting |
| 5 | The supplier is better | Low or High | Low | Low | Low | Low | Lump sum/best value competition |
| | | | | | | | Rate based |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | High | Rate-based competition |

94. In the scenario a), the client would be advised to advance the design as in the case of E18 to about 50%, creating a fully costed reference scenario with a default zoning plan, and following other recommendations for reducing pre-contract uncertainty for the bidders, before going to a DB tender. In the case of scenario b), the design is already so advanced that it would make little sense to organize a DBB tender and hence a DB tender is a logical choice.

95. The Figure 4.3 represents the summary of the whole analysis and outcomes, for both scenarios, i.e., a) if we went back in time before ECI phase one was chosen and b), what does STEPS recommend now that ECI phase one is completed.

**Figure 4.3. A summary of the proposed procurement strategy for E6**




## 4.3. An illustration – what if Nye Veier were under time pressure in E6

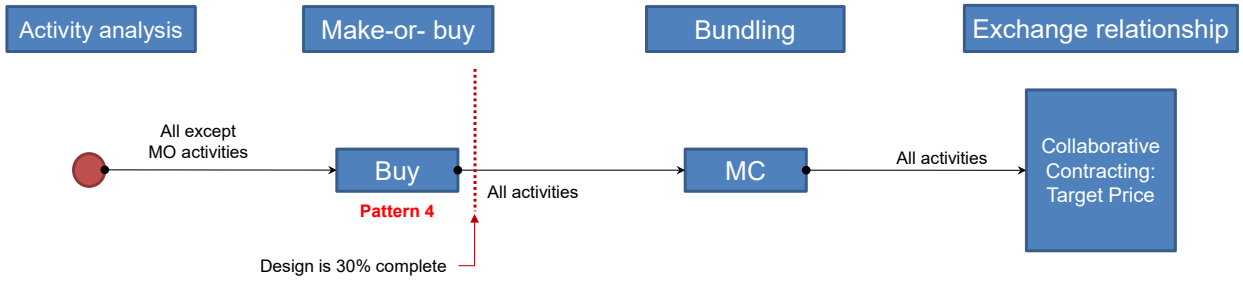
96. For the purpose of illustration only, we consider one more hypothetical scenario in this subsection. In this case the design is 30% complete, however, Nye Veier is under time pressure to deliver the project as soon as possible.

97. In this case the evaluation of activities would show that uncertainty is high, because the design and other relevant investigations to prepare for construction aren't yet complete. A competitive exchange relationship would yield a contract in which it would be extremely difficult to price and constant variation claims would occur during execution. The fact that the client would be in a hurry would create a temporal asset specificity. Hence both the uncertainty from the incomplete preparations as well as the time pressure would put the client in a hold-up situation across all activities, i.e., all activities would be qualified as pattern 4. In this case STEPS would advise that a collaborative approach be taken, or in this case, a managing contractor approach (MC) as illustrated in Figure 4.4.

98. With MC, Nie Veyer would hire a highly skilled contractor, which would take responsibility for the design and construction. During the design phase, the contractor acts as a consultant/project manager to the client to offer suggestions on innovations, cost and schedule savings, and constructability issues. Upon completion of individual design packages, the contractor and client negotiate a price for the construction contract, and then the construction manager (and/or his subcontractors) acts as a general contractor to complete construction. This also implies that for the client, this approach requires the administration of multiple contracts as opposed to say DB. This approach allows for faster project delivery, because construction begins as soon as a design package is ready, but provides less cost certainty. The client has a final say in the selection of designers and subcontracts and open book principles will be applied. The

payment mechanism is either a cost reimbursable or a target price contract, i.e., time and cost risks are borne by the client or shared via a pain/gain mechanism.

### Figure 4.4. E6 procurement strategy if Nye Veier were in extreme hurry



# 5 QUT model evaluation and OECD adjustments

99. Before the application of the new tool to the two case studies in the preceding chapters, the OECD was tasked with reviewing the soundness of the theoretical foundations on which the tool rests. The point of the review was not to question the theories behind the tool, which are well established, but to check whether these are appropriately used and whether significant additional insights have been discovered since. The OECD did find scope to expand the theoretical base and partially upgrade the analysis on which the tool relies. In what follows, the theoretical structure on which the original QUT approach relied is briefly outlined and the amendments to it described.

100. We stress that the theoretical landscape in economics is not always continuous in the sense where one theory stops with its explanatory power and another begins. Some theories compete, i.e., offer alternative explanations for the same economic phenomena. The objective of the tool was not to reconcile diverging views by academics, where some disputes are decades old. In seeking to address real world problems, the tool provides practical context, where one view and its insights could dominate an alternative view. The ultimate objective of the tool is to operationalize theoretical insights into a process that will help in practical decision making.

## 5.1. The theoretical framework of the STEPS model outlined

101. The preceding versions of STEPS were developed in successive research by Bridge and Teo at the QUT (Bridge and Tisdell, 2004[26]; Bridge, 2008[27]; Teo, 2014[28]; Teo and Bridge, 2017[29]) and was also supported by the Australian Research Council. Table 5.1 captures key theories behind the original QUT approach.

### Table 5.1. The theoretical framework of the original QUT approach

| Theory applied to issue/decision in step in Tool | Economic Thought | Theory | Leading scholar examples |
|---|---|---|---|
| **Step 1.** Project activity break-down | Classical Economics | Division of Labour/ Specialisation | Adam Smith |
| | New Institutional Economics | Transaction Costs Economics | Oliver Williamson (Nobel Prize 2009) [10] |
| **Step 2.** Project Specific-or-Network Analysis | Classical Economics | Economics of Scale | Adam Smith |
| Step 3. Activity analysis | Uses theories listed under steps 4-6 to inform the economic characteristics of activities, making the analysis in those steps possible | | |
| **Step 4.** | New Institutional Economics | Transaction Costs Economics | Oliver Williamson (Nobel Prize 2009) |

[10] Oliver Williamson introduced the concept of technologically bounded activities.

| | | | |
|---|---|---|---|
| Make-or-Buy Analysis | New Institutional Economics | Transaction Costs Economics | Ronald Coase (Nobel Prize 1991) |
| | Strategic Management | Resource-Based Theory (competence and capabilities) | Jay Barney |
| **Step 5.** Contract Packaging (Bundling) Analysis | Classical Economics | Economies of Scope | John Panzar and Robert Willig |
| | New Institutional Economics | Transaction Costs Economics | Oliver Williamson (Nobel Prize 2009) |
| | Strategic Management | Resource-Based Theory (competence and capabilities) | Jay Barney |
| **Step 6.** Competitive-or-Collaborative Contracting (Exchange Relationship) Analysis | New Institutional Economics | Transaction Costs Economics | Oliver Williamson (Nobel Prize 2009) |
| | Neoclassical Economics | Principal-Agent Theory (contract theory) | Oliver Hart & Bengt Holmström (Nobel Prize 2016), Michael C. Jensen & William Meckling |
| | Strategic Management | Resource-Based Theory (competence and capabilities) | Jay Barney[11] |

Source: (Bridge, 2020[30]) with OECD adjustments.

102. The original QUT approach takes existing theories and applies them in the appropriate step. In the review of the theoretical base, however we encountered two issues. The first is a solution to issues in Transaction Cost Economics (TCE) and Resource Based Theory (RBT), which affect the make-or-buy and exchange relationship steps. We believe a clarification was necessary to explain how STEPS accommodated the two theories, complementing or unpacking a widely accepted paper by Argyres and Zenger (2012[31]), which represents the two theories as complementary. Without this clarification STEPS might be interpreted as affront to Argyres and Zenger because for example it allows the insourcing of generic assets to solve hold-up, which in an orthodox interpretation of their paper should not happen. The second is a case, where the tool applied the existing (standard) theory in the bundling/contract scoping and exchange relationships steps. More recent insights and evidence however show that the theory should be adjusted. Both issues are treated below.

## 5.2. The role of TCE and RBT in STEPS

103. Before any firm starts to think how it should contract (or procure), it needs to first resolve whether it should contract at all. Economists have long been trying to understand what drives a firm to insource, rather than outsource, activities. With few adjustments, their insights can also be used to inform the boundaries of public organisations.

104. Ronald Coase (1937[32]) introduced the concept of transaction cost[12], which made it clear that there is a cost involved to buying activities on the market. On the other hand, as organisations grow they also become more complicated to manage and organise, with an increasing cost of a bureaucracy. Williamson (1979[33]) further developed these concepts and established TCE. The opportunistic behaviour of suppliers and the potential of hold-up is the key driver of transaction cost[13]. Opportunism comes to the forefront especially when we cannot write a complete contract that would foresee everything and

[11] The resource based angle in the exchange relationship analysis is for example that a procurement entity cannot engage in a collaborative procurement approach if the capability level of the supplier far exceeds that of the entity. Hence, we cannot insource an activity in pattern 6 so resolve a hold-up problem.

[12] e.g., specifying what you want to buy, organizing a tender/competition, defining/negotiating a contract, contract management and monitoring.

[13] The concepts related to TCE were introduced already in chapter 2, so we do not repeat the explanations here.

renegotiations will be necessary after its signature. TCE uses the frequency, uncertainty, and asset specificity of transactions to help guide both the make-or-buy and exchange relationship decision.

105. The key issue with TCE is that it assumes homogeneity of firms, i.e., all firms are equally capable and already poses all the knowledge and capabilities required to perform on the market or insource any activity if needed. In practice, this stance would lead to several errors when devising a procurement strategy, for example:

a) In the make-or-buy phase, TCE can propose insourcing as a way to resolve the risk of hold-up. When the procuring entity's capabilities are far very from those of the supplier in terms of the accumulated knowledge and technology, the procuring entity will be unable to insource them.
b) In the bundling phase, ignoring the capability perspective, the TCE would allow us to bundle activities which have very few suppliers (because the required capabilities to deliver those activities are rare and costly to imitate). The result would be a competition failure.
c) Similarly, in the exchange relationship phase TCE might propose a relational exchange (i.e., collaborative procurement) to address hold-up/uncertainty, ignoring the procuring entity's capabilities. If these are inferior to the contractors', the latter will fully dominate and "manage" its client rather than the other way around.

106. A strong alternative view to why firms insource or outsource is the resource-based theory (RBT), with Barney (1991[34]) as one of the main protagonists. RBT proposes that firms insource because they seek to gain capabilities that will give them a temporary or sustainable competitive advantage. RBT however has nothing to say on opportunistic behaviour and incomplete contracts. Over the past decades, proponents of TCE or the RBT were caught in a discussion why one or the other should prevail.

107. More recently, Argyres and Zenger (2012[31]) proposed that the TCE and RBT views are two sides of the same coin. In their view, firms use the capabilities perspective to decide which resources (physical, knowledge…) are uniquely complementary to their own (and would lead to a temporary or sustainable competitive advantage). Their core proposition is that "[firm] boundary choices are driven… by the unique complementarity among assets and activities rather than by the 'inherent capability' embedded in any given asset or activity." Once these resources are identified, however, the TCE logic is applied in terms of how they will be governed – whether they will be insourced or outsourced, and how. The nature of uniquely complementary assets or activities is such that they also lead to hold-up by default. In the view of Argyres and Zenger therefore, these assets or activities always need to be insourced.

108. Argyres and Zenger perform the theoretical fusion of RBT and TCE with a broad brush to keep their exposition simple. Their thinking is set in the medium to long-term context with implied high frequency leading to clear cut results where uniquely complementary assets always need to be insourced. With the long-term perspective, a difference in capabilities between the buyer and seller is never an issue when trying to insource an asset. In other words, a buyer always eventually attains a sufficient level of knowledge and experience to insource an asset that is more sophisticated than their current operations. If Argyres and Zenger built a table of patterns, there would only be two, one in which we insource uniquely complementary assets and the other where the assets aren't uniquely complementary and are bought. In practice, however, there are a lot of "in-between" situations where the view of Argyres and Zenger needs to be unpacked or adjusted.

109. STEPS adopts a view put forward by Bridge and Tisdell (2004[35]), which at face value appear to advance a different interpretation to Argyres and Zenger. Bridge and Tisdell do not view the TCE and RBT as steps of the same process in which RBT first helps identify a uniquely complementary resource and the TCE guides a decision on the make-or-buy. Instead, they propose one theory dominates the other, depending on the context in which they are used. In Table 5.2 in patterns 1, 2 and 7, 8, it is the resource based view that dominates, suggesting both at what capability level the buyer is and the market as well as the expected market structure (i.e. we can hope to find very few suppliers in pattern 8, because they

produce services or products that are both rare and costly to imitate). In patterns 4 and 5, TCE dominates, where the state has similar capabilities than the market, but it is the frequency and the presence of hold-up that guide the decision of insourcing or outsourcing. Hold-up due to a temporal asset specificity would be a classic case, which would fit in these two patterns.

110. Despite this difference on a declarative level, the OECD views the QUT approach as complementary to Argyres and Zenger in the sense that it unpacks their view into distinct patterns leading to pre- and/or post-contract failures as well as a pattern, where no contract failures are to be expected (pattern 6 below). The conditions in patterns 1-3 (in Table 5.2) also imply high complementarity to the existing firm activities so despite a differing description by both author pairs, the final result of the analysis would not be affected. From a theoretical perspective though, there is one potential mismatch that concerns patterns 4 and 5, which again though would not lead to a different analysis result. A brief discussion of the mismatch is provided in Box 5.1.

### Table 5.2. The original QUT approach to TCE and RBT fusion

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Value (RBT) | Rarity (RBT) | Costly to Imitate (RBT) | Governance (Make-or-Buy) |
|---|---|---|---|---|---|---|---|---|
| 1 | The buyer is far better | High | Low or High | High | High | High | High | Internal |
| 2 | The buyer is substantially better | Low or High | Low or High | High | High | High | Low | Internal |
| 3 | The buyer is better | Low or High | Low | High | High | Low | Low | Internal |
| 4 | The buyer is better, hold-up managed through insourcing | High | High | High | Low or High | Low | Low | Internal |
| 5 | The supplier is better, hold-up managed through contract | High | High | Low | Low or High | Low | Low | External |
| 6 | The supplier is better | Low or High | Low | Low | Low | Low | Low | External |
| 7 | The supplier is substantially better | Low or High | Low or High | Low | Low | High | Low | External |
| 8 | The supplier is far better | Low or High | Low or High | Low | Low | High | High | External |

Note: An error in the original patterns three and six was corrected – originally asset specificity in both patterns was "low or high", which would repeat the result of patterns four and five, where hold-up occurs.
Source: (Bridge and Guppy, 2020[36]), (Bridge, 2008[23]), (Bridge and Tisdell, 2004[23]).

### Box 5.1. Unique complementarity, temporal asset specificity, and semantics

The unique complementarity concept addresses a unique combination of assets to generate a temporary or sustainable competitive advantage. The complementarity does not depend only on the characteristics of the asset we are considering for potential insourcing per se. It depends how well it matches with the existing activities or assets we (the firm) are already executing or using. Due to this unique complementarity, we are prepared to pay more to acquire the focal asset than other firms where complementarity is lower. But this also brings in the problem of hold-up. In the words of Argyres and Zenger (2012[31]), "at precisely the moment the buyer's valuation of this unique complementarity is revealed to the party that owns the focal asset in question, potential holdup becomes a problem.

A problem that does not seem to fit nicely in the conceptualisation of Argyres and Zenger is hold-up due to temporal asset specificity. Temporal asset specificity occurs because of the context and not because of the nature of the activity. With the additional presence of uncertainty, we will be unable to write a complete contract and the scene for hold-up will be set. For example, let's assume we are procuring an infrastructure project where being on time is critical. Let's also assume, broadly available generic services happen to be on the critical path of our project. If the contracts with these suppliers happen to be incomplete, renegotiations will be necessary and we will be held up.

The trouble with being theoretical precise though, is that "unique complementarity" follows from a capability perspective. In the case of temporal asset specificity though, it is not clear what the capability perspective is that would explain why this focal asset is important. It is clear though, why it is important from a TCE perspective. We were unsure whether the semantics of "unique complementarity" can be expanded to include cases such as above. Following TCE logic, the solution however, would not change.

If frequency is high, we should seek to insource such an activity. If frequency is low, the contract with the suppliers should be negotiated separately and backed up with credible threats (due to high uncertainty no complete contract is possible).

111. The brief theoretical excursion above was necessary in terms of future theoretical advances to increase the precision of the terms used in a way that could affect the STEPS analytical process. At present though, there are no practical implications for the analytical process. The OECD did make two adjustments regarding the matrix structure and variables used.

112. The first is the omission of the variable "value", which Barney (1991[34]) originally included in RBT when trying to explain competitive advantage. However, as this variable was difficult to establish on its own and at present does not add to the explanatory power of the matrix (i.e., not being the consequence of both rarity and costly to imitate; or frequency), the OECD decided to omit it from STEPS.

113. The second practical adjustment is the merger or patterns 1, 2 and 7, 8 into just two patterns. The detail – whether an asset is just rare or rare and difficult to imitate – does not lead (i.e., original patterns 7 and 8) to a differing treatment. Moreover, the separation overplays the precision with which we can hope to measure the two variables in practice. STEPS is nevertheless a heuristic tool. Both of the adjustments were already taken into account in the STEPS matrix presented earlier in Chapter 2.

## 5.3. Recent advances affecting activity bundling and exchange relationship analysis

114. With regard to bundling across the project life cycle and the exchange relationship decision, the original QUT approach applied advice from standard contract theory. This meant that:

a) In high uncertainty situations, where contracts can't be made reasonably complete, low powered incentives should be preferred or risks should be shared (Bajari and Tadelis, 2001[37]). The QUT approach extends the risk sharing proposition to highly complex larger projects where there is also scope for innovation in design/construction solutions. In these cases, the QUT approach proposes a collaborative contracting approach[14].

b) If one can define the outcomes of the project well, bundling across project life cycle phases can increase contract completeness and hence contract like Design and Build or Design-Build-Operate-Maintain become compatible with high powered incentives (lump sum contracts with high penalties for non-performance) (Hart, Shleifer and Vishny, 1997[38]) (Hart, 2003[39])( (Iossa and Martimort, 2015[40]).

c) Along the same lines, bundling across Design-Build-Operate-Maintain is also expected to lead to the internalization of the quality shading problem. That is, when the client can't sufficiently monitor the quality of the output, the contractor may try to reduce its quality to increase his margin.

115. In recent years, however, different examples of empirical research indicated that the expectations of standard contract theory regarding bundling are inadequate. Bundling can indeed internalize moral hazard problems but it also increases upfront uncertainty for the bidders and exacerbates risk pricing inefficiency. Acknowledging these points changes the expected solutions and also opens up the question as to how to deal with uncertainty upfront, which includes the choice of the bidding process and efforts by the procuring entity to reduce the uncertainty. The original QUT approach is mute on these points and its "lowest unit" of contracting will in most cases be a design and build contract[15]. Their consideration however would in many cases yield a substantially different procurement strategy.

### *5.3.1. Bundling activities over project phases – caveats and trade-offs*

116. Following recent findings (Makovšek and Bridge, 2021[25]) and past ITF work on PPPs (ITF, 2017[41]; ITF, 2018[16]), there are not only benefits, but significant down-sides as well to bundling across project phases, e.g., for both DB contracts and DBOM type contracts and variants (commonly used in PPPs).

117. Bundling across project phases increases the exposure of bidders to uncertainty during the bidding phase, making competition outcomes less efficient and the infrastructure disproportionately more costly (see Box 5.2). The uncertainty increases with the complexity of the project and/or the length of the contract. With the application of STEPS, the performance of bundled contracts, especially the DBOM, could no doubt be improved. The prevention of competition failures, hold-up situations, and "one-size fits all" risk allocation however, does not solve the issue of increased up front uncertainty as that is a separate problem.

[14] The emergence of collaborative contracting has surpassed contract theory, which has not yet treated this specific approach. It is nevertheless an extreme example of risk sharing and falls within the broad prescription (prediction) of economic theory.

[15] The tool would only recommend a DBB contract if the bundling of the design and build in a particular market would lead to a competition failure, which in advanced economies and developed markets is unlikely.

### Box 5.2. Pre-contract uncertainty bidders face in competitive bidding for infrastructure projects

The proposition that pre-contract information might importantly influence both the risk pricing efficiency and the level of competition for the contract was put forward by both auction theory (Goeree and Offerman, 2003[42]) and conventional financial economics (Makovšek and Moszoro, 2018[43]). The key point though is to connect these insights with what happens in the bidding process.

In a competitive bidding, the point at which the contractors are required to price a given scope of work is of critical importance. The information they have available at that point will determine any risk premia or contingencies built in their bids. It is well established that strong competition alone is insufficient to guarantee efficient outcomes if the bidders face significant uncertainties when trying to price the object or service they are supposed to deliver.

In DB contracts for example, the bidders typically start with outline design, while in an EPC contract the bidders normally start only with a functional specification, describing the purposes the infrastructure is supposed to serve. Making bidders price their designs fast, will give them potentially more freedom in choosing the design solutions and at the same time speed up the delivery of the project. It will also expose the bidders to significant uncertainty at the time they need to form a price for their bid.

Furthermore the bidders face the risk of losing the competition. As in most project tenders bidders aren't compensated for their cost of developing a design solution, they will develop a design to a point that meets a client's minimum information requirements (and to assist with its own risk assessment) but will be cautious not to over-specify, in order to preserve capacity to amend design post award.

In addition, the amount of information with regard to risk in the project, whether that information presented in an accessible manner, can the bidders rely on the information provided, will all impact their perception of uncertainty when pricing their bid.

Available empirical evidence suggests that bidders are highly sensitive to uncertainty already in small DBB road contracts with average values up to EUR 5 million, where the risk exposure for contractors is relatively small compared to other formats. For example:

- When a public client absorbed a 5% risk of cost increase in one of the production inputs, the winning bids reduced by 11% on average (Kosmopoulou and Zhou, 2014[44]).
- The release of a fully costed design rather than just the total estimated value of the contract led to a 9% reduction in the average bid for bridge maintenance work (De Silva et al., 2008[45]).
- Switching from a bill of quantities pricing to a lump-sum could yield an average 133% increase in price (Bolotnyy and Vasserman, 2019[46]). Makovsek and Bridge (2021[25]) suggest that the high result might in part be a consequence of the measurement approach chosen. Nevertheless, a high premium is still expected.

118. In a dedicated ITF report (Kennedy et al., 2018[24]), it was shown that pre-contract uncertainty is not to be treated as given but can be reduced with a series of dedicated measures by the procuring entity. This may involve the development of a more advanced and fully costed reference design with degrees of freedom where it would like the bidders to innovate. A prepopulated and shared risk register could also be developed, for example.

119. A further aspect to be considered in the reduction of upfront uncertainty is the bidding procedure. Not all procedures lend themselves equally well to pre-contract information exchange. Competition with negotiations or the competitive dialogue procedure are to be preferred in complex contracts. In a competitive dialogue the client engages with the pre-selected bidders in separate dialogues to exchange further pre-contract information, i.e., helps them develop their solutions independently. Because the

participation in a competitive dialogue is costly for the bidders, for larger projects, partial bidding cost compensation may be necessary to keep them participating in competition. In the E18, partial compensation was offered to bidders even in what is essentially a less complex project, in order to maximize bidder interest.

120. The measures to reduce uncertainty will substantially increase the cost of the procuring entity. From a broader perspective, however, the reduction of uncertainty will disproportionally reduce the cost of infrastructure. That said though, the added preparation upfront may at least partly reduce the speed benefit of DB contracts (these are about 30% faster than DBB contracts) and similarly somewhat prolong the total time it takes to deliver PPP contracts.

### *5.3.2. Reconciling the expected benefits of bundling and increased pre-contract uncertainty*

121. The existing empirical evidence suggest that project phase bundling also has downsides in terms of increased uncertainty. Targeted measures can be undertaken by the procuring client to reduce the uncertainty but this cannot be fully mitigated.

122. A straightforward conclusion is that bundled delivery models should only be employed when the client is clear that the benefits of bundling will offset the down-sides. But when is that the case?

123. The benefits of bundling across several project phases will offset the cost when performance of a DBB contract with value engineering will be inferior along two dimensions:

a) If DBB projects suffered from substantial errors and omissions in the design documentation leading to high cost overruns and delays, which could be avoided by relying on DB or EPC contracts.
b) If by using a DBB delivery model (rather than DB or EPC), we would miss out on significant opportunities to find improvements such as superior engineering solutions, substantially reducing the cost of the project or increasing its value.

124. With regard to the first dimension, there is no evidence (in roads) that on average DB projects suffer from significantly smaller cost overruns than DBB contracts. There is strong evidence that EPC (in PPPs) contracts exhibit smaller cost overruns than DBB contracts. That said, average cost overruns in DBB contracts aren't that high to begin with, reaching max 9% on average. Box 5.3 provides more details for road infrastructure where it is easier to find larger samples of different contracts. On the other hand, limited available evidence suggests EPC contracts (in PPPs) can be about 20% more costly (construction cost only) than DBB projects even after accommodating the respective average cost overruns in both contract types.

125. The available evidence isn't detailed enough to control for the adequacy of the pre-contract exchange of information. In most cases, it is also not possible to control for the complexity of projects. Hence the conclusion is that in an "average" road project up to a range of several hundred EUR million, DB or EPC delivery models are unlikely to result in value for money, compared to a DBB (provided speed of delivery isn't a critical condition). Put differently, if bundled delivery models can deliver superior value for money, most of them to date have been applied on inadequate projects[16] or their procurement has been inadequate. The OECD stresses that this conclusion is based on (all) available large sample statistical evidence on road infrastructure to date. Nevertheless, the available evidence on which the conclusion above is made is indicative. Further research in the form of large scale infrastructure

[16] Or in the case of DB applications, projects which prioritized speed of delivery. Transport infrastructure owners in the US commonly express "speed" as the key reason for the choice of alternative delivery models (incl. DB) (Touran et al., 2011[50]), but it is not clear whether they are aware of the cost premium the model might yield. Namely, no organisation to date in the world has established ex-post benchmarking of normalized project cost to enable apples to apples comparisons of project cost (and other) performance.

benchmarking will be necessary in the future to increase the robustness of what we can currently conclude. Moreover, there is far less information available for infrastructure other than roads. In more complex projects there may be greater scope for innovation, however the upfront risk pricing inefficiency of bidders in the case of bundled delivery models (and lump-sum payment mechanisms) will also be greater.

### Box 5.3. Bundled delivery models, roads, and outcomes

126. Bundling the design and build stages is not only expected to allow greater scope for improvements (to a DBB approach with value engineering) but also reduce issues due to contract incompleteness. Regarding the design stage, contract incompleteness primarily manifests as the client's inability fully define and monitor the completeness and quality of the design. The consequences are omissions and errors in the design documentation (e.g. constructability issues), which manifest as cost overruns and/or delays due to additional claims by the construction contractor.

127. The introduction of superior engineering solutions for example, which are the most tangible improvement due to bundling, is systematically difficult to prove against a DBB baseline. Measuring increased contractual completeness, e.g., smaller cost overruns, are, however, a less demanding research question to test. The review of extant empirical research between DBB and DB contracts in road infrastructure in Makovsek and Bridge (2021[25]) show no statistically significant differences between both DBB and DB contracts, with averages for both moving below the 10% range for project size up to a few hundred EUR million. DB contracts do beat DBB contracts in commercial projects (buildings, office space…), but the differences are in the order of one percentage point (Franz, Molenaar and Roberts, 2020[47]). Of note here at least for public projects is that a major driver of variation claims in both DBB and DB contracts are client driven scope adjustments during the contract execution, i.e. the inability of public clients to fully define their needs in advance. This is an issue bundling cannot resolve.

128. EPC contracts, which are normally used in PPPs do perform significantly better with average cost overruns reaching as low as 2%. A conjecture offered by Makovsek and Bridge (2021[25]) is that high transaction cost of scope adjustments in a PPP (involving a much more complex web of contractual arrangements) acts as a deterrent. The evidence they cite also shows that EPC contracts are on average about 20% more costly than DBB counterparts, even when controlling for project complexity with no clear evidence that for example the infrastructure was built to a higher standard.

129. There is no way of knowing, whether the findings above would have been substantially different had STEPS and/or the recommendations by Kennedy et al. (2018[24]) been applied on the projects analysed in the literature. Theoretically the cost overruns could be reduced in both the DBB and the contracts using DB or EPC and the premium of bundled delivery models could also be reduced or disappear altogether.

130. Moreover, it is likely that the use of a target price payment mechanism in competition may take some pressure off the bidders as compared to the lump-sum option, leading to lower premium for uncertainty at the pricing stage, however no evidence exists to test this hypothesis. An improved result also does not come as self-evident because strategic bidder behaviour is also possible with the target price mechanism[17]. Moreover, the use of this mechanism likely requires a client that is substantially more capable than one who is used to relying on functional specifications and lump-sum payment mechanisms. The open book principle that goes with target pricing implies that the client will actively supervise contractor in terms of the cost that were incurred.

[17] In the case of the target price, bidders would compete to set a target price instead of a lump-sum. In a target price arrangement (e.g. in the New Engineering Contract templates in the UK) the client and the contractor share savings and cost overruns 50:50, for example in the range of +/-20% of the target price, while overruns going beyond 20% are subject to a different rule (shared, absorbed by the contractor, or client). A target price is a cost reimbursable contract operated on "open book" principles, which means that the contractor's remuneration is split into the cost they incur, plus the fee. The "open book" refers to the possibility of the client to check and audit the records of the contractor to

131. There is insufficient evidence available to determine whether a joint application of STEPS and recommendations in Kennedy et al. (2018[24]) would nullify the premium of DB and EPC contracts. It is clear however that:

a) bid pricing is highly sensitive to uncertainty;
b) bids in DB or EPC delivery models generally won't achieve a complete detailed design status when priced;
c) the default payment mechanism in both DB and EPC delivery models is lump-sum; and
d) average cost overruns in DBB contracts are relatively small.

132. As a conservative suggestion, the OECD therefore recommends that DB and EPC delivery models be used only when there is a strong expectation that this approach will yield a significant and superior engineering solution to a DBB approach. The solution would help increase the value of the project and/or offset the cost of inefficient risk pricing due to the fact that DB and EPC contracts are lump-sum and that these generally have to be priced well before the design reaches 100%. If this is not the case, a DBB approach should be preferred. This recommendation would lead to an adjustment of the original exchange analysis matrix illustrated in Table 5.3, where the pattern 5 would add a rate-based competition option for cases when bundled delivery models aren't expected to lead to superior engineering solutions.

133. Collaborative contracting involving also the construction is recommended for pattern 4 situations (hold-up), where even with a detailed design a complete contract remains an impossibility. This is also the competence range, where the client can competently engage the contractor. Considering a collaborative approach in pattern 5 activities places an extremely high expectation on the performance of the model in terms of original solutions as compared to the DB or EPC counterfactuals. As already explained in chapter 2, pattern 6 activities imply a competition failure due to competitive advantage of the supplier/s. In this case the public client does not have the competence to effectively engage and match the supplier in collaboration.

### Table 5.3. Exchange relationship analysis – original QUT assumptions

| Pattern | Dominant Logic (who is better positioned to deliver an activity) | Asset Specificity (TCE) | Uncertainty (TCE) | Frequency (TCE) | Rarity (RBT) | Costly to Imitate (RBT) | Exchange relationship |
|---|---|---|---|---|---|---|---|
| 4 | The supplier is just as good, hold-up managed through contract | High | High | Low | Low | Low | Collaborative contracting/target price |
| 5 | The supplier is better | Low or High | Low | Low | Low or High | Low | Lump sum/best value competition |
| 6 | The supplier is far better | Low or High | Low or High | Low | High | Low or High | Rate-based competition |

Source: Adapted based on (Bridge and Guppy, 2020[36]), (Bridge, 2008[23]), (Bridge and Tisdell, 2004[23]).

134. At present, STEPS isn't equipped to inform what characteristics precisely lend a project to an increased likelihood of superior engineering solutions through bundling or when a bundled delivery model could beat the DBB approach in terms of variation claims and delays. For the moment, this judgement has to be left to the procuring entity. Nye Veier for example believes that the procuring client can develop experience, which allows it to judge, in which case DB, EPC, or collaboration is likely to yield a superior

increase the certainty the cost reported are valid. In terms of incentives, if the target price is set to high, the contractor will likely try to meet it to maximise gains. If it is too low, they will try to compensate through variation claims/compensation events.

engineering solution as opposed to DBB. Their experience with the E6 will help add to that experience. For Nye Veier, complexity will be a key driver in this decision. That said, in the future ex post analysis and infrastructure performance benchmarking will be instrumental in building the evidence base to help objectivize this very important decision.

135. STEPS, at the moment, also does not precisely qualify what competencies and capabilities an organisation should have to engage in DB, EPC, or collaborative delivery models. This has to be supplemented by guidance from other sources.

136. In summary, overall the OECD view is that STEPS is effective in bringing the various theoretical views and insights together. The bigger challenge of STEPS remain the questions which need to be asked to determine the economic characteristics of the variables. These need to be further simplified and examples of failures accumulated, so that future respondents may find it easier to identify the subject of the questions. The need for targeted market or other analysis may also become apparent. Lastly, the tool could benefit from more precise guidance/support material on determining the required competencies an organisation should poses for engaging in various delivery models. This is a separate question from the issue, which delivery model is best suited for what type of project (assuming the objective is best value/price outcome).

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# Annex A. Targeted reduction of pre-contract uncertainty

## Table A A.1. Targeted reduction of pre-contract uncertainty in E18 and E6

| Guiding questions | Answer |
|---|---|
| **Design clarity (and flexibility)** | |
| Under a DBB delivery model the client produced a complete, detailed, fully approved and fully costed design before tender issue. | N/A |
| All necessary design details and obtaining prior approvals/permits have been elaborated to avoid future claims by bidders after contract award? | N/A |
| | |
| Under DB and EPC (PPP) delivery models the client, at a minimum, produced a fully costed reference design before tender issue? | √ |
| The reference design was approved by the system operator, or their representative, to ensure that it is acceptable to them and to give contractors confidence there is an accepted fall-back design solution? | √ |
| The reference design provided flexibility to bidders by being detailed in some areas and not in others depending on planning conditions, project complexity or any areas the client has particular interests in? | √ |
| Bidders were allowed to change, replace, and/or take specific parts of the reference design as they see fit, as long as it is clear that they also take responsibility for the design sections which they did themselves or amended | √ |
| The reference design was fully costed by the client and the cost estimate shared with all participating bidders? | √ |
| A clear and complete functional specification with regard to the project was available? | √ |
| Bidders were taken through the reference design, where they can engage/ask questions to the client and designer (during the tendering stage)? | ? |
| | |
| Under collaborative delivery models (e.g. ECI) the client produced a fully costed reference design before engaging with the private sector? | √ |
| | |
| **Risk management** | |
| The client followed established risk allocation principles? | √ |
| The client engaged in joint risk management with the bidders/contractor? | X |
| The client evolved its risk management approach to reflect the relevant size/complexity of the project? | √ |
| | |
| **Information provision** | |
| An "industry open day" was considered in getting early feedback from the contractors in your project and if yes did you organize one? | X |
| The information provided to the bidders was organized and signposted well? (rather than being an "information dump") | √ |
| It is clear to what extent can the bidders rely on the information received - is your organisation liable (responsible) for the accuracy of key information provided and if there are cases where this is not so have clear caveats been provided? | √ |
| | |
| **Bid process: Timeframes, criteria and clarity of objectives** | |
| A clear tender programme was set out and followed? | √ |
| Bid timeframes correspond to the delivery model used? (e.g. The bid timeframe that enables bidders to evaluate the reference design and identify opportunities to further improve it; any complaints or suggestions from the bidders?) | √ |

| | | |
|---|---|---|
| | Ambiguity in tender financial requirements (e.g. price indexation) has been kept at minimum? | √ |
| | Tender requirements that were placed on the bidders were proportionate to the benefit that these requirements provide (e.g. time/effort needed to fulfil a particular criterion should be proportionate to the proportionate to the weight of that criterion in the bid scoring)? | ? |

Source: (Kennedy et al., 2018[24]).

# Annex B. Informing the economic characteristics of activities

## Risk (*Make-or-Buy*) Analysis Questions

### *Resource-Based Theory*

Buyer Capability and Capacity

a) Did Nye Veier have the in-house capability (knowledge and skills) to deliver the activity across the entire project in-house? Please insert in the activity's row:
   - "Yes (Capable)" or "No (Not Capable)
b) Did Nye Veier have the in-house capacity (sufficient in-house resources) to deliver the activity across the entire project in-house? Please insert in the activity's row:
   - "Yes (Capacity)" or "No (Capacity)"

Supplier/Market Capability and Capacity

c) How much was there likely to be a sufficient supply (5 or more market firms) a) locally/headquartered within the Eastern region of Norway; b) nationally/headquartered in Norway; and c) internationally/headquartered outside Norway) capable of delivering the activity across the entire project and likely to apply for qualification? Please insert in the activity's row:
   - "Yes (Sufficient/5 or more - locally)" or "No (Insufficient/4 or less)"
   - "Yes (Sufficient/5 or more - nationally)" or "No (Insufficient/4 or less)"
   - "Yes (Sufficient/5 or more - internationally)" or "No (Insufficient/4 or less)"
d) Regarding an activity that you have ticked "Sufficient/5 or more", then was there anything about the project that may have given a significant competitive advantage to any of those market firms – vis-à-vis the activity – which would have effectively reduced your choice of supply of the activity to 4 or less market firms? Please insert in the activity's row:
   - "Yes (Reduced Supply/4 or less - locally)"; Blank response = "No"
   - "Yes (Reduced Supply /4 or less - nationally)"; lank response = "No"
   - "Yes (Reduced Supply/4 or less - internationally)"; lank response = "No"

Costly to Imitate

e) If you answered "Yes (Reduced Supply/4 or less)" to Q11d, then how hard would it have been for other rival market firms to develop and match this competitive advantage – in an acceptable timeline and to increase the supply to 5 or more firms? Please insert in the activity's row:
   - "Yes (Hard/Costly - locally)"; Blank response = "No (Easy/Not Costly)"
   - "Yes (Hard/Costly - nationally)"; Blank response = "No (Easy/Not Costly)"
   - "Yes (Hard/Costly - internationally)"; Blank response = "No (Easy/Not Costly)"

## Transaction Costs Economics

### *Asset Specificity*

(market firm's bargaining power associated with potential direct and indirect switching costs, i.e. disestablishment of existing supplier and re-establishment of new supplier of the activity on the occurrence of a change in the works that affects the activity)

f) How much would a contractor (or their consultant designer), upon award of a contract to deliver the project, need to customize its existing knowledge and/or skills (including any software or hardware) to deliver the entire activity within the project? Please insert in the activity's row:

- "Yes (Significant Customisation/Investment i.e., more than 20% of the time for the contractor to deliver the entire activity without any customisation)" or "No (less than 20%)"

[For example, this customization could involve acquiring new software (e.g. design/BIM software) to deliver models or other outputs required by the client but which the contractor cannot use in other projects with different clients. In other words, how much investment unique to the project does the contractor need to incur - only because of the activity.]

g) At the start of the activity (i.e., start of design of the activity – if it is a design activity or the start of construction/installation of the activity – if it is a construction activity or the start of the operations of activity - if it is an operations activity or the start of the maintenance of the activity – if it is a maintenance activity), how much flexibility would there have been to extend the period of time initially allowed for the design of entire activity or the construction of the activity or the operations of the activity or maintenance of activity in the project? Please insert in the activity's row:

- "No (Practically No Flexibility)"; or "Some (Some Flexibility)"; or Both

[For example:

I. If design and construction activities are on the critical path they may have practically no flexibility

II. If the activity has some float-time (i.e. more than 20% of the original timeline for the activity), then the answer will be "Some Flexibility"; If the activity is on the critical path, then the answer may still be "Some Flexibility" if Nye Veier is not upset with the late delivery of activity and it delaying the completion of the entire E18 project

III. In some operations and maintenance activities there may be both some flexibility and practically no flexibility e.g. inspections (some flexibility) and statutory requirements including health and safety requirements (no flexibility)]

***Uncertainty*** *(following the start of the activity, likelihood of changes including variations and disruptions to the works)*

Design activities

h) Following the start of a design activity, how much where there changes/interruptions/disruptions that created significant increases in time and/or significant cost delays (over 20% of the anticipated cost and/or time) because of the requirement to satisfactorily meet project requirements?

Please insert in the activity's row:

- "Yes (significant increases in time and/or significant cost delays )" or "No (little or no increases in time and/or cost delays )"

[For example, after the start of the activity did Nye Veier make changes in requirements concerning the activity; and/or did Nye Veier delay in checking submissions; and/or were they any delays

beyond the expected processing time for verifications and approvals from the Road Authority; and/or were there any delays beyond the expected processing time for rezoning plans by the municipality; and/or delays resulting from interference from other third parties like environmental agencies.]

i) How much was the changes/interruptions/disruptions that created significant increases in time and/or significant increases in cost delays expected?

j) Please insert in the activity's row:

- "Yes (expected)" or "No" (not expected) or "NR"

Construction activities

k) Following the start of the construction activity, how much where there changes/interruptions/disruptions that created significant increases in time and/or significant cost delays (over 20% of the anticipated cost and/or time) because of the requirement to satisfactorily meet project requirements? Please insert in the activity's row:

- "Yes (significant increases in time and/or significant cost delays )" or "No (little or no increases in time and/or cost delays )"

  [For example, after the start of the activity did Nye Veier make changes in requirements concerning the activity; and/or were they any delays beyond the expected processing time for verifications and approvals from the Road Authority; and/or delays resulting from interference from other third parties like environmental agencies.]

l) How much was the changes/interruptions/disruptions that created significant increases in time and/or significant increases in cost delays expected? Please insert in the activity's row:

- "Yes (expected)" or "No" (not expected) or "NR"

Operations and Maintenance activities

m) Following the start of the operations and maintenance activity, and up to but excluding rehabilitation of road, how much is the activity likely to be significantly disrupted by environmental changes e.g., changes to traffic flow and/or type of traffic, technology, and health and safety, developments concerning climate change? Please insert in the activity's row:

- "Yes (Likely)" or "No (Unlikely)"

n) If "Likely" to above question, then very approximately how many years after the start of the operations and maintenance activity, is the activity likely to be unaffected/free environmental disruptions?

- Please insert the very approximate number of unaffected years

***Frequency*** *(potential to generate a level of continuous demand for the activity sufficient – relative to the market - to deliver the activity in-house)*

Part A explores Norway government (Nye Veier and its sister organisation) potential to efficiently internalise the activity based on achieving similar ***economies of scale*** as leading consultants and/or main contractors supplying the activity.

o) How big was the total amount of the activity across all of the Norway government (Nye Veier and its sister organisation) projects that was being designed and/or being constructed in Q2, 2016 relative to the scale of the activity being designed and/or being constructed in Q2, 2016 by:

   Leading **local (headquartered in Eastern Norway)** consultants and/or main contractors supplying the activity. Please insert:

- Bigger (more than 20%); or About Same; or Smaller (less than 80%)

Leading national (headquartered in Norway) consultants and/or main contractors supplying the activity. Please insert:

- Bigger (more than 20%); or About Same; or Smaller (less than 80%)

Leading international (headquartered outside Norway) consultants and/or main contractors supplying the activity. Please insert:

- Bigger (more than 20%); or About Same; or Smaller (less than 80%)

Part B explores how much the potential in Part A would be undermined by an intermittent flow of the activity that would frustrate **learning curve economies** and which may create additional costs to allow flexibility e.g. use of agency staff to smooth out fluctuations in demand and/or additional external transactions costs associated with a hire-and-fire approach to staff.

p) How far could the Norway government (Nye Veier and its sister organisation) be confident to forecast a continuous flow of new work to be designed and constructed that involves a similar or greater total amount of the activity as that total amount for the activity in the quarter in which the procurement decision made. Please insert:
   - Confident over 5 years from Q2, 2021;
   - Confident 3 to 5 years from Q2, 2021;
   - Confident 1 to 3 years from Q2, 2021;
   - Confident 1 to 12 months from Q2, 2021;