Governing Phase I: time in the two-phase approach for Dutch infrastructure projects

Towards a predictable phase I in Dutch two-phase infrastructure Projects

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TU Delft

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Towards a predictable phase I in Dutch two-phase infrastructure Projects

by

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: Cover: Topview Photo by Mobilis TBI of A16 Groene Boog project (delivered in a DBFM-contract)

TU Delft

Preface

Dear reader,

Over the past months, I have worked on this thesis in partial fulfillment of the requirements for the Master's degree in Construction Management and Engineering at Delft University of Technology. The process started in November, when I first got in contact with Maarten and Wilco. During an initial brainstorming session, in which we discussed my interests, we identified the topic that would form the foundation of this thesis: the two-stage approach. After a second brainstorming session with Cora, the focus of the research became clearer and eventually developed into the subject of delays in the two-stage approach.

Working on this thesis has taught me a great deal about procurement, collaboration, and project delivery within the Dutch infrastructure sector, many aspects of which are reflected in this research. At the same time, the process has also been personally valuable. It helped me to better understand my own interests, what it means to work independently on a subject over a longer period, and how strongly my enthusiasm lies within civil engineering and large-scale infrastructure projects.

I would like to express my sincere gratitude to everyone who contributed to this thesis. In particular, I would like to thank my supervisors Maarten, Wilco, Ad, Jelle, and Marcel for their guidance, feedback, and support throughout the process. Their help in shaping the research, refining the methodology, and providing direction has been invaluable.

I would also like to thank my parents, who have always supported me throughout my years as a student. I am also grateful to my friends and family, who helped me along the way or simply listened as I talked endlessly about my thesis. A special word of thanks goes to my girlfriend, Ella, who supported me greatly throughout this process. Our runs, during which we discussed both of our theses at length, were not only enjoyable but also genuinely helpful in steering our research in the right direction.

This thesis also marks the final chapter of my time as a student. What started several years ago in Groningen has, through many experiences, lessons, friendships, and opportunities, brought me to this point. I look back on this journey with great appreciation and enjoyment, and I am excited to see what the future holds.

Enjoy reading!

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Samenvatting

Context en probleem

De Nederlandse infrastructuur veroudert. Een groot deel van de bruggen, viaducten, sluizen, duikers en kademuren in het land is gebouwd tussen de jaren vijftig en zestig en bereikt nu, bij een gebruikelijke levensduur van zestig tot tachtig jaar, het moment waarop vervanging of grootschalige renovatie nodig is. De totale waarde van deze civiele voorraad wordt geschat op ongeveer €347 miljard, en de vervangings- en renovatieopgave alleen al op circa €260 miljard, terwijl de huidige jaarlijkse vernieuwingsproductie ruimschoots achterblijft bij wat de komende decennia nodig zal zijn. De sector staat daardoor niet alleen voor een kwantitatieve uitdaging, maar ook voor een kwalitatieve: projecten moeten voorspelbaarder, efficiënter en duurzamer worden gerealiseerd dan voorheen.

In dezelfde periode verschoof de publieke aanbestedingspraktijk weg van de traditionele Design–Bid–Build-vorm, waarin de opdrachtgever de ontwerpverantwoordelijkheid behoudt, naar geïntegreerde contracten zoals D&B, D&C en E&C, waarin meer van het ontwerp en de bijbehorende risico's bij de opdrachtnemer worden gelegd. Die verschuiving had echter een prijs. De tenderkosten voor geïntegreerde contracten kunnen oplopen tot ongeveer 2,5 keer die van traditionele contracten, en Rijkswaterstaat (RWS) constateerde een gestage afname van het aantal inschrijvers op zijn grootste en meest risicovolle projecten. Daarmee ontstond het vooruitzicht van een situatie met slechts één inschrijver, waarin de onderhandelingspositie van de opdrachtgever zwak zou zijn, en werd bovendien de haalbaarheid van het uitvoeren van de groeiende vervangingsopgave als geheel in twijfel getrokken.

Als reactie hierop introduceerde RWS in 2019, onder andere, de tweefasenaanpak. Opdrachtgever en opdrachtnemer worden vroeg in het proces samengebracht en ontwikkelen in Fase I gezamenlijk het ontwerp, de risicoverdeling en de prijs, waarna de uitvoering in Fase II start op basis van een realistischer, marktconforme prijs. De onderliggende logica is dat deze vroege samenwerking leidt tot betere identificatie en mitigatie van risico's, en dus tot beter beheersbare en voorspelbaardere projecten. In de praktijk duurt Fase I echter vaak langer dan gepland en wordt deze fase breed ervaren als onzeker en lastig te beheersen.

Bestaand onderzoek naar vertraging in de ontwerp- en planningsfasen van infraprojecten wijst op factoren zoals veranderende eisen van de opdrachtgever, laattijdige input van stakeholders, het ontbreken van een scope freeze, trage besluitvorming, optimism bias en strategische misrepresentatie. Dit onderzoeksveld is echter ontwikkeld binnen traditionele contractuele contexten, en geen van deze studies behandelt Fase I van de tweefasenaanpak. Dat is de lacune die deze scriptie beoogt te adresseren, via de centrale onderzoeksvraag: *Hoe kunnen opdrachtgevers en opdrachtnemers tijd beheersen in de eerste fase van de tweefasenaanpak*? Deze vraag wordt benaderd aan de hand van vier deelvragen: het beoogde doel van de aanpak (RQ1), de factoren die het tijdmanagement in infraprojecten beïnvloeden (RQ2), de processen die tijd in Fase I beïnvloeden (RQ3), en de suggesties die opdrachtgevers en opdrachtnemers kunnen gebruiken om deze tijd te beheersen (RQ4). De wijze waarop de geplande einddatum van Fase I wordt vastgesteld, valt bewust buiten de scope. De focus ligt op de processen die zich binnen die grenzen afspelen.

Aanpak

Het onderzoek combineert twee literatuuronderdelen met een empirische multiple-case study en een expertvalidatie. RQ1 en RQ2 zijn beantwoord op basis van literatuur, met aandacht voor contract- en uitvoeringsmodellen, complexiteitstheorie, samenwerking tussen opdrachtgever en opdrachtnemer, onzekerheid en gedragsmatige bias. RQ3 is beantwoord via een multiple-case study van twee afgeronde of zeer ver gevorderde Fase I-trajecten: de A27 Houten–Hooipolder Noord (Case A) en de OVT 2-

terminal bij Zuidasdok (Case B). Voor elke case is een gestructureerde beoordeling van Technical, Organisational and External (TOE)-complexiteit gecombineerd met semigestructureerde interviews, in totaal dertien, afgenomen bij zowel deelnemers aan opdrachtgevers- als opdrachtnemerszijde. Aannemer Mobilis fungeerde hierbij als belangrijkste toegangspunt. De suggesties voor RQ4 zijn vervolgens getoetst in een focusgroep met twee RWS-praktijkdeskundigen die bij geen van beide cases betrokken waren. De studie is gepositioneerd binnen een pragmatisch paradigma en volgt een abductieve benadering: gestructureerde TOE-concepten, en literatuur concepten, boden een gedeeld vertrekpunt, terwijl de open interviews de mechanismen blootlegden die Fase I in de praktijk daadwerkelijk vormgaven.

Theoretische lens

De literatuur is samengebracht in een alignment framework. Infraprojecten kennen twee soorten complexiteit. Structurele complexiteit, de vaste en kenbare ordening van componenten en interfaces, leent zich voor een predict-and-control-benadering (Type I) Dynamische complexiteit, de emergente en veranderende relaties tussen componenten in de tijd, vraagt om een prepare-and-commit-benadering (Type II). Omdat grote projecten onvermijdelijk beide typen complexiteit bevatten, vereist de beheersing van het project als geheel een bewuste combinatie van beide. Het framework is uitgewerkt in drie proposities: beheersing (Type I) past bij structurele complexiteit (P1). Interactie (Type II) past bij dynamische complexiteit (P2) en een misalignment tussen beide, in het bijzonder wanneer dezelfde parameter wordt aangestuurd vanuit niet-vereenigde Type I- en Type II-logica's, zal naar verwachting Fase I tijdsmanagement hinderen en daarmee ook de voorspelbaarheid van deze fase (P3). Drie aanvullende factoren zijn van invloed op tijdmanagement volgens de literatuur: de relationele kwaliteit van de samenwerking en vertrouwen. De scope- en ontwerpiteratiekeuzes die bepalen hoe tijd wordt benut en de gedragsmatige biases die het realisme van vroege ramingen vertekenen.

Bevindingen: een contrasterend beeld in twee cases

De twee cases lieten duidelijk verschillende trajecten zien. Case A, een snelwegproject dat begon vanuit een relatief open scope en een hybride contractstructuur met één opdrachtgever, werd gekenmerkt door ambiguïteit in de front-end en erosie van de relatie. Het budget was in Fase 0 vastgesteld op een structureel zwakke basis, en de interpretatie ervan, als harde bovengrens of als indicatieve waarde, stond vanaf de eerste weken van Fase I ter discussie en werd nooit expliciet opgelost. Het budget, de sturingsruimte binnen de project management driehoek en de scope werden door de opdrachtgever beheerst vanuit een predict-and-control-logica en door de opdrachtnemer vanuit een prepare-and-commit-logica, zonder dat deze met elkaar werden vereenigd. Precies die misfit die P3 in verband brengt met verlenging en verminderde voorspelbaarheid. Juist het uitblijven van die vereeniging tastte het onderlinge vertrouwen aan: uiteenlopende besluitvormingsculturen en onduidelijke mandaten verscherpten de spanning, en personeelswisselingen rond het einde van de voorlopig-ontwerpfase doorbraken de relationele continuïteit, zodat het cumulatieve effect een afname van vertrouwen was die uiteindelijk leidde tot traditionele onderhandelingen aan het einde van Fase I, in strijd met de filosofie van de aanpak. Alleen daar waar bewust een tegenarrangement werd ingericht, de KICKs-werkgroep, als gedeeld horizontaal forum voor de dynamische interfacecomplexiteit die voortkwam uit de hybride scopescheiding, werd die complexiteit weer onder gezamenlijke controle gebracht.

Case B, de OVT-terminal bij Zuidasdok, op een van de drukste stations- en snelweglocaties van Nederland en uitgevoerd in samenwerking tussen RWS, ProRail en de gemeente Amsterdam, volgde een fundamenteel andere logica. Fase I begon met een meegekregen Definitief Ontwerp dat de opdrachtnemer moest overnemen en verder uitwerken, terwijl vaste buitendienststellingen voor spoor en snelweg een grotendeels onveranderlijke planning dicteerden. De governance-structuur met meerdere opdrachtgevers vereiste formele afstemming via de OCHOO-programmaraad. Toch zorgden juist deze harde, overwegend randvoorwaarden, in combinatie met een Type I-uitvoeringsdiscipline en Type II-relationele instrumenten zoals werkhypothesen, medewerkers met opdrachtgeverservaring en leereffecten uit het voorgaande project, voor een taakgerichte cultuur waarin het vertrouwen grotendeels behouden bleef. De vertragingen die wel optraden, waren technischer van aard.

Cross-case bevindingen en interpretatie

Over beide cases heen wordt het tijdmanagement in Fase I bepaald door de robuustheid van de front-endvoorbereiding, de expliciete afstemming over de interpretatie van het budget en de sturingsmogelijkheden binnen de project management driehoek, de compatibiliteit van de projectmanagement-methoden van beide partijen, de kwaliteit van interorganisationele besluitvorming en de helderheid van mandaten, personele continuïteit, en het cumulatieve effect van dit alles op vertrouwen. Uit de vergelijking volgen verschillende diepere inzichten.

Ten eerste is de werkzame variabele niet de contractvorm, maar de aanwezigheid of afwezigheid van bewuste tegenarrangementen. Beide cases gebruikten een tweefasencontract, en in Case A en B voorkwam de collaboratieve contractvorm op zichzelf niet dat het proces alsnog terugviel in traditionele onderhandelingen. Waar voor elk cluster van dynamische complexiteit bewust een Type II-tegenarrangement werd ingericht om beheersing en interactie met elkaar te verbinden, bleef de complexiteit beheersbaar. Waar dat ontbrak, kon zij zich vrij ontwikkelen tot wantrouwen en vertraging. Alignment wordt dus bereikt of gemist per proces, en niet op het niveau van het project als geheel.

Ten tweede kunnen harde randvoorwaarden stabiliserend werken. Contra-intuïtief scoorde Case B, ondanks het grotere aantal opdrachtgevers en de complexere governancestructuur, lager op organisatorische complexiteit dan Case A en vertoonde deze case een meer taakgerichte cultuur, omdat de vaste randvoorwaarden weinig ruimte lieten voor fundamenteel meningsverschil en de aandacht richtten op opleveren binnen de opdracht in plaats van op heronderhandeling ervan. Juist het relatieve ontbreken van zulke randvoorwaarden in Case A creëerde ruimte voor dat fundamentele meningsverschil. Tijd beheersen in Fase I is daarom ook een kwestie van alle bestaande grenzen vanaf het begin ondubbelzinnig voor alle partijen duidelijk maken.

Ten derde is de betekenis van “tijdsoverschrijding” in Fase I breder dan alleen kalendervertraging. Er zijn nog twee andere verschijningsvormen waargenomen: het doorschuiven van onopgeloste kwesties tussen baselines, waardoor een verborgen achterstand ontstaat terwijl het project ogenschijnlijk op schema ligt, en de verdichting van werk binnen formeel tijdige mijlpalen, waardoor de kwaliteit van de onder die druk opgeleverde producten afneemt.

Suggesties en validatie

Op basis hiervan zijn zes voorstellen geformuleerd en vervolgens gevalideerd, niet als op zichzelf staande oplossingen maar als bewuste tegenarrangementen die de fit herstellen tussen de complexiteit van een proces en de wijze waarop dat proces wordt behandeld. Ze clusteren rond drie thema’s: de front-end van Fase I: een inhoudelijke kick-off waarin expliciet aandacht is voor de interpretatie van het budget, de sturingsruimte binnen de project management driehoek en de verschillende projectmanagementmethoden van beide partijen. Bemensing: de bewuste selectie van “vertalers” met ervaring binnen de andere organisatie, en de inzet van neutrale rollen zoals een gezamenlijk erkende kostendeskundige en procesontwerp binnen Fase I: het expliciet in kaart brengen van de consequenties van besluiten, de mogelijkheid faciliteren om counterarrangements te laten ontsaan, en het continu investeren in iteratief leren tussen projecten.

De experts onderschreven deze richtingen in grote lijnen, maar plaatsten ook enkele kanttekeningen. Geen enkele kick-off, hoe goed ook georganiseerd, kan compenseren voor een pre-tenderraming die op zichzelf te dun is: zowel de inhoudelijke kick-off als de robuustheid van de front-end moeten gezamenlijk worden verbeterd en niet als alternatieven worden gezien. De personeelsgerelateerde suggesties riepen de meeste weerstand op, niet vanwege hun logica maar vanwege hun haalbaarheid op grotere schaal, omdat RWS momenteel niet beschikt over voldoende diepgaande kennis van de opdrachtnemerskant. Dit tekort werd aangemerkt als de grootste bottleneck voor het opschalen van de aanpak, waardoor deze suggesties vooral relevant zijn als onderdeel van een langetermijnstrategie voor kennisbehoud en personeelsontwikkeling. De meest uitgebreide discussie betrof het reserveren van een apart blok onderhandelingstijd aan het einde van Fase I. Dit is het best te begrijpen als een overweging.

Conclusie

Opdrachtgevers en opdrachtnemers kunnen tijd in Fase I het meest effectief beheersen door bewust in te grijpen op de processen die die planning vormgeven: door een inhoudelijke kick-off te organiseren, gekoppeld aan een voldoende robuuste front-end, die de ambiguïteiten wegneemt die anders het vertrouwen zouden ondermijnen, door personeel te selecteren dat beide organisaties kan overbruggen, waar mogelijk, en neutrale expertise in te zetten waar informatieasymmetrie structureel is. Door besluitconsequenties en de tijd die besluitvorming vraagt expliciet te maken en door ruimte voor creative oplossingen zoals werkhypothesen te faciliteren om ambiguïteit. De praktische relevantie ligt minder in de keuze van de contractvorm dan in het bewust, proces voor proces, construeren van tegenarrangementen die beheersing en interactie bij elkaar houden waar dynamische complexiteit ontstaat. De focusgroep bevestigde dat de geïdentificeerde processen, en in het bijzonder de heronderhandeling aan het einde van de fase, herkenbaar zijn in de bredere portefeuille van tweefasenprojecten binnen RWS, wat erop wijst dat zij inherent zijn aan de aanpak zelf en niet slechts aan de omstandigheden van een individueel project.

Summary

Context and problem

The Dutch infrastructure stock is ageing. A large share of the country's bridges, viaducts, locks, culverts and quay walls was built between the 1950s and 1960s and, with typical service lives of sixty to eighty years, is now due for replacement or major renovation. The total value of this civil stock is estimated at roughly €347 billion, and the replacement and renovation task alone at around €260 billion, while current annual renewal output falls well short of what the coming decades will require. The sector therefore faces not only a quantitative challenge but a qualitative one: projects have to be delivered more predictably, more efficiently and more sustainably than before.

Over the same period, public procurement shifted away from traditional Design–Bid–Build, in which the client retains design responsibility, towards integrated contracts such as D&B, D&C and E&C, which transfer more of the design and its risks to the contractor. That transfer came at a price. Tender costs for integrated contracts can run up to roughly 2.5 times those of traditional ones, and Rijkswaterstaat (RWS) observed a steady decline in the number of bidders for its largest and highest-risk projects. This raised the prospect of a one-bidder situation in which the client's negotiating position would be weak, and cast doubt on the feasibility of delivering the growing replacement task at all.

In response, RWS introduced the Two-Phased Approach in 2019. Client and contractor are brought together early and jointly develop the design, the risk allocation and the price during Phase I, before execution begins in Phase II on the basis of a more realistic, market-based price. The underlying logic is that early collaboration enables better identification and mitigation of risks, and so leads to more manageable and more predictable projects. In practice, however, Phase I frequently runs longer than planned and is widely experienced as uncertain and difficult to control.

Existing research on delay during the design and planning stages of infrastructure projects points to factors such as changing client requirements, untimely stakeholder input, the absence of a scope freeze, slow decision-making, optimism bias and strategic misrepresentation. This body of work, however, was developed in traditional contractual settings, and none of it addresses Phase I of the Two-Phased Approach. This is the gap the thesis sets out to address, through the main research question: How can clients and contractors govern time in the first phase of the two-phase approach? The question is approached through four sub-questions: the intended goal of the approach (RQ1), the factors that influence time management in infrastructure projects (RQ2), the processes that shape time in Phase I (RQ3), and the suggestions clients and contractors can use to manage it (RQ4). The way in which the planned end date of Phase I is established is deliberately placed outside the scope. The focus is on the processes that play out within those boundaries.

Approach

The research combines two literature reviews with an empirical, multiple-case study and an expert validation. RQ1 and RQ2 were answered through literature, covering delivery models, complexity theory, client–contractor collaboration, uncertainty and behavioural bias. RQ3 was answered through a multiple-case study of two completed or sufficiently advanced Phase I trajectories: the A27 Houten–Hooipolder Noord (Case A) and the OVT 2 terminal at Zuidasdok (Case B). For each case, a structured assessment of Technical, Organisational and External (TOE) complexity was combined with semi-structured interviews, thirteen in total, conducted with both client- and contractor-side participants; the contractor Mobilis served as the main point of entry. The suggestions for RQ4 were then tested in a focus group with two RWS practitioners who had not been involved in either case. The study is positioned within a pragmatic paradigm and proceeds abductively: structured TOE concepts provided a

shared entry point, while the open interviews surfaced the mechanisms that actually shaped Phase I.

Theoretical lens

The literature was drawn together into an alignment framework. Infrastructure projects present two kinds of complexity. Structural complexity, the fixed and knowable arrangement of components and interfaces, lends itself to a predict-and-control (Type I) management approach. Dynamic complexity, the emergent and changing relations among components over time, calls for a prepare-and-commit (Type II) approach. Because large projects inevitably present both, managing the project as a whole requires a deliberate combination of the two. The framework is expressed in three propositions: control (Type I) fits structural complexity (P1). Interaction (Type II) fits dynamic complexity (P2) and a misalignment between the two, in particular the same parameter governed under unreconciled Type I and Type II logics, is expected to hinder time management in Phase I and, with it, the predictability of this phase (P3). Three further factors bear on time management: the relational quality of the collaboration, and trust above all. The scope and design-iteration choices that structure how time is used and the behavioural biases that distort the realism of early estimates.

Findings: a contrasting picture across two cases

The two cases produced markedly different trajectories. Case A, a motorway project that began from a comparatively open scope and a hybrid contract structure with a single client, was shaped by front-end ambiguity and relational erosion. The budget had been set on a structurally weak foundation in Phase 0, and its interpretation, as either a hard ceiling or an indicative value, was contested from the first weeks of Phase I and never explicitly resolved. The budget, the room for manoeuvre within the project management triangle, and the scope were governed by the client from a predict-and-control logic and by the contractor from a prepare-and-commit logic, without these being reconciled. This is precisely the misfit that P3 associates with extended duration and reduced predictability. It was precisely the absence of such reconciliation that undermined mutual trust: diverging decision-making cultures and unclear mandates intensified the tension, while staff changes around the end of the preliminary design phase disrupted relational continuity, such that the cumulative effect was a decline in trust that ultimately led to traditional negotiations at the end of Phase I, contrary to the philosophy of the approach. Only where a deliberate counter-arrangement was created, the KICKs working group, as a shared horizontal forum for the dynamic interface complexity arising from the hybrid scope division, was this complexity brought back under joint control.

Case B, the OVT terminal at Zuidasdok, one of the busiest stations and motorway sections in the Netherlands and a collaboration between RWS, ProRail and the municipality of Amsterdam, followed a fundamentally different logic. Phase I began with an inherited Definitive Design that the contractor had to adopt and elaborate, while fixed out-of-service windows for rail and motorway dictated a largely immovable schedule. The multi-client governance structure required formal coordination through the OCHOO programme board. Yet these hard, constraints, combined with a Type I delivery discipline and Type II relational devices such as working hypotheses, client-experienced staff and learning effects carried over from the predecessor project, produced a task-oriented culture in which trust was largely preserved. The delays that did occur were, accordingly, more technical in nature.

Cross-case findings and interpretation

Across both cases, time management in Phase I is shaped by the robustness of front-end preparation, the explicit alignment of budget interpretation and steering possibilities within the project management triangle, the compatibility of the two parties' project-management methods, the quality of inter-organisational decision-making and the clarity of mandate, personnel continuity, and the cumulative effect of all of these on trust. Several deeper insights follow from the comparison.

First, the operative variable is not the contract form but the presence or absence of deliberate counter-arrangements. Both cases used a two-phase contract, and in Case A the collaborative form did not by itself prevent the collapse into adversarial negotiation. Where, for each pocket of dynamic complexity,

a deliberate Type II counter-arrangement was put in place to hold control and interaction together, complexity was contained. Where it was absent, it was free to convert into mistrust and delay. Alignment is therefore achieved or missed process by process, rather than at the level of the project as a whole.

Second, hard boundary conditions can be stabilising. Counterintuitively, Case B, despite involving more clients and a more complex governance structure, scored lower on organisational complexity than Case A and exhibited a more task-oriented culture, because its fixed constraints left little room for fundamental disagreement and directed attention towards delivering within the assignment rather than renegotiating it. The relative absence of such constraints in Case A created space for exactly that fundamental disagreement. Governing time in Phase I is therefore also a matter of making whatever boundaries do exist unambiguously clear to all parties from the outset.

Third, the meaning of “time overrun” in Phase I is broader than calendar slippage. Two further manifestations were observed: the systematic carry-over of unresolved issues across baselines, which creates a hidden backlog while the project appears on schedule, and the compression of work within nominally on-time milestones, which degrades the quality of deliverables produced under that pressure.

Suggestions and validation

On this basis, six suggestions were formulated and then validated, framed not as isolated remedies but as deliberate counter-arrangements that restore fit between a process’s complexity and the way it is handled. They cluster around three themes: the front-end of Phase I: a substantive kick-off that explicitly addresses budget interpretation, the steering room within the project management triangle and the differing project-management methods of the two parties, staffing: the deliberate selection of “translators” with experience inside the opposing organisation, and the introduction of neutral roles such as a jointly recognised cost expert and process design within Phase I: explicit mapping of decision consequences, creating room for counter-arrangements to emerge, and continuous investment in iterative learning across projects.

The experts broadly endorsed these directions while qualifying several. No kick-off, however well organised, can compensate for a pre-tender estimate that is itself too thin: the substantive kick-off and the robustness of the front-end must be improved jointly, not treated as alternatives. The personnel-related suggestions attracted the strongest pushback, not on their logic but on their feasibility at scale, since RWS does not currently hold the depth of contractor-side knowledge required. This shortage was identified as the single largest bottleneck for scaling up the approach, so these suggestions are relevant chiefly as part of a longer-term organisational strategy of knowledge retention and staff development. The most extended discussion concerned reserving a dedicated block of negotiation time at the end of Phase I. This is best understood as a trade-off.

Conclusion

Clients and contractors can govern time in Phase I most effectively not by acting on the schedule itself but by acting deliberately on the processes that shape it: by organising a substantive kick-off, paired with a sufficiently robust front-end, that resolves the ambiguities which would otherwise erode trust, by selecting personnel that bridge the two organisations where possible, and introducing neutral expertise where information asymmetry is structural, by making decision consequences and decision-making time explicit, by facilitating room for creative solutions such as working hypotheses to keep ambiguity productive, and by investing continuously in trust and in iterative learning across projects. The practical leverage lies less in the choice of contract form than in the conscious, process-by-process construction of counter-arrangements that hold control and interaction together where dynamic complexity arises. The focus group confirmed that the processes identified, end-of-phase renegotiation in particular, are recognised across the wider portfolio of two-phase projects within RWS, which suggests that they are inherent to the approach itself rather than to the circumstances of any individual project.

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1

Introduction

In recent years, two-phase contracting has gained increasing attention in Dutch infrastructure projects. Several public clients, including Rijkswaterstaat, ProRail, and large municipalities, have already adopted this approach. As a collaborative procurement model between client and contractor in the Dutch infrastructure sector, two-phase contracting is the central subject of this thesis. This chapter introduces the subject of this thesis.

To provide a structured understanding of the topic, it is first necessary to outline the market environment in which two-phase contracting emerged. Section 1.1 therefore describes the developments in the Dutch infrastructure sector around 2019 and explains the practical relevance of this study. Next, Section 1.2 presents the research question. Section 1.3 discusses the scientific relevance by reviewing the existing literature. Finally, Section 1.4 outlines the research design.

1.1. The challenge

This thesis examines the first phase of two-phase contracts in Dutch infrastructure projects, with a specific focus on why this phase is often less predictable and more time-consuming than initially expected. The two-phase approach was introduced “to reduce and better manage the risks associated with large, complex infrastructure projects” (Rijkswaterstaat, 2019). Despite this intention, questions remain regarding its effectiveness in practice, particularly in relation to time and costs performance.

This issue becomes increasingly relevant when considering the broader context of the Dutch infrastructure sector. Dutch infrastructure plays a crucial role in ensuring the country’s safety, accessibility, and liveability (Bleijenberg, 2021). At the same time, a significant portion of these assets is approaching the end of its functional lifespan. The total value of Dutch civil infrastructure is estimated at approximately €347 billion, consisting of tens of thousands of assets such as bridges, culverts, jetties, and sheet pile walls (Rasker et al., 2023). Much of this infrastructure was constructed between the 1950s and 1960s (Rijkswaterstaat, 2025), and with typical lifespans of 60 to 80 years, a large share is now due for replacement or major renovation.

This leads to a substantial and urgent replacement and renovation challenge. The total replacement task is estimated at €260 billion, while current annual renewal production falls significantly short of what is required in the coming decades (Rasker et al., 2023). Moreover, the annual investment needed is expected to increase further over time. As a result, the sector faces not only a quantitative challenge but also a qualitative one: projects must be delivered more efficiently, predictably, and sustainably.

In response to this growing complexity, Rijkswaterstaat (RWS) has emphasized the need for a financially healthy, innovative, and competitive civil engineering sector (Rijkswaterstaat, 2019). However, achieving this is not straightforward. Increasing demands related to sustainability, stakeholder management, and system integration have made infrastructure projects inherently more complex. Consequently, traditional procurement approaches have evolved over time.

As outlined in the 2019 RWS report Future Task Rijkswaterstaat, procurement strategies have shifted

from traditional models, where the client retained design responsibility, towards more integrated forms such as D&B, D&C, and E&C (Rijkswaterstaat, 2019). These approaches involve a redistribution of risks to contractors and rely more heavily on functional specifications. While this shift was partly driven by policy and market demands for earlier contractor involvement, it also introduced new challenges.

In particular, integrated contracts have led to increased tendering costs and greater risk exposure for contractors. Tendering costs for integrated contracts can be up to 2.5 times higher than for traditional approaches (Hardeman, 2014), which has made contractors more selective in their participation. At the same time, RWS observed a decline in the number of bidders for large-scale projects. This raised concerns about market competitiveness and the feasibility of delivering the growing replacement task.

To address these issues, RWS introduced several measures, including the Two-phase approach (Rijkswaterstaat, 2019). This approach aims to improve collaboration between client and contractor by involving both parties in a joint design process during the first phase. The underlying idea is that early collaboration enables better risk identification and mitigation, leading to more predictable project outcomes.

However, despite these intended benefits, practical experiences suggest that the Two-phase approach does not automatically lead to improved predictability. In particular, the first phase is often perceived as uncertain and time-consuming, with schedules frequently exceeding initial expectations (Construction Specialist, 2025). This raises questions about whether the collaborative setup effectively addresses the underlying causes of planning uncertainty.

While planning and scheduling issues are not unique to two-phase contracts, they are especially relevant in this context due to the combination of high uncertainty, complex stakeholder interactions, and altered client–contractor relationships. Extensive research has shown that large infrastructure projects are prone to cost overruns and delays (Flyvbjerg, 2007a; Flyvbjerg, 2007b), but less is known about how these dynamics manifest within collaborative procurement models such as the Two-phase approach.

This thesis therefore focuses on understanding how time-related uncertainties emerge in the first phase of two-phase contracts, and more specifically, how clients and contractors can collaboratively improve the controllability of time within this phase. By examining the interaction between contractual structure, project complexity, and stakeholder behavior, this research aims to contribute to a better understanding of how planning performance can be improved in collaborative infrastructure projects.

1.2. Research question

This thesis focuses specifically on the predictability of time in the first phase of the two-phase approach. It builds on the assumption that greater control over time-related processes may contribute to greater predictability, as prior construction management research emphasizes the role of preventive, predictive, and corrective measures in improving time control under conditions of uncertainty and complexity (Olawale & Sun, 2010). Governing time in this aspect can be seen as finding measures to increase the likelihood of staying in time during the first phase, and by doing so decrease the chance of delays occuring in the first phase. Resulting in the following reasearch question:

How can clients and contractors govern time in the first phase of the two-phase approach?

This question will be answered by answering the following sub-questions:

RQ1: *What is the intended goal of the two-phase approach?*

RQ2: *What factors influence time management in infrastructure projects?*

RQ3: *What processes have an influence on time management in the first phase of the two-phase approach?*

RQ4: *What recommendations can clients and contractors use to manage time?*

The first two research questions establish the theoretical foundation for examining the role of the two-phase approach in the infrastructure sector and identifying factors that influence time management. This framework captures both the intended objectives of the two-phase approach in relation to common infrastructure practices and the literature-based factors affecting time management in infrastructure

projects. It will subsequently guide the multiple case study, in which interviews and document analysis are used to assess which components are present in the selected cases.

It is important to note that the establishment of the Phase I end date is outside the scope of this study. For example, strategic misrepresentation may result in a deliberately shortened Phase I (i.e., strategic misinterpretation) (Flyvbjerg, 2003). While it is a very interesting element, studying the establishment of the boundaries in which time management takes place in Phase I, the establishment of the end date of Phase I is not discussed, partially to keep the scope of the investigation manageable and partially due to the availability of this information. Therefore, the focus of this research is not on defining or assessing the planned duration of Phase I itself.

At the same time, strategic misrepresentation at the overall project level, such as project costs, is taken into account to the extent it influences time management in Phase I of both projects. In this way, the study focuses on the processes that had an influence on time management in Phase I and on how these time management may be addressed, while excluding the end-date-setting process of Phase I itself from the scope.

The practical relevance of this thesis has already been discussed in Section 1.1. Section 1.3 will give an overview of the existing literature. Given the limited scientific literature on the Two-phase Approach, particularly regarding time overruns in Phase I, this chapter will shift its focus to other approaches. It is important to understand why design stages in 'regular' or other unique approaches face delays or are consequently underestimated.

1.3. Scientific Relevance

In this section, the scientific relevance of this study is substantiated by discussing articles that have examined time management in infrastructure projects during the design phase. By providing a comprehensive overview of the current literature on factors influencing time management, this review demonstrates how the present research complements and extends the existing body of work.

Research focusing on time management and governing time during the planning and design stages of infrastructure projects, such as the study by Yang and Wei (2010), It highlights changing client requirements as a dominant factor in schedule overruns, as a factor contributing to delays, by doing so having an effect on time management. However, this finding is derived from traditional project settings without reference to the collaborative approach applied. Because the client's requirements are functional in the two-phase approach, it remains interesting whether these mechanisms also play a role in the Two-phase approach. Also, shared decision-making and iterative scope development may affect the extent to which client-induced changes delay the project.

Other studies concentrate on the quality and timing of design deliverables as key drivers of time management. (O'Connor and Woo, 2017), For instance, emphasize the effects of untimely stakeholder input, insufficient expertise, and an insufficient scope freeze during design. These issues are predominantly situated within Design–Bid–Build contracts. In these contracts, late involvement of operational stakeholders often triggers revisions and schedule disruptions. While the authors note that more integrated forms, such as Early Contractor Involvement or alliances, may reduce these inefficiencies, it remains interesting to validate these conclusions through Two-phase Approaches. Consequently, it remains unclear to what extent similar causal patterns challenge time management in Phase I, where contractor participation is already embedded and a strong emphasis on collaboration exists. These collaborative foundations could mitigate the effects of delayed input and the absence of experience, ultimately enabling more robust time governance.

A broader meta-analysis of delay factors by (Amarkhil et al., 2021) identifies slow decision-making, poor communication, and ineffective planning as critical threats to time management and primary drivers of delay in infrastructure projects. The study does not distinguish between collaboration forms or project phases. Therefore, while these internal organizational factors undoubtedly influence how time is governed during Phase I, the analysis does not offer evidence specific to a collaborative form. Ultimately, the chosen delivery model might either proactively mitigate these inefficiencies or be (partially) responsible for disrupting effective time governance.

Further insight into time management in infrastructure projects is provided by (Son and Rojas, 2011),

who examines optimism bias in project planning and control. This phenomenon, which describes the tendency to exhibit unwarranted confidence or certainty about planned outcomes. Managers suffering from this bias pursue baseline plans that are unlikely to be achieved because they overestimate their ability to control problems and underestimate the impact of unexpected events, This ultimately disrupts effective time governance, leading to a ”delusion of success” regarding organizational and information-handling issues. While this article does not go into specific collaboration or contract forms, it remains interesting whether this cognitive bias challenges time management by contributing to the underestimation of the lead time for Phase I of the Two-Phase Approach.

While (Flyvbjerg et al., 2002) primarily analyzes the systemic underestimation of project costs in public works, identifying technical, economic, psychological, and political explanations, their insights are highly relevant for time management. Although their analysis focuses on budgetary rather than temporal overruns, underlying mechanisms such as strategic misrepresentation and strict adherence to the ”Everything Goes According to Plan” (EGAP) principle directly undermine effective time governance and fundamentally contribute to schedule delays. Specifically, the tendency to neglect uncertainty and deliberately omit time buffers in the early stages of Two-Phase projects can lead to highly unrealistic baseline schedules, paralyzing proactive time management during the initial phase. Nevertheless, because the study confines itself to cost forecasting and does not explicitly address Two-Phase procurement, its findings only indirectly inform our understanding of how time is governed and why delay dynamics unfold in Phase I

Taken together, the studies summarized in Table 1.1 seek to identify the general determinants of time management in construction projects. However, they do not account for the specific characteristics of time management in the first phase of Two-Phase Approaches or within ECI approaches. None of the reviewed literature explicitly considers how the open-scope, collaborative, and iterative nature of Phase I influences the causal mechanisms found in traditional models. As a result, additional research is required to identify which complexity factors specifically affect time management in this phase and how clients and contractors can jointly mitigate them.

Table 1.1: Overview of delay and cost factors identified in the literature

Factor	Description	Source
Changing client requirements	Dominant factor in schedule overruns. Unclear whether mechanisms apply to Phase I of Two-phase Approach with iterative scope development.	Yang and Wei, 2010
Untimely stakeholder input & lack of scope freeze	Late involvement triggers revisions and disruptions. In Phase I, contractor participation and collaborative emphasis may mitigate these effects.	O’Connor and Woo, 2017
Slow decision-making & poor communication	Critical delay drivers in infrastructure projects. Unclear whether Two-phase model mitigates or exacerbates these factors.	Amarkhil et al., 2021
Optimism bias	Managers overestimate control and underestimate uncertainty. Impact on Phase I lead time estimation remains open.	Son and Rojas, 2011
Strategic misrepresentation & EGAP principle	Systematic underestimation through neglect of uncertainty and omission of buffers. Indirectly relevant for realistic Phase I planning.	Flyvbjerg et al., 2002

1.4. Research design

The research design will follow the steps described in Figure 1.1. Section 1.4.1 will discuss RQ1, Section 1.4.2 will discuss RQ2. RQ3 will be discussed in Section 1.4.4. Lastly, RQ4 will be discussed in Section 1.4.5.

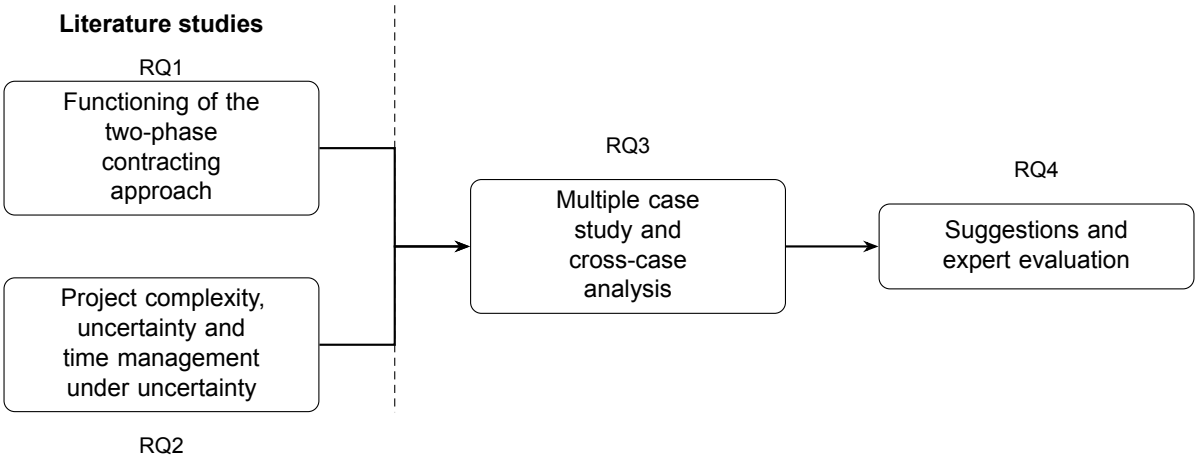


Figure 1.1: Schematic overview of the research process.

1.4.1. Chapter 2: Literature studies (RQ1)

What is the intended goal of the two-phase approach?

This question will be addressed through a literature review. Several steps will be taken to answer it. First, existing forms of collaboration will be identified and described. To gain a thorough understanding of the two-phase contracting approach and the position of the two-phase approach in the Dutch infrastructure landscape, it is essential to review other collaboration models and their respective objectives. These questions will be addressed in Chapter 2.

An assessment of time governance in Phase I requires a clear understanding of the intended objectives of the two-stage approach. Without establishing what the approach seeks to achieve, it is not possible to meaningfully evaluate how time is managed in the first phase.

1.4.2. Chapter 3: Literature studies (RQ2)

What factors influence time management in infrastructure projects?

This question will be answered through a literature study. As discussed in section 1.1, the Two-phase approach is intended for the most complex projects. Complexity theories will be reviewed to gain a thorough understanding of complexity in projects and its effects.

Also, the existing literature on Client-Contractor collaboration will be reviewed, as the first phase of the Two-phase approach involves intensive collaboration between the Client and Contractor. These insights can help identify why and how potential delays occur.

Finally, the literature on managing time in the face of uncertainty will be reviewed. Knowledge of decision-making, planning, project management, and design iteration could provide insights into decisions made and components of solutions for dealing with situations encountered in the first phase of the Two-Phase Approach. Also, literature concerning biases will be discussed, since these may be relevant to understanding decision-making in complex situations.

1.4.3. Chapter 4: Operationalization

Chapter 4 discusses the operationalization of the case study design. It outlines the key methodological choices underlying the research, including case selection, the use of a complexity framework, and the design of the data collection process. Also attention is given to how differing perspectives of participants within each case will be systematically captured and compared.

1.4.4. Chapter 5: Multiple case study & Cross case analyses (RQ3)

What processes have an influence on time management in the first phase of the two-phase approach?

An in-depth multiple-case study serves as the empirical basis for identifying the processes described in the research question. The design and criteria established in Chapter 4 guide the execution of this case

study. The insights obtained from the literature studies in RQ1 and RQ2 form the theoretical foundation for the analysis, as illustrated in Figure 1.1.

1.4.5. Chapter 6: Suggestions and expert validation (RQ4)

What suggestions can clients and contractors use to manage time? And how do experts evaluate these?

The lessons learned from Research Questions 1, 2, and 3 will be formulated into recommendation to improve time management in Phase I of the Two-phase approach. The focus will be on how to prevent or mitigate certain processes that have a negative effect on time management in this phase.

The recommendation developed in this chapter will be validated by experts in two-phase contracting. The expert panel will consist of professionals who have not been involved in this research. The experts will also assess whether the processes identified in the case studies can be recognized in other two-phase contracting contexts.

2

Delivery Models

This chapter discusses the main delivery models relevant to complex infrastructure projects, because the Two-phase Approach has been developed within this context. To understand the Two-phase Approach's intended goal, it is necessary to first examine the limitations of traditional and integrated contract forms.

Therefore, this chapter first discusses the traditional Design-Bid-Build approach, then integrated contract forms such as UAV-GC 2005, and finally the Two-phase Approach itself. This structure shows which potential shortcomings and/or limitations in earlier delivery models have contributed to the development of the Two-phase Approach and why it is applied to projects characterized by high complexity and uncertainty. By comparing these delivery models, the chapter provides the basis for answering the research question: *What is the intended goal of the Two-phase Approach?*

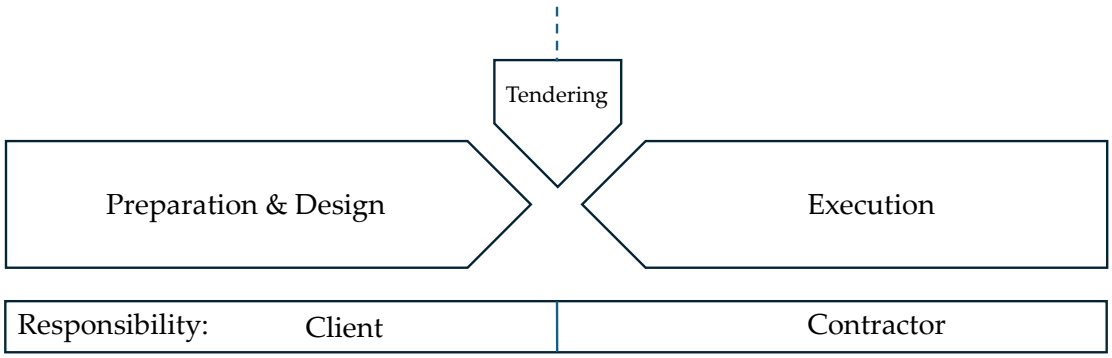
2.1. Delivery models

In this section, various delivery methods will be discussed. They will be discussed in relation to complex infrastructure projects, as that is the field in which the Two-phase approach is applied. To understand the Two-phase approach, it is essential to distinguish it from the traditional approach. In section 2.1.1, traditional contracting will be discussed. The integrated approach will be discussed in section 2.1.2. The Two-phase approach will be addressed in section 2.1.3. Concluding with an answer to research question 1 in 2.1.4

2.1.1. Design-Bid-Build

In traditional contracting, the client is responsible for preparing the design, which may be developed internally or outsourced to a civil engineering firm. A prepared design is put on the market, and contractors can enter the tender procedure and win the bid. Figure 2.1 shows a schematic of a traditional tender procedure. In this procedure, the contractor has no influence on the design. Making it more complicated for contractors to use techniques they are experienced with. The responsibility of the design solely relies on the client, which can also be undesirable in complex infrastructure projects (Buitenruimte, z.d.).

Figure 2.1: Schematic Overview of the Traditional Contracting Method



Note. Adapted from *Toepassing 2-fasen aanpak bij Rijkswaterstaat projecten*, by Rijkswaterstaat, 2023.

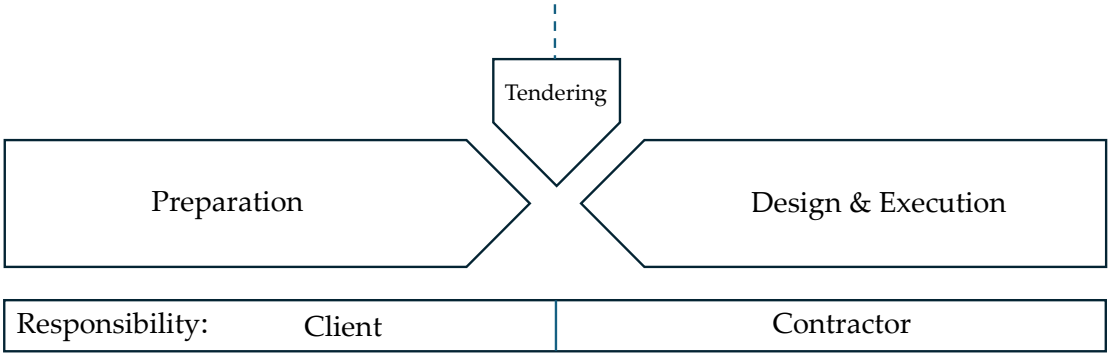
Additionally, not every project condition can be identified before detailed design is carried out, which makes it challenging for the client to develop a fully detailed, buildable design independently. As a result, important construction knowledge and market input from contractors are only introduced after tender, which can lead to design changes, delays and additional costs.

2.1.2. Integrated contract forms

The characteristic difference between the tendering process for a traditional building contract on the one hand and an integrated construction contract on the other concerns the level of detail in the specifications on which the candidates' bids must be based. In a traditional building contract, the tender specifications are detailed (down to the level of the specifications) and a candidate can calculate fairly accurately the price at which he wishes to carry out the tender specifications (Janssen, 2000).

In integrated contract forms, contractors' knowledge is used in the design phase, which can improve the project's quality. Dealing with one of the limitations of the Design-Bid-Build approach. For example, in DBFM contracts, contractors are responsible for the entire life cycle, which incentivizes them to design cost-effective solutions for maintenance and energy use over the long term (Rijkswaterstaat, 2019). Figure 2.2 gives a schematic overview of an integrated approach.

Figure 2.2: Schematic overview of an integrated contract form



Note. Own work.

In this thesis, the characteristics and limitations of the UAV-GC 2005 are discussed for the integrated

approach. This version is the one used in the decade(s) leading up to the Two-phase approach.

Integrated contract forms also have certain implications for complex, high risk, infrastructure projects. unknown risks that eventually became the contractor's responsibility, lack of team feeling, erosion of client expertise, and forced roles. The most important issues identified for the UAV-GC 2005 are presented in Chao-Duivis, 2019.

- the provision of a price at an overly early stage
- the scope and delineation of the works
- the allocation of tasks and the mutual relationships
- the sequencing of activities

The most important limitation of the UAV-GC 2005 is the information management. The legal framework of integrated contracts has created a culture of fear regarding communication, often described as the model's "Achilles heel". A culture has developed in which parties fear that "he who protects, bleeds" (meaning that if a client helps or warns, they might inadvertently assume liability). This has led to situations where parties question whether they are even allowed to talk to one another, fearing legal consequences. The regulation regarding information sharing (specifically paragraph 3 lid 1 of the UAV-GC 2005) is defensive. The client is not obliged to share all information, only what is "necessary". This reticence to share information prevents a project-friendly flow of data (Chao-Duivis, 2019).

Also, shifting the risk to the contractor posed some problems. The shifting of risks for complex projects has led to severe financial consequences when those risks materialize. Because the profit and risk margins included in the bids were often insufficient, contractors have incurred substantial financial setbacks that threaten their solvency. A notable example is the Zeetoegang IJmond project, where the contractor consortium had to accept a loss of approximately €200 million due to a risk that was allocated to them. The increased risk for contractors could lead to a more risk-averse attitude. Consequently, this caution could cause contractors to refrain from tendering, especially in a market with an abundance of projects, where they deem the risk profile unfavorable (Rijkswaterstaat, 2019).

The renewed UAV-GC 2025, which is released after the introduction of the Two-phase Approach, attempted to address the problem concerning the provision of information. Under UAV-GC 2025, the Client is explicitly responsible for any missing or incomplete information. There is a nuance: for the risk to shift to the Client, the Contractor must demonstrate that they acted as a "careful contractor" and could not have reasonably expected the deviation (Roordink and van Dijk, 2025).

2.1.3. The Two-Phase Approach

General approach

In the Two-phase approach, after award, the first phase (design phase) is executed collaboratively by the client and the contractor. They cooperate and perform the first phase together. The second Phase (realization phase) is executed by the contractor. Figure 1.3 illustrates the Two-phase Approach. The Two-phase approach is not an effective approach for every project. In general terms, it can be stated that a two-phase contract offers added value if the following conditions are met (Moonen, 2022), (van Wijk – van Gilst, 2020):

- Due to a certain complexity, the client is unable to formulate the assignment and requirements in sufficient detail.
- An assignment involves (multiple) significant uncertainties/risks for which it is not reasonably possible to quote a fixed realization price.

Figure 2.3: Schematic Overview of the Two-phase Approach

Note. Adapted from *Toepassing 2-fasen aanpak bij Rijkswaterstaat projecten*, by Rijkswaterstaat, 2023.

The Two-Phase approach begins with RWS preparation (Phase 0), during which planning frameworks are established and functional requirements are clarified. During this preparation, the design is elaborated in a risk-driven manner to a specific level of detail, allowing parts with significant uncertainties or

opportunities to remain at a global level. Following preparation, the contract is tendered, using competitive dialogue as a starting point. The commission for Phase I is granted unconditionally to the market party, subject to a 'waiting chamber procedure'. While Phase II is granted conditionally (Rijkswaterstaat, 2023).

At the end of Phase I, a feasible and achievable design will be established, and a realistic and market-based fixed price for Phase II must be agreed upon. This leads to the formal Go/No-Go moment, at which point RWS assesses whether all predetermined contractual conditions have been met to start Phase II (Rijkswaterstaat, 2023).

Following a positive decision, Phase II (Execution) starts. Sometimes a final design needs to be carried out by the contractor, dependent on agreements made in Phase 0. In terms of methodology, this corresponds to the execution of regular projects, where the market party often finalizes the design to be execution-ready. A key strength of this approach is that the intensive collaboration and mutual knowledge transfer in Phase I are expected to carry over positively into Phase II, ultimately contributing to higher-quality outcomes and better projects for all parties. Through joint efforts to mitigate risks before the final price is determined, projects become more manageable and predictable for both RWS and the market (Rijkswaterstaat, 2023).

The Two-phase approach has two clear goals. Firstly, 'using market expertise to reduce project risks and exploit opportunities, so that projects can be priced more accurately and become more manageable and predictable for both Rijkswaterstaat and the market'. Secondly, 'reducing transaction costs for the benefit of a financially sound and productive sector' (Rijkswaterstaat, 2023). Addressing the risk in a different way directly targets the main limitation of the integrated approach discussed in Section 2.1.2.

In the Two-phase Approach, knowledge from different parties is combined. Combining a client's knowledge and experience with a contractor's practical expertise should yield better, more sustainable solutions at a lower cost (Mobilis TBI, 2025).

Phase I

In this subsection, Phase I in the Two-phase Approach will be further discussed. The first phase is further explained, as it is the subject this thesis will focus on. This section will discuss the goals of Phase I, the process of Phase I and the end of Phase I (Go/NoGo moment).

Goals

Phase I is a stage, participated in by both the contractor and the client, in which research and design work are carried out (van Dijk, 2025). The goal of Phase I is to jointly and in a controlled manner, within the contractual frameworks, achieve the following results(Rijkswaterstaat, 2023):

- A feasible and achievable design in which opportunities have been exploited and risks mitigated
- A robust schedule for Phase I
- An acceptable risk profile for Phase II that can be supported by the market
- A realistic and market-based fixed price for the realization phase (Phase II)

A positive outcome of Phase I contributes to the predictability and controllability of the project's realization phase. The goals and activities for the phase may differ between projects, as customization is often required (Rijkswaterstaat, 2023).

Proces

The process in Phase I is cyclical and iterative, working with different design layers and predetermined milestones. RWS determines the goals and activities to be set in Phase 0 for Phase I. The lead time and costs for Phase I are also determined in Phase 0. Lastly, contract forms and collaboration forms are also determined in Phase 0 (Rijkswaterstaat, 2023). Depending on the contractor's entry point in Phase I, the design effort varies. At the start of the collaboration, these process deadlines, milestones, and design efforts are coordinated (van Dijk, 2025).

During Phase I, the design is elaborated step by step. Each design stage is concluded with a baseline, in which a cost estimate for the realization phase is drawn up for the products then available. The cost estimate comprises construction costs, property costs, engineering costs, additional costs, and

a risk reserve, in accordance with the SSK system. Each baseline results in a cost estimate and a cost memorandum. This describes the justification for the estimate, including the assumptions, the consequences of changes (in the design), the implementation method and duration, and the (adjusted) risk assessment (van Dijk, 2025). The following design stages are typically covered in Phase I.

- Schetsontwerp (SO) (Schematic Design)
- Voorlopig Ontwerp (VO) (Preliminary Design)
- Definitief Ontwerp (DO) (Final Design)
- Uitvoerend Ontwerp (UO) (Execution Design)

The starting and ending points of Phase I vary across projects. Consequently, so do the designs carried out in the first phase. It depends on the agreements made during Phase 0. Sometimes the Go-NoGo moment lies before the execution design.

Go/NoGo-Moment

Phase I concludes with the Go/NoGo moment, as discussed in the previous paragraph. During the Go/NoGo moment, it is determined whether the conditions set in Phase 0 are met to move into Phase II. These stipulated conditions could include whether the design stage has been met, the extent to which risks are managed and opportunities are exploited, and the final price for Phase II (Rijkswaterstaat, 2023). The end date (Go/NoGo moment) of Phase I in the two-phase approach is referred to as the “target date” Nagelkerke and van Dijke, 2020. They emphasize steering toward collaboration, assessments, and absolute equality regarding the end date/completion of the first phase.

These factors combined make adhering to a fixed deadline complex when the two parties with (partially) different interests must reach an agreement. A key complexity, therefore, is determining when Phase I is sufficiently complete to proceed to the Go/NoGo moment and continue to Phase II. Contractors also indicate that Phase I often takes longer than anticipated. This has a big influence on the planning of Phase II (Vitale Infrasector, 2025).

The additional lead time for Phase I has consequences for both the client and the contractor. The contractor has trouble planning its people and materials. The contractor’s business model relies on revenue from the execution phase, meaning it is not realized during the initial stage (van Dijk, 2025). For the client, the additional lead time may result in missed delivery dates and a possible carryover of budget from Phase II to Phase I. This might result in a smaller budget remaining for Phase II.

Table 2.1: Theoretical framework derived from Chapter 2: delivery models and the Two-phase Approach.

Theoretical dimension	**Conceptualization based on Chapter 2**	**Key references**
Positioning of the Two-phase Approach in the delivery model landscape	Two-phase Approach as response to limitations of Design–Bid–Build and integrated UAV-GC contracts in complex, high-risk infrastructure projects, especially regarding risk allocation, information management and pricing under uncertainty.	(Rijkswaterstaat, 2019); (Rijkswaterstaat, 2023); (Chao-Duivis, 2019); (Janssen, 2000)
Timing of contractor involvement	In DBB, contractor enters after client design is complete and tendered. Integrated and two-phase forms bring contractor expertise into the design stage; Phase I is explicitly joint design and risk mitigation.	(O’Connor & Woo, 2017); (Rijkswaterstaat, 2019); (Rijkswaterstaat, 2023)

Continued on next page

Table 2.1: Theoretical framework derived from Chapter 2: delivery models and the Two-phase Approach (continued).

Theoretical dimension	Conceptualization based on Chapter 2	Key references
Design completeness and scope definition at award	DBB assumes largely completed client design at tender. Integrated and two-phase contracts accept that not all project conditions and scope can be specified up front; Phase I develops the design in a risk-driven, stepwise manner.	(Buitenruimte, z.d.); (Vidal & Marle, 2008)
Risk allocation and financial exposure	Integrated UAV-GC forms shifted substantial, often poorly understood risks to contractors, causing financial setbacks and risk-averse tendering. Two-phase Approach seeks to rebalance this by jointly identifying and mitigating risks before fixing the Phase II price.	(Rijkswaterstaat, 2019); (Rijkswaterstaat, 2023); (Chao-Duivis, 2019)
Information management and communication culture	Under UAV-GC 2005, defensive information regime (“he who protects, bleeds”) created a culture of fear and limited data sharing. Two-phase Approach relies on more open, project-friendly information flows in Phase I.	(Rijkswaterstaat, 2023); (Chao-Duivis, 2019)
Price formation and timing of price fixation	Traditional and integrated forms require pricing at early stages. In Two-phase Approach, realistic and market-based fixed price for Phase II is agreed only at the end of Phase I, after joint design and risk analysis.	(Rijkswaterstaat, 2019); (Rijkswaterstaat, 2023)
Collaborative design and mutual knowledge integration in Phase I	Phase I is joint research and design stage in which client and contractor combine functional knowledge and practical expertise to achieve feasible design, exploit opportunities and mitigate risks.	(Rijkswaterstaat, 2023)
Iterative, baseline-driven Phase I process	Phase I organized as an iterative process with SO, VO, DO (and sometimes UO) and associated baselines, each including SSK-based cost estimates, assumptions, and updated risk assessments.	(van Dijk, 2025); (Rijkswaterstaat, 2023)
Go/No-Go governance and ‘target date’	Go/No-Go moment marks transition to Phase II and is tied to conditions on design maturity, risk mitigation and price agreement. Referred to as “target date”, difficult to meet due to differing interests and joint decision-making.	(Nagelkerke & van Dijke, 2020); (Rijkswaterstaat, 2023)
Phase I duration, time governance and perceived predictability	Sector signals and literature indicate Phase I often takes longer than anticipated, creating planning issues for both client and contractor and raising questions about predictability and controllability of the first phase.	(Vitale Infrasector, 2025); (Yang & Wei, 2010); (Amarkhil et al., 2021)

2.1.4. Conclusion

This chapter showed that the Two-phase Approach was developed as a response to the limitations of both traditional and integrated contract forms in complex infrastructure projects and gives an answer to RQ1: *What is the intended goal of the two-phase approach?*. Table 2.1 illustrates the literal framework. The literal framework will be used in the result section as well as the discussion, where certain processes will be substantiated with respect to the intended use of the Two-phase approach. In Design-Bid-Build, contractor input is entered too late, leading to design changes, delays, and additional costs during execution. Integrated contract forms partially address this by involving the contractor earlier, but they may also create problems such as premature pricing, unclear task allocation, information management issues, and excessive transfer of risk to the contractor.

The intended goal of the Two-phase Approach is therefore to use market knowledge earlier and more structurally, so that risks and opportunities can be jointly developed during Phase I, the design becomes more feasible, and Phase II can begin with a more realistic, market-based price. In addition, the ap-

proach aims to reduce transaction costs, thereby improving both project predictability and the sector's financial robustness.

In short, the Two-phase Approach is intended to make complex projects more manageable, more predictable, and better priced by jointly developing design, risk assessment, and pricing before execution begins.

3

Complexity Theories

In infrastructure projects, time management is not determined by planning alone. It has been acknowledged that there is a correlation between project performance and complexity (Gajic & Palcic, 2019). The way time is managed is strongly shaped by project complexity, the quality of client-contractor collaboration, and the presence of uncertainty during design and decision-making.

This chapter examines the theoretical factors that help explain how time is managed across infrastructure projects. First, complexity theories are used to show how structural and dynamic complexity affect predictability, planning, and control. Second, the literature on client-contractor collaboration is discussed, as two-phase projects depend on interaction, trust, and alignment between parties, which may either support or hinder timely progress. Third, the chapter reviews time management in complex environments, including iteration, scope choices, and management strategies, because these directly influence whether projects stay on schedule or require rework and delay.

Finally, behavioral biases and heuristics are included because time management decisions are not always purely rational. Optimism bias, planning fallacy, anchoring, and strategic misrepresentation can influence early estimates, scheduling choices, and the willingness to share realistic information, all of which may affect project timing. Together, these perspectives provide a theoretical basis for identifying which factors influence time management in infrastructure projects and how they may interact in the first phase of a two-phase approach.

These perspectives are consolidated into an alignment framework that connects complexity type and management approach to the duration and predictability of Phase I, thereby addressing the research question: *'What factors influence time management in infrastructure projects?'*

RQ2 is addressed by first developing the two analytical axes that form the backbone of the framework: the *type of complexity* a process exhibits (Section 3.1) and the *management approach* through which that complexity is handled (Section 3.1.2). These are brought together in an alignment framework (Section 3.2) that links complexity type and management approach to the time and predictability of Phase I. Three further factors that also bear on Phase I time are then reviewed: client–contractor collaboration (Section 3.3.1), scope and design iteration (Section 3.3.2), and behavioural biases (Section 3.3.3). An answer to RQ2 is formulated in the conclusion (Section 3.4).

3.1. Project complexity and management

The inability to manage complexity has been recognized as a major factor in project failure for several years (Williams, 1999). Or in other words, complexity appears to be one of the main reasons for the unpredictability of projects, particularly in terms of problems and failures (Vidal and Marle, 2008). The inherently complex nature of the Two-phase Approach projects makes it essential to gain a thorough understanding of project complexity.

The complexity of construction projects has increased due to many different factors in the previous decades. Increasing client requirements, such as sustainability and accessibility requirements, have

increased the number of projects. Also, dynamic factors such as unstable political situations or volatile prices make projects extra complex. In the following section, the differences between Structural and Dynamic complexity will be discussed, while both require different management approaches (Koppenjan et al., 2011).

3.1.1. Structural and dynamic complexity

The first axis distinguishes two types of complexity. Structural complexity, closely related to what Hertogh and Westerveld (2010) call detail complexity, refers to the arrangement of, and interrelation between, the many components of a project: tasks, disciplines, sub-systems, contracts, stakeholders and the governance that connects them (Brady & Davies, 2014). In the terms of Baccarini (1996) it is a matter of *differentiation* (the number of components) and *interdependence* (the degree of interrelatedness) Structural complexity is, in principle, knowable and measurable in advance, and it can be captured at the front end as a complexity footprint across the technical, organisational and environmental dimensions of the TOE framework (M. Bosch-Rekveldt et al., 2011). Its building blocks are fixed: a given set of components arranged in a given way.

Dynamic complexity refers to the changing relationships among components, and between the project and its environment, over time (Brady & Davies, 2014; Hertogh & Westerveld, 2010). It is associated with emergent events and with uncertainty that ranges from foreseen to entirely unforeseen. Where structural complexity resides in the arrangement of components, dynamic complexity resides in how that arrangement behaves and shifts as the project unfolds. A point made by Brady and Davies (2014) is important for what follows: structural complexity *generates its own internal uncertainty*, so that a fixed front-end condition can become a continuing source of in-time, emergent difficulty. The two types are therefore analytically distinct but empirically connected.

These two poles of the complexity axis are summarised in Figure 3.1.

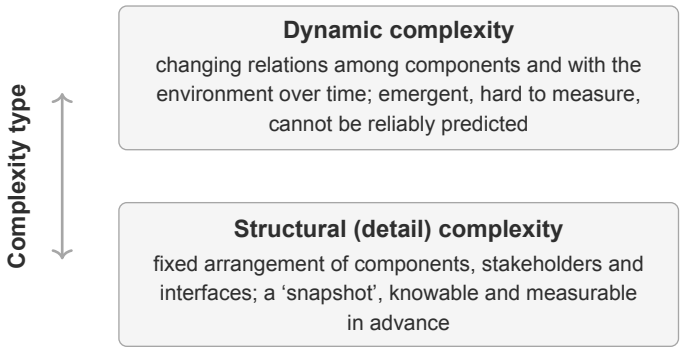


Figure 3.1: The complexity axis: structural (detail) and dynamic complexity, based on Brady and Davies (2014) and Hertogh and Westerveld (2010).

3.1.2. Management approaches

As described above, the dynamic and structural complexity requires different project management approaches. These two approaches form the second analytical axis, following Koppenjan et al. (2011), and are further outlined in this section.

Predict-and-control

The predict-and-control approach is a traditional, mechanistic management style designed to tackle structural complexity, referred to as the type I approach. Because structural complexity involves a large but stable number of interacting components (such as technological parts and stakeholder networks) that can be quantified and measured in advance, the type I approach assumes the project can be fully mapped out before execution begins. It focuses on rigid planning, strict control, and hierarchical steering and focuses on hard values such as financial targets and deadlines (Koppenjan et al., 2011).

Prepare-and-commit

Prepare-and-Commit is an organic, adaptive management style necessary for dealing with dynamic complexity, a type II approach. Because dynamic complexity involves elements that are constantly

subject to unpredictable changes, uncertainties, and emergent behaviors over time, these factors cannot be reliably quantified or prepared for using a static blueprint. It focuses on functional flexibility, embracing change, networked steering and focuses on soft values such as innovation, system quality and safety (Koppenjan et al., 2011).

Prepare or commit?

The case study by Koppenjan et al., 2011 raises several interesting points about the Type I and Type II approaches. The difference between the strategies is mapped out in broad terms and parameter by parameter in Table 3.1. First of all, no single management approach is seen as dominant. Both management approaches were dominant in this project, across different subjects or time periods. Moreover, management decisions were often not the result of conscious choices. For instance, the LoR, rather than a more strict design, was constructed due to prespecified time pressure.

Table 3.1: Synthesis of the two management approaches, combining Koppenjan et al. (2011) with the Systems and Interactive Management framework of Hertogh and Westerveld (2010). Cyan marks the elements that derive specifically from Hertogh and Westerveld (2010).

	Type I — predict-and-control *(Systems Management)*	**Type II — prepare-and-commit** *(Interactive Management)*
Underlying worldview		
View on uncertainty	Can be tamed	Will inevitably bite the project
View on change	Undesirable; to be limited	Inevitable; to be facilitated
Front-end development		
Primary effort	System development	Coalition building
Front-end deliverables	Schedule, budget, design, work breakdown	Milestones, funding, rules of play, roles
Terms of reference	Blueprint	Functional
Structuring the work		
Task definition	Narrow and singular, for control	Broad and overlapping, for cooperation
Contract	Task execution	Functional realisation
Incentives	Work-task based	System-output based
Steering & coordination		
Driving force	Control — stay on the plotted course	Commitment — keep moving forward
Steering mode	Hierarchical	Network
Information exchange	Limited, standardised	Open, demand-driven
Interface management	Project-management task	Shared task

Elements that derive specifically from Hertogh and Westerveld (2010) (Systems / Interactive Management); all unmarked elements from Koppenjan et al. (2011).

The authors also observe a clear relationship between the management approach and the types of project values prioritized: Type I tends to manage easily quantifiable “hard” values such as time and money, whereas Type II emphasizes “soft” and more complex values such as quality, scope, and safety. Because hard values are easier to predict, control, and communicate externally, external pressure can reinforce Type I, risking that Type II elements are crowded out and that quality and safety are compromised. Giezen, 2012 verifies this by stating that in practice, management types are applied in mixed form as project managers work between limitations and opportunities that are not always theirs to choose. These two poles of the management axis are summarised in Figure 3.2.

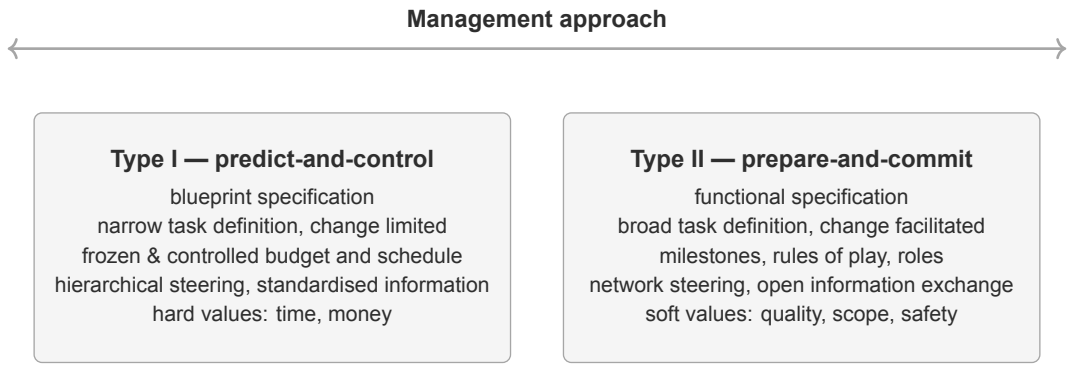


Figure 3.2: The management axis: Type I (predict-and-control) and Type II (prepare-and-commit), adapted from Koppenjan et al. (2011).

3.2. Aligning complexity and management approach

Having established the two analytical axes, complexity type and management approach, this section consolidates them into a single alignment framework.

3.2.1. Effects of misaligned management approaches

The two approaches introduced above are not only alternatives at the level of a project as a whole. In a two-party setting, they are also distributed between the client and the contractor. Each party may lean towards a different approach, the same project parameter can be governed under a Type I logic by one party and a Type II logic by the other at the same time . This matters because control and flexibility impose contradictory requirements on the management of a project: control calls for parameters to be rigidly specified and held, whereas flexibility calls for those same parameters to be kept open, functional, and revised (Koppenjan et al., 2011) . Project success is at risk precisely when the parties do not succeed in reconciling these contradictory requirements into a workable combination through 'mindfulness' (Koppenjan et al., 2011) or 'dynamic management' (Hertogh & Westerveld, 2010).

Counter-arrangements are specific management interventions designed to mitigate the one-sidedness of a prevailing management style. For instance, if a project's baseline is heavily dominated by a Type I approach, characterized by strictly unbundled contracts and frozen budgets, managers must introduce Type II counter arrangements, such as horizontal cooperation forums, shared interface management, or working hypotheses, to provide the necessary flexibility (Koppenjan et al., 2011).

What (Koppenjan et al., 2011) define as the mindful application of counter-arrangements is conceptualised (Hertogh & Westerveld, 2010) as 'Dynamic Management': the continuous and deliberate balancing of Systems Management (control) and Interactive Management (interaction). Both theories highlight that structural constraints and dynamic uncertainties cannot be managed sequentially or in perfect harmony, but must deliberately co-exist through dual-focused management structures.

Contrasting management styles generate persistent organisational tensions that surface around key decisions. Unless these tensions are actively managed, they produce oscillation, stalled decision-making, and premature convergence rather than resolution (Hertogh & Westerveld, 2010; Koppenjan et al., 2011).

3.2.2. Alignment and theoretical propositions

Bringing the two axes together yields the central logic of the framework: the effect of a process on Phase I time and predictability is expected to depend on the alignment between the type of complexity it exhibits and the management approach through which it is handled. Figure 3.3 sets this out as a two-by-two relationship between the complexity axis and the management axis. The expectation is summarised in three propositions, stated as associations to be examined rather than as normative claims about which approach is preferable.

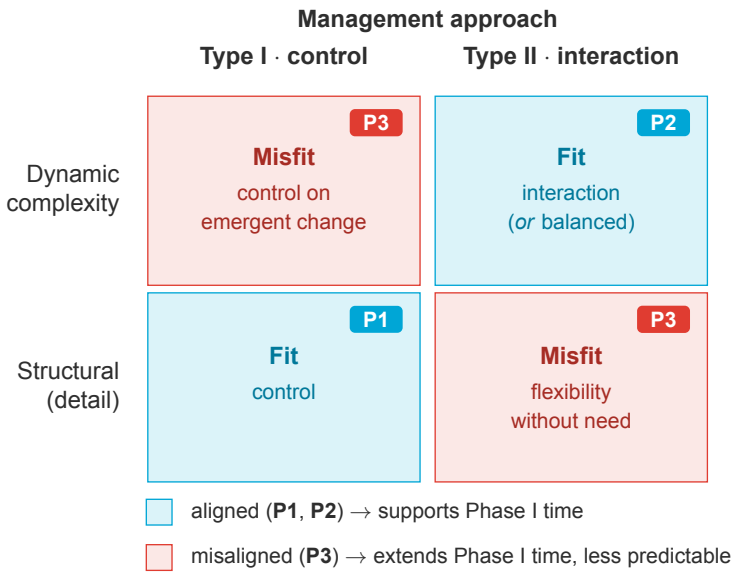


Figure 3.3: Alignment of complexity type and management approach, and the expected effect on Phase I time and predictability.

The expectation is summarised in three propositions, stated as associations to be examined rather than as normative claims about which approach is preferable. Because large projects present both types of complexity, the project as a whole calls for a deliberate balance of control and interaction—what Hertogh and Westerveld (2010) term dynamic management and Koppenjan et al. (2011) mindfulness—in which a dominant style is offset by deliberate counter-arrangements (Koppenjan et al., 2011). Where the complexity type and the management approach are aligned (P1, P2), Phase I duration and predictability are expected to be supported; where they are misaligned (P3), duration is expected to extend and predictability to decrease.

P1. Structural (detail) complexity is expected to be associated with control-oriented (Type I) handling, as a means of containing a fixed and knowable arrangement of components (Hertogh & Westerveld, 2010; Koppenjan et al., 2011).

P2. Dynamic complexity is expected to be associated with interaction-oriented (Type II) handling, as a means of absorbing emergent, in-time uncertainty (Hertogh & Westerveld, 2010; Koppenjan et al., 2011).

P3. A misalignment between complexity type and management approach, for example control-oriented handling of dynamic complexity, or, in particular, the same parameter governed under unreconciled Type I and Type II logics by the two parties without deliberate counter-arrangements, is expected to extend Phase I duration and reduce its predictability (Hertogh & Westerveld, 2010; Koppenjan et al., 2011).

3.3. Further factors influencing time management

The alignment framework above identifies the fit between complexity type and management approach as a central influence on Phase I time and predictability, but it is not the only one. The literature points to three further factors that bear on how time is managed in Phase I, each in its own right rather than as part of the fit logic: the quality of client-contractor collaboration, the scope and design-iteration choices made during the design process, and the behavioural biases that shape time estimates. This section reviews each in turn.

3.3.1. Collaboration Client & Contractor

The Two-phase Approach it is handled jointly by client and contractor, which makes the quality of their collaboration an important factor in how time is managed. As discussed in section 2.1.3, the Two-phase approach is a highly collaborative delivery model by a client and a contractor. This section reviews the

literature on client-contractor relationships.

The client-contractor relationship is not as easy as just following the contents of a contract. One should consider several things. Especially regarding the specific interest of both parties. Bresnen, 2007 developed an interesting response on the proposed benefits of partnering developed by Bennett et al., 1998.

Rather than accepting Bennett and Jayes's "Seven Pillars of Partnering" as a simple blueprint for success, Bresnen argues that these foundational concepts inherently create paradoxes and unintended consequences in practice. For instance, efforts to build collaborative relationships based on exclusivity can foster an inward-looking culture that reduces innovation, while attempts to explicitly engineer trust often ironically reinforce a desire for managerial control.

Ultimately, Bresnen concludes that successful partnering requires a much greater degree of commercial and organizational realism than standard prescriptive toolkits suggest. Instead of assuming that collaboration will naturally align differing interests, clients and contractors must recognize that partnering is a fragile "leap of faith" that fundamentally involves the ongoing management of inherent power imbalances, conflicting goals, and underlying contradictions.

Suprapto et al., 2015 studies reflect the varied views of project practitioners, including shared team responsibility, execution-focused teams, joint capabilities and structures, and senior leadership pairs. In essence, these perspectives show that teamworking, relational attitudes, team integration, and capabilities matter more than just joint procedures and contracts.

Affective trust, shared vision, a no-blame culture, and open and honest communication are considered the most essential ingredients for owner-contractor collaboration on projects. Suprapto et al., 2015 conclude that specific strategies, such as ECI, are not universally superior, but rather context-dependent options that complement each other. The role of contract in the relationship is perceived as necessary to reduce initial ambiguity, but not sufficient to ensure effective owner-contractor relationships.

Similarities can be seen in the article by Suprapto et al., 2016. The article elaborates on how different contract types and incentive schemes affect owner–contractor relationships and, in turn, project outcomes. It acknowledges that relational attitudes at inter-organizational and team levels such as trust, respect, commitment, and a no-blame culture, significantly influence team working quality and thereby project performance. It acknowledges that relational attitudes and teamworking can increase with incentive structures as suggested by Meng and Gallagher, 2012. Likewise, projects with a collaborative contract form, such as a partnering/alliance contract, are likely to be more collaborative than a lump-sum or reimbursable contract. The most important takeaway from Suprapto et al., 2016 is that contract types and incentive mechanisms are not, by themselves, decisive factors. Rather, it is the parties' attitudes toward collaborative relationships and how these attitudes are translated into actual team-working behavior throughout the project that ultimately drive performance. The question of whether delays in Two-phase approaches can be attributed to the level or quality of collaboration remains interesting.

3.3.2. Scope and design iteration

While complexity is established as an important factor in Two-phase projects, and client-contractor relationship difficulties have been discussed, it is important to review time management in complex situations.

Brady, Davies, and Nightingale investigate decision-making in extreme uncertainty (Brady et al., 2012). They revisited the work of Klein and Meckling, 1958. They state that in situations with high uncertainty about the eventual performance, cost, time, availability, marketability, and even the utility of the various alternatives, final design decisions should be delayed to a later stage. This is one of the key characteristics of the Two-Stage Approach.

Dealing with complexity: scope

An important mitigation measure for managing time under uncertainty is the scope. Giezen, 2012 mentions that infrastructure should be an instrument to achieve particular goals and ambitions. Retrofitting a project later for future developments, such as adding a new stop, is generally a more expensive and complex solution. This means it is important to have a clear view of the problems the project will need to solve, both now and, to a certain extent, in the future.

The risk of a strong focus on simplification or reducing complexity is that the strategic potential of a project is ignored. Feedback in the form of new ideas and critiques is filtered out too early on, and the adaptive and strategic capacity is lost (Bertolini, 2007).

Often, projects start as projects that become goals in themselves rather than the best possible solution to a particular problem (Priemus, 2007).

Priemus claims that a precisely defined set of performance specifications must serve as the foundation for the design and execution of major infrastructure works. By asking competing teams to propose solutions that meet these criteria, project owners can encourage new ideas. The team that offers the best balance between quality and price will win (Priemus, 2007). Although in the Two-Phase Approach the tender is already won, in an undetailed scope, these remarks may still be relevant. Especially considering projects Two-phase projects that start from scratch.

Design iteration

Design iteration is one of several mechanisms that structure how time is used in Phase I.

As discussed in section 2.1.3. Design iteration is an important process in the first phase of the Two-phase Approach. Iteration is mentioned as an important measure to cope with complexity.

Wynn and Eckert, 2017, gives an interesting insight into different types of iterative procedures. Three types of iteration exist and can be distinguished by their functions: Progressive, Corrective, and Coordinative iteration. *Progressive iteration* is driven by the fundamental need to create knowledge and resolve uncertainty in 'ill-structured' problems, utilizing "stereotypes" such as exploration and convergence to move a design towards completion. In contrast, *Corrective iteration* responds to "unplanned adverse events" or errors, often manifesting as rework or churn, which is generally viewed as undesirable but sometimes necessary to implement changes. Finally, *Coordinative iteration* is explicitly introduced to manage the complexity of interactions between people and tasks. It aims to make the process more effective and predictable through mechanisms like governance, negotiation, and parallelization.

3.3.3. Behavioural biases and heuristics

Alongside complexity, collaboration and management approach, the realism of time estimates also depends on how people judge and decide under uncertainty. For measuring project (dynamic) complexity at specific points in time, understanding biases is crucial. Williams and Samset, 2010 state that decision making might become less rational in situations with dynamic complexity (among other things). In order to recognize these biases, a portion of the biases is discussed.

Behavioral biases can significantly shape project outcomes. They may mislead project planners and undermine effective project management, ultimately harming performance. If these biases go unrecognized, they can also create issues during project delivery (Flyvbjerg, 2021).

In the article *'Top Ten Behavioral Biases in Project Management: An Overview'* by Flyvbjerg, 2021 the top ten biases are mapped out.

Strategic misinterpretation and cognitive bias

Strategic misrepresentation is the deliberate and systematic distortion or misstatement of information for strategic purposes. This bias is sometimes also called political bias, strategic bias, power bias, or the Machiavelli factor. Strategic misrepresentation can be traced to agency problems and political-organizational pressures, for instance, competition for scarce funds or jockeying for position (Flyvbjerg, 2021).

Optimism bias

Optimism bias is a cognitive bias, the tendency for individuals to be overly bullish about the outcomes of planned actions (Kahneman 2011, as cited in Flyvbjerg, 2021). Optimism bias is non-deliberate. Optimism and a can-do attitude are necessary to get projects done. But, but optimism can seriously trip projects up if planners and managers are unaware of its pitfalls and therefore take on risks that would have been avoided if they had known the real, non-optimistic odds were on the table (Flyvbjerg, 2021).

Strategic misinterpretation and cognitive bias reinforce each other. While strategic misinterpretation is deliberate, cognitive bias is non-deliberate and can lead to underestimated project costs and overestimated project benefits. Both can have an influence in decision making in the first phase of the Two phase Approach. The effects will be measured during the cases in delays, the root being possibly one of both will be retrieved in the interviews

Planning fallacy

Planning fallacy is a subcategory of optimism bias. It occurs when individuals make plans and estimates that are unrealistically close to the most favorable (best-case) scenarios. Originally, the concept was devised to describe the tendency for people to underestimate the time needed to complete tasks. Later, this definition was broadened to include the general tendency to underestimate the costs, timelines and risks of planned actions on the one hand, and to overestimate the benefits and opportunities on the other (Flyvbjerg, 2021).

Anchoring

Anchoring is a phenomenon in which people rely too heavily on a single piece of information when making a decision. The human brain will anchor in most anything, whether random numbers, previous experience, or false information (Flyvbjerg, 2021).

Table 3.2: Theoretical framework derived from Chapter 3: complexity, management approach, collaboration and time governance.

Theoretical dimension	Conceptualization based on Chapter 3	Key references
Structural (detail) complexity	Structural complexity as the fixed arrangement of, and interrelation between, project components: tasks, disciplines, sub-systems, contracts, stakeholders and connecting governance. A matter of *differentiation* (number of components) and *interdependence* (degree of interrelatedness); knowable and measurable in advance, and capturable at the front end as a complexity footprint across the technical, organisational and environmental (TOE) dimensions.	(Brady & Davies, 2014); (Baccarini, 1996); (M. Bosch-Rekveldt et al., 2011); (Hertogh & Westerveld, 2010)
Dynamic project complexity	Dynamic complexity as the changing relations among components, and between the project and its environment, over time; emergent, uncertain (from foreseen to entirely unforeseen), hard to measure and not reliably predictable. Structural complexity generates its own internal uncertainty, so a fixed front-end condition can become a continuing source of emergent, in-time difficulty.	(Brady & Davies, 2014); (Hertogh & Westerveld, 2010); (Koppenjan et al., 2011); (Vidal & Marle, 2008)
Predict-and-control (Type I) management approach	Mechanistic Type I approach suited to structural complexity: assumes the project can be mapped out in advance, with rigid planning, strict control and hierarchical steering, prioritising hard values such as time and money.	(Koppenjan et al., 2011); (Hertogh & Westerveld, 2010); (Giezen, 2012)
Prepare-and-commit (Type II) management approach	Organic, adaptive Type II approach suited to dynamic complexity: functional flexibility, milestones, rules of play, roles, coalition-building and networked steering, prioritising soft values such as quality, scope and safety.	(Koppenjan et al., 2011); (Hertogh & Westerveld, 2010); (Giezen, 2012)

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Table 3.2 – *continued from previous page*

Theoretical dimension	Conceptualization based on Chapter 3	Key references
Counter-arrangements, mindfulness and dynamic management	Neither approach suffices on its own; managers must show mindfulness by deliberately introducing counter-arrangements that offset a dominant style, for example Type II cooperation forums or shared interface management within a Type I baseline. Conceptualised as dynamic management: the continuous, deliberate balancing of systems (control) and interactive (interaction) management.	(Koppenjan et al., 2011); (Hertogh & Westerveld, 2010); (Giezen, 2012)
Alignment of complexity type and management approach in Phase I	Fit between complexity type and management approach—Type I control for structural complexity (P1) and Type II interaction for dynamic complexity (P2), with a dominant style offset by counter-arrangements (dynamic management)—is expected to support Phase I time and predictability, whereas misalignment, including unreconciled Type I/Type II handling of the same parameter by the two parties, is expected to extend duration and reduce predictability (P3).	(Koppenjan et al., 2011); (Hertogh & Westerveld, 2010); (Brady & Davies, 2014)
Effects of misalignment	Misalignment propagates from the management approach into coordination problems and relational breakdown: contrasting styles produce persistent tensions and premature or stalled decisions; contested rather than organised interface management drives reactive, corrective iteration; and the relational basis erodes where prescriptive partnering ignores the paradoxes of collaborative working.	(Koppenjan et al., 2011); (Hertogh & Westerveld, 2010); (Bresnen, 2007)
Client-contractor relational quality and trust	Collaboration quality depends on relational attitudes (affective trust, shared vision, no-blame culture, open and honest communication) and on realism about power imbalances and conflicting interests; partnering is a fragile 'leap of faith', not a guaranteed solution. Trust is a primary condition for resolving dynamic complexity.	(Bresnen, 2007); (Suprapto et al., 2015); (Suprapto et al., 2016); (Bennett et al., 1998)
Contract form versus relational attitudes and incentives	Contract types and incentive schemes shape the context but are not decisive; outcomes depend on how parties translate them into day-to-day teamworking, although collaborative contract forms and incentive structures can support relational attitudes.	(Suprapto et al., 2015); (Suprapto et al., 2016); (Meng & Gallagher, 2012)
Strategic scope framing and front-end definition	Scope choices are central to time management: infrastructure should serve goals rather than become a goal in itself; over-simplification filters out strategic potential, while narrow or poorly framed scope can add complexity. Scope should be problem-driven and performance-oriented, and under extreme uncertainty final design decisions are deliberately delayed.	(Giezen, 2012); (Bertolini, 2007); (Priemus, 2007); (Brady et al., 2012)

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Table 3.2 – *continued from previous page*

Theoretical dimension	**Conceptualization based on Chapter 3**	**Key references**
Design iteration as response to complexity	Iteration structures how time is used in Phase I: progressive iteration creates knowledge and resolves uncertainty in ill-structured problems; corrective iteration responds to unplanned events and rework; coordinative iteration manages interactions between people and tasks through governance, negotiation and parallelisation.	(Wynn & Eckert, 2017); (Brady et al., 2012)
Behavioural biases in time estimation and governance	Decision-making becomes less rational under dynamic complexity. Behavioural biases—strategic misrepresentation (deliberate), optimism bias and its planning-fallacy subcategory, and anchoring (non-deliberate)—systematically distort early time and cost estimates and reinforce one another, the more so in complex, high-stakes projects.	(Flyvbjerg, 2021); (Williams & Samset, 2010)
Complexity, management, collaboration and time governance synthesis	Complexity type and management approach and their fit, together with collaboration quality and trust, scope and design-iteration choices, and the behavioural realism of estimates, jointly explain why Phase I time management is difficult and prone to underestimation and delay.	Williams (1999); Vidal & Marle (2008); Koppenjan et al. (2011); Hertogh & Westerveld (2010); Suprapto et al. (2015, 2016); Flyvbjerg (2021)

3.4. Conclusion

This chapter addressed RQ2: *what factors influence time management in infrastructure projects?* Its central analytical contribution is an alignment framework (section 3.2) that links the type of complexity a process exhibits to the management approach through which it is handled. This fit is not the whole answer: alongside it, the chapter reviewed three further factors that bear on Phase I time in their own right, the quality of client–contractor collaboration, scope and design iteration, and behavioural bias. The literature underpinning the full account, the complexity–management fit together with these parallel factors, is summarised in Table 3.2.

The framework rests on two analytical axes. The first distinguishes structural (detail) complexity: the fixed and knowable arrangement of components, interfaces and stakeholders, from dynamic complexity, the changing relations among those components, and between the project and its environment, over time. The second distinguishes a Type I, predict-and-control approach, suited to the stable arrangement of structural complexity, from a Type II, prepare-and-commit approach, suited to the emergent uncertainty of dynamic complexity. Bringing the two axes together yields the central logic, stated as propositions P1–P3: structural complexity is expected to be contained by control (P1), and dynamic complexity by interaction (P2). Because projects present both, the project as a whole calls for a deliberate balance of the two—dynamic management—in which a dominant style is offset by counter-arrangements. Where the management approach is misaligned with the complexity type, in particular where the same parameter is governed under unreconciled Type I and Type II logics by the two parties, Phase I duration is expected to extend and its predictability to decrease (P3). These propositions are stated as associations to be examined rather than as established claims, and are carried into the empirical analysis.

Three further factors complete the account. The relational quality of the client–contractor collaboration,

and trust above all, is a primary condition for resolving dynamic complexity, and the literature is consistent that contract form alone cannot secure it: affective trust, a shared vision and a no-blame culture matter more than procedures, and partnering remains a fragile undertaking rather than a guaranteed outcome. Scope and design-iteration choices structure how time is used, with iteration serving as a mechanism for building knowledge, correcting errors and coordinating a multi-actor design process. And behavioural biases, optimism bias, the planning fallacy, anchoring and strategic misrepresentation, systematically distort early time and cost estimates, the more so under complexity and high stakes, with the deliberate distortion of strategic misrepresentation interacting with the non-deliberate biases rather than standing apart from them.

Taken together, time management in infrastructure projects is therefore not a purely technical planning exercise. It is shaped first by the type of complexity a project presents and by the management approach through which that complexity is handled, the fit that the alignment framework of section 3.2 formalises in propositions P1–P3, and, alongside this, by the relational quality of the collaboration, the way scope and iteration are managed, and the behavioural realism of the estimates that underpin the plan. The propositions are carried into the case analysis as the central expectation to be examined, while collaboration, iteration and behavioural bias accompany them as parallel factors against which the same cases are read.

4

Operationalization of the case studies

This chapter operationalizes the research design for the case studies. It explains the selection of cases, participants, and methods, and how these together translate the research questions into a concrete empirical procedure. It supplements the points already discussed in Section 1.4.3 and Section 1.4.4.

4.1. Introduction and overview of the research design

The purpose of this chapter is to make transparent *what* was done in the empirical part of this study and *why*. To keep the design legible, the procedure is first presented as a whole, after which each component is justified in turn: the research strategy and paradigm (Section 4.2), case selection (Section 4.3), the operationalization of complexity through the TOE framework (Section 4.4), data collection (Section 4.5), and data analysis (Section 4.6).

The case study serves to answer the following research question:

What processes have an influence on time management in the first phase of the two-phase approach?

In short, the research design follows six steps, summarized in Figure 4.1:

1. **Case selection.** Two cases are selected against a fixed set of criteria: the A27 Houten–Hooipolder project as the primary case and the Zuidasdok OV-terminal as a secondary case (Section 4.3).
2. **Operationalizing complexity.** The TOE (Technical, Organizational, External) framework is used as a structured lens to make project complexity discussable and comparable across participants and cases (Section 4.4).
3. **Stage 1 – structured rating.** Per case, participants rate the 47 TOE elements on a 1–5 scale, producing a complexity profile for Phase 1 (Section 4.5.2).
4. **Stage 2 – process-oriented interviews.** The highest-rated elements serve as entry points for semi-structured interviews that reconstruct the processes affecting time in Phase 1 (Section 4.5.3).
5. **Triangulation (Case A27).** For the primary case, anonymized project documents are used to support or challenge the interview findings (Section 4.3).
6. **Hybrid coding and synthesis.** Transcripts and documents are analyzed through a hybrid (deductive and inductive) coding strategy, resulting in a process reconstruction table that links each process to the relevant literature and TOE element(s) (Section 4.6).

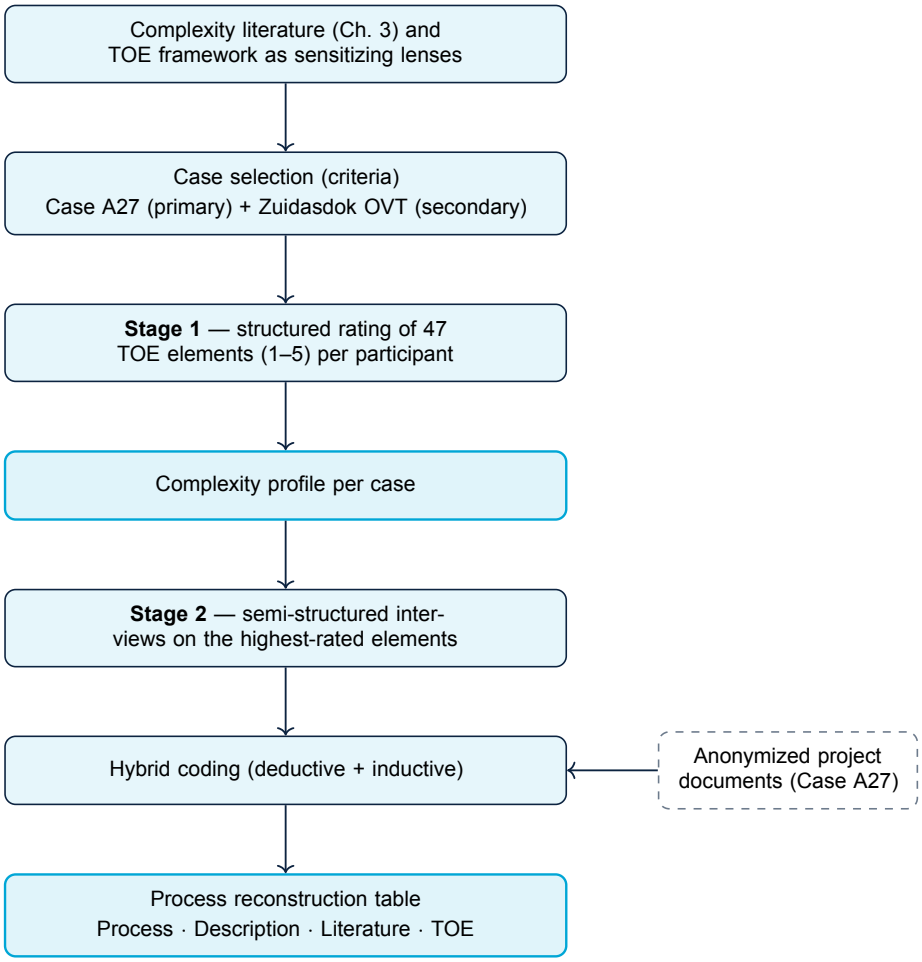


Figure 4.1: Overview of the two-stage case study research design and its analytical output. The dashed box indicates a supplementary source used only for the primary case (A27).

4.2. Research strategy and paradigm

This section sets out the methodological choices that underlie the multiple case study approach: the case study strategy and the research paradigm. Case selection, the complexity framework, and the data collection and analysis procedures are discussed in the subsequent sections.

4.2.1. Case study strategy

The case study is the chosen research methodology for this study. It operationalizes the research design that aims to uncover the processes that have an influence on time management in the first phase of two-phase infrastructure contracts. The case study is the preferred research strategy when the central research questions ask “how” or “why” something occurred within a real-life context. This is particularly relevant when aiming to gain a deep understanding of a complex phenomenon in its natural setting (Crowe et al., 2011). Both conditions apply here, as the research seeks to reconstruct the mechanisms through which project complexity contributes to delays in Phase 1.

A multiple-case design is employed, consisting of a primary case and a secondary, smaller case study. Multiple-case studies enable broader exploration of the research questions and support theoretical development (Gustafsson, 2017). Such designs follow a replication logic, where a second case is used to confirm or challenge findings from the first (Crowe et al., 2011). This strengthens the robustness and trustworthiness of the conclusions by reducing the likelihood that findings are attributable to idiosyncrasies of a single project.

The design consists of two sequential stages: a structured rating exercise grounded in a complexity

framework, followed by in-depth semi-structured discussions guided by the outcomes of that rating. This structure is applied consistently across both cases.

4.2.2. Research paradigm

The research is theory-developing and is positioned within a pragmatic research paradigm. A pragmatic stance takes the practical problem as its starting point, in this study, the structural underestimation of time in Phase I in Dutch two-phase contracts, and treats methodological choices as subordinate to the research question rather than to a fixed theoretical worldview (Morgan, 2007). Knowledge is therefore judged primarily by its usefulness in explaining, and ultimately improving, project practice. This orientation justifies the combination of a structured instrument (the TOE rating) and an open, interpretive instrument (the semi-structured interviews) within a single design.

The accompanying mode of reasoning is abductive. The literature reviewed in Chapters 2 and 3 and together with the TOE complexity elements, provides theoretical concepts that sensitise the analysis, but it does not specify which mechanisms combine to produce delay in this specific context. Abduction moves iteratively between these theoretical concepts and the empirical material: theoretically informed expectations guide what is observed, while surprising or anomalous observations in the case data prompt a search for the most plausible explanatory mechanisms (Dubois & Gadde, 2002). This dual movement, structured entry, open exit, is operationalised in the two-stage design described in Section 4.5.2 and, analytically, in the hybrid coding strategy described in Section 4.6.2, where the deductive codes represent the theoretical lenses and the inductive codes capture mechanisms the framework does not yet describe.

Within this abductive design, the theoretical propositions formulated in Section 3.2 function as sensitising rather than confining devices (Blumer, 1954). They were specified before the cross-case analysis in order to direct it, but were developed abductively, in interplay with the literature and an initial reading of the cases, rather than deduced from a closed theory or produced inductively from the data alone. They translate the alignment framework into explicit, theoretically informed expectations that direct attention to the relationships worth examining in each case, but they do not fix the outcome in advance: stated as associations to be examined, they are propositions rather than hypotheses. Consistent with systematic combining (Dubois & Gadde, 2002), the propositions are confronted with the case material and, where the data prove anomalous or richer than the framework anticipates, refine rather than simply confirmed or rejected. This is the precise sense in which the study is theory-developing: it does not build theory from a blank slate, but takes an existing framework as its point of departure and returns a refined, context-specific account of how time is governed in Phase I.

4.3. Case selection

As Table 4.1 shows, only a limited number of projects have been procured through the two-phase approach by Rijkswaterstaat. The selection of cases follows a set of criteria to ensure both theoretical relevance and practical feasibility. The cases must:

- Involve a two-phase contract within the Dutch infrastructure context.
- Have a clearly defined and completed (or sufficiently advanced) Phase 1.
- Exhibit indications of planning challenges or delays in Phase 1.
- Provide access to relevant stakeholders and, where possible, project documentation.

Based on these criteria, two cases are selected: a primary case and a secondary case. This choice has been made while a large amount of information was available for the first case in the form of project documents. For the secondary case this was not the case.

- Case 1 — A27 Houten–Hooipolder (primary case): A major road widening project under a two-phase contract between Rijkswaterstaat and the contractor. This case serves as the primary unit of analysis, in which the full complexity assessment and process reconstruction are conducted. The primary focus of this research is one of the two-phase parts of the project: the Hagesteinsebrug.
- Case 2 — OV-terminal Zuidasdok (secondary case): A complex urban infrastructure project in-

volving the redevelopment of the Zuidasdok OV-terminal. This case is used as a secondary case, with its own findings, that might challenge or add to the findings.

Table 4.1: Overview of Two-Phase Infrastructure Projects (Klinder and Wluandari, 2025)

No.	Projectnaam	Phase	Type Project	Type 2-Phase	Contract
1	A12 IJsselbruggen	Fase II	Renovatie	Volledig	E&C
2	A27 Houten - Hooipolder Noord	Fase I	Aanleg	Hybride	D&C
3	A27 Houten - Hooipolder Zuid	Fase I	Aanleg	Hybride	DBM
4	A73 Roertunnel en Swalmen tunnel	Opgeleverd	Renovatie	Hybride	E&C
5	DECODE Maeslantkering	Opgeleverd	Renovatie	Volledig	E&C
6	Hydraulische installaties Oosterscheldekering (OSK)	Fase I	Renovatie	Hybride	D&C
7	Krib- en oeververlaging Pannerdensch Kanaal (KOP)	Opgeleverd	Renovatie	Hybride	D&C
8	Onderhoudscontract Corridor Noordzeekanaal (NZK)	Fase I	Renovatie	Hybride	DBM
9	Renovatie Koninginnesluis en Houtribsluis Deel B	Fase I	Renovatie	Volledig	D&C
10	Renovatie Kooybrug en draaibrug Montfoort	Fase II	Renovatie	Volledig	D&C
11	Renovatie Prinses Marijkesluis	Fase II	Renovatie	Volledig	D&C
12	Renovatie Sluizen Zeeland 1 (Zandkreek & Hansweert)	Fase I	Renovatie	Volledig	D&C
13	Renovatie Sluizen Zeeland 2 (Grevelingen, Roompot...)	Aanbesteding	Renovatie	Volledig	D&C
14	VenR Bediening en besturing Maasobjecten (MB2.0)	Voorbereiding	Renovatie	n.t.b.	D&C
15	Waardengedreven Onderhoud UiterWaarden (WOUW)	Opgeleverd	Onderhoud	Hybride	D&C
16	Weurt-Heumen (sluiscomplex)	Voorbereiding	Renovatie	n.t.b.	D&C
17	Zuidasdok - Openbaar Vervoer Terminal (OVT)	Fase II	Aanleg	Volledig	E&C
18	Zuidasdok - Tunnel	Fase I	Aanleg	Volledig	D&C
19	Zuidasdok - Knooppunt Amstel	Aanbesteding	Aanleg	Volledig	D&C

For the primary case (A27), anonymized project documents are available through Mobilis. These include memos, and progress reports which are used to reconstruct Phase 1 processes. The role of these documents is summarized in Table 4.2. Due to the sensitivity of these documents, they can merely be used as context setting and can in no way be used to publish.

Table 4.2: Project documents used for Phase I event reconstruction (anonymized)

Document type	Purpose in this study	Notes
Memos	Capture communication, decisions, and clarifications between project parties during Phase I, providing insight into collaboration dynamics and issue resolution.	Anonymized
Progress reports	Track project development, milestones, risks, and resource planning updates. Used to reconstruct progress and performance over time in Phase I.	Anonymized

4.4. Theoretical grounding and operationalization of project complexity

As introduced in the opening paragraph of Chapter 3, a complexity perspective provides a useful starting point for identifying delays and inefficiencies in project time management. In infrastructure projects, time performance is rarely determined by planning alone, and earlier research has demonstrated a relationship between project complexity and project performance (Gajic & Palcic, 2019). Accordingly, this study first examines the complexity perceived by participants in both cases. As discussed in Chapter 3, project complexity can be understood as both structural and dynamic. Various authors have attempted to conceptualize and categorize complexity, but no single universally accepted framework exists (Shenhar et al., 2016). Complexity frameworks aim to support project managers in identifying and characterizing relevant aspects of complexity and adapting project approaches accordingly (Vidal

and Marle, 2008; M. Bosch-Rekveldt et al., 2011). A framework for this study should meet the following criteria:

- Provide a comprehensive and structured representation of project complexity.
- Be applicable to large-scale infrastructure projects.
- Allow for both qualitative interpretation and quantitative operationalization (e.g., through scoring).
- Enable comparison across different stakeholders and across cases.
- Provide room for discussion in an interview to reveal processes.

Based on these requirements, the TOE (Technical, Organizational, External) framework is selected to operationalize project complexity. This framework breaks down complexity into a set of predefined elements across three dimensions: technical, organizational, and external. In total, it includes 47 elements that together provide a structured "footprint" of a project's complexity (M. Bosch-Rekveldt et al., 2011). Applying this framework allows for a systematic assessment of complexity and supports tailoring front-end project activities to specific challenges.

The most recent version of the TOE framework is used in this study, in which environmental complexity is referred to as external complexity (M. G. C. Bosch-Rekveldt, 2011). The full set of elements is presented in Table 4.3.

Technical Complexity *(17 elements)*	**Organizational Complexity** *(17 elements)*	**External Complexity** *(13 elements)*
High number of project goals	High project schedule drive	External risks
Non-alignment of project goals	Lack of Resource & Skills	Number of external stakeholders
Unclarity of project goals	Lack of Experience with parties	Variety of stakeholder perspectives
Uncertainties in scope	Lack of HSSE awareness	Dependencies on stakeholders
Strict quality requirements	Interfaces between disciplines	Political influence
Project duration	Number of financial sources	Lack of company internal support
Size in CAPEX	Number of contracts	Required local content
Number of locations	Type of contract	Interference with existing site
Newness of technology	Number of different nationalities	Remoteness of location
Lack of experience with tech	Number of different languages	Lack of experience in the country
High number of tasks	Presence of JV partner	Company internal strategic pressure
High variety of tasks	Involvement of different time zones	Instability of project environment
Dependencies between tasks	Size of project team	Level of competition
Uncertainty in methods	Incompatibility between PM tools	
Involvement of tech. disciplines	Lack of trust in project team	
Conflicting norms and standards	Lack of trust in contractor	
Technical risks	Organizational risks	

Table 4.3: Overview of project complexity elements (M. G. C. Bosch-Rekveldt, 2011).

4.5. Data collection

Data collection is structured in two sequential stages per case: a structured rating exercise followed by an in-depth semi-structured discussion. This design is applied consistently across both cases.

4.5.1. Participants

For each case, 6 to 7 participants are interviewed. Participants are selected both from the client side (opdrachtgever) and the contractor side (opdrachtnemer), ensuring that the complexity profile and process reconstruction reflect the perspectives of all parties involved in the two-phase contract process. This multi-stakeholder approach is methodologically important, as research consistently shows that clients

and contractors hold divergent perceptions of project dynamics, success criteria, and process quality (Bryde and Robinson, 2005). Including both perspectives reduces the risk of a one-sided account and enables the research to identify where perceptions align or misalign, which is itself analytically relevant for understanding planning outcomes in Phase 1.

Participants are selected based on their direct involvement in Phase 1 of the respective cases and their ability to discuss the complexity encountered during that phase.

4.5.2. Stage 1: Structured rating of complexity elements

In the first stage, participants are asked to rate each of the 47 TOE elements on a 1–5 scale, reflecting on the presence of each element in the project for the first phase of the case they are being questioned about. This produces a complexity profile for the case: a structured representation of which factors were most prominent and most impactful during Phase 1. The use of a numerical rating scale for each element follows the operationalization logic of (M. Bosch-Rekveldt et al., 2011), who similarly used scored complexity indicators to create project profiles that could be compared and analyzed across cases.

The use of a 1–5 Likert-type scale for each element is appropriate because it captures the inherently subjective and graduated nature of complexity perception while producing a structured and comparable output. Additionally, using Likert-type ratings to quantify and prioritize a large set of latent complexity factors is consistent with previous applications of the TOE framework and related complexity studies, in which practitioners rate the extent to which predefined elements contribute to project complexity and subsequent analysis focuses on the highest-scoring elements (Gajic & Palcic, 2019).

4.5.3. Stage 2: Prioritization and process-oriented discussion

In the second stage, the highest-rated elements from stage 1 serve as structured entry points for an in-depth semi-structured discussion with each participant. Focusing the conversation on the elements with the highest scores maximizes the relevance of the conversation by directing attention to what the participant themselves identified as most present and most impactful.

The purpose of this discussion is not to verify the ratings, but to reconstruct the processes and mechanisms that occurred in Phase 1 of the project, especially the effects they had on possible delays in the first phase of these projects. Semi-structured interviews are the appropriate instrument for this goal because they provide thematic structure while allowing participants to elaborate in their own terms, revealing causal pathways and contextual dynamics that a closed instrument cannot capture.

4.6. Data analysis

In the following section, the data analysis approach is explained. Section 4.6.1 describes how the TOE data and interview data will be integrated. This analytical logic will be applied to both cases. The coding approach is further justified in Section 4.6.2.

4.6.1. Process of data analysis

The analysis proceeds in two steps, corresponding to the two stages of data collection. The rated complexity profiles are compared within and across cases to identify which TOE elements were consistently rated as most present and influential. The perspectives of different parties within each case are also examined to explore how stakeholders rated these elements relative to one another. Additionally, a careful comparison is made between the ratings, though firm conclusions cannot be drawn given the small sample size. Together, this produces a structured, theoretically grounded description of the complexity experienced during Phase 1 in each case.

The TOE framework forms the basis of the interviews, during which the highest-rated elements are discussed with each participant. The structure of the results section follows these elements accordingly. The most important conclusions are derived from the discussions that followed, specifically regarding which processes affected delays and to what extent. The way coding will be applied is discussed in Section 4.6.2.

Lastly, the results of the interviews for case A27 will be accompanied by anonymized project documents,

possibly supporting or challenging the various opinions that have been gathered.

In the case analysis, a process is characterised on this axis by first setting out its components, the concrete components, conditions and actors that constitute it, and then asking whether the complexity resides in the fixed arrangement of those blocks (structural) or in their change and interaction over time (dynamic), or in both.

Furthermore, the way these components are handled by the client, the contractor, or both will be discussed. If a specific management approach can be identified, this approach is described and explained in terms of how it is applied by the actors involved. The analysis then examines whether this handling reflects a Type I logic, a Type II logic, or a combination of both.

4.6.2. Hybrid coding

The qualitative material, interview transcripts for both cases and the anonymized project documents for Case A27, is analyzed through a hybrid coding strategy that combines deductive (theory-driven) and inductive (data-driven) codes (Saldaña, 2013), who treats deductive and inductive coding as complementary rather than mutually exclusive, and is methodologically aligned with the hybrid thematic analysis approach formalized by Fereday and Muir-Cochrane, 2006. The strategy proceeds as follows:

- **Deductive codes** are derived from the theoretical framework in Chapters 2 and 3 and from the TOE elements. Examples include codes such as iteration, trust between parties, planning fallacy, strategic misrepresentation, prepare-and-commit, and interface management, but also the TOE elements discussed. These codes provide an initial vocabulary for organizing what participants describe, and ensure that processes recognised in the existing literature can be identified when they occur in the data. They function as the operational counterpart of the sensitizing concepts described in Section 4.2.2.
- **Inductive (emergent) codes** are generated during analysis to capture processes and mechanisms that the deductive framework does not adequately describe. Inductive codes are formulated in terms close to participants' own language whenever possible, and are subsequently refined as further interviews are coded. They can be seen as the processes found in the respective cases.

5

Case Studies

In this section, the TOE frameworks will be discussed by highlighting the differences and shared views between the client and contractor perspectives for each case. This will be followed by the results from the interviews, which outline the processes that emerged. Lastly, the cases will be compared based on TOE framework outcomes as well as processes. It is important to note that every participant has been assigned a random number, which in no way corresponds to any of the tables or quotes that are displayed in this or any other chapter. All remarks were made on an individual basis and not on behalf of their organisation.

5.1. Survey Approach and Participation

As discussed in Chapter 4, operationalization of the case studies, every participant has filled in the TOE framework and has been questioned about the result.

In total, 13 individuals actively participated in this research by completing the survey and taking part in interviews. Due to logistical reasons, a strict division between client and contractor was not practically feasible, These choices and their effect are further substantiated in Chapter 7. Two participants from each case's client organization were involved. For each case, careful consideration has been given to which roles have been asked to participate in these studies, which will be substantiated in the section of each case.

Each participant has completed the survey, resulting in figures 5.1, 5.2, 5.3, 5.4, 5.5 and 5.6, The discussion of these factors, follows the methodology explained in chapter 4,

5.2. Time Pressure in Phase I: Milestone Carry-Over and Hidden Backlogs

Each interview was structured around the TOE framework, which provides the backbone for the case results presented in this chapter. Before those results are discussed per case, however, it is useful to clarify a nuance that several participants raised about how time pressure becomes visible in Phase I, a nuance that shapes how the subsequent process findings should be read. Governing time presupposes a shared understanding of how that pressure surfaces, and the interviews showed that this is less self-evident than a planning view would suggest. When asked whether their projects had in fact run over schedule, several participants questioned both the extent and the relevance of the slippage that had occurred.

One participant pointed out that the lead time had not been postponed by much, and that the extension which did occur was negligible compared with a conventional procedure. He stated that a traditional approach would have taken roughly twice as long, and was proud that the lead-time extension had remained limited to about ten per cent (Quote 6A).

This indicates that the effect of Phase I processes on time cannot be captured by lead-time expansion

alone. The comparison the participant draws, a limited extension set against a conventional procedure assumed to take twice as long, shows how elastic lead time is as a standard: when the reference point is generous, even a considerable extension can be presented as a success. The more important implication is that judging Phase I by lead time treats time as a hard, measurable quantity, registered only when the schedule is exceeded. The interviews suggest that this is too narrow. Time pressure in Phase I does not always translate into a longer lead time. It can also accumulate in forms that leave the schedule untouched, and it is these less visible forms that the analysis now turns to.

The first of these forms concerns the carry-over of unresolved issues between project stages. Milestones can be reached and passed and the next stage entered, for instance, the transition from SO to VO, so that the project appears on track when viewed solely from a planning perspective. At the same time, important issues can remain unresolved and be carried along with the project, or even 'dragged' through successive gates towards completion. The schedule shows no slippage, because deliverables are made fit for the next stage despite being incomplete. When asked about issues carrying over, one participant noted:

"We've always been dragging unresolved issues along with us … to get us through the gate" (Quote 7A).

Also other participants noted something similar (Quote 1A). In this case the unresolved issues concerned disputes between contractor and client over cost agreements, although comparable carry-over can be observed for other deliverables as well. Such disputes can persist until the end of the first phase, where they have to be settled through negotiation (Quote 7I), which is not the intended outcome of the two-phase approach, in which these matters are meant to be resolved jointly along the way. In several deadlines were in fact not met, with unfinished deliverables carried over into the next phase (Quote 7B).

The second form concerns time pressure that builds up within a project stage rather than between stages. A VO milestone, for example, comprises a design together with the technical calculations based on it, resulting in a price and a risk register (Quote 7C). The design itself can take longer than initially planned for various complexity-related reasons, while the overall timeline stays unchanged. Because the milestone date is still met, this internal slippage remains invisible and the project continues to appear on track. This impression can be misleading: when the time absorbed by the design is not recovered, the subsequent tasks, such as pricing the design, are carried out under compressed time or in insufficient depth, producing a hidden backlog rather than visible schedule (Quote 1B), .

… A great deal of work had to be done in quite a short period of time. [...] After the design phase, we still had a whole list of things [...] — the risk dossier, planning, budget — all things we could only do properly once the design was truly in good shape, which meant all of that also came under pressure." (Quote 7K)

Taken together, these observations show that the effect of Phase I processes on time is only partly captured by schedule slippage in the strict sense. Two further manifestations are therefore taken into account in the analysis that follows: time pressure that is absorbed without extending deadlines, thereby increasing the workload on other tasks, and deliverables that are not completed on time, resulting in the carry-over of unresolved issues or additional work elsewhere. Both are treated as relevant ways in which time management becomes strained in the first phase, and the remainder of this chapter examines the processes that give rise to them.

5.3. Case A: A27 Houten--Hooipolder Noord

Case A is the primary case in this research. Section 5.3.1 describes the project characteristics. The complexity experienced by the participants is discussed in Section 5.3.2. Finally, the processes that influenced these complexity ratings are examined in Section 5.3.3. The data integration follows the logic described in Section 4.6.1.

5.3.1. Project Description and Context

The A27 Houten–Hooipolder project concerns the widening of the A27 motorway between Houten and the Hooipolder interchange. The goal of the project is to improve traffic flow, reduce congestion and rat-running in the surrounding area, and enhance the availability and resilience of the motorway network for future traffic demand and in case of incidents Ministerie van Infrastructuur en Waterstaat, 2019.

A significant milestone for the project was reached on December 20, 2018, when the Minister of Infrastructure and Water Management signed the Route Decision (Tracébesluit or TB) and the Sanitation Decision (Saneringsbesluit or SB). Rijkswaterstaat actively engaged with the community by hosting three public information evenings in January 2019 across Werkendam, Vianen, and Raamsdonksveer. These sessions were attended by over 500 local residents and commuters, demonstrating high public interest in the project. Furthermore, public input (zienswijzen) from earlier draft phases directly influenced the final plans A27 Houten-Hooipolder, 2026.

This large-scale motorway widening project spans 47 kilometres and includes, amongst other things, additional lanes, river crossings and the modification of approximately 60 bridges and viaducts. The total project is expected to take 8 years to complete.

The overall project is divided into two contracts: the A27 Noord and A27 Zuid section. Of the total A27 scope, the Zuid project is approximately three times larger than the Noord section. A key distinction is that the contractor for the southern section (covering the route from Everdingen to Hooipolder) is responsible not only for the road widening but also for 15 years of subsequent maintenance A27 Houten-Hooipolder, 2026.

On the first of November 2021, the procurement documents for the A27 Noord contract were published Vitale Infrasector, 2021. The A27 Noord project has been set up as a Hybrid Two-phase approach “Vimeo video”, 2024.

This study focuses on the A27 Noord section. Within this contract, the detailed design and execution plans are being developed by the contracting consortium “De Groene Waarde”.

Following the draft phase, a major design shift occurred regarding the highway’s primary bridges: the Hagesteinsebrug, Merwedebrug, and Keizersveerbrug will be completely replaced by three new bridges rather than undergoing renovation. To minimize disruption, the construction strategy involves building the new bridges alongside the existing ones. The old bridges will only be demolished once traffic can be diverted to the new structures, ensuring continuous traffic flow A27 Houten-Hooipolder, 2026. The Houtense brug will not be replaced, but it will be widened on its western side to create more space “Vimeo video”, 2024.

While the administrative and preparatory phases occurred in 2018 and 2019, the physical execution is phase as follows:

- **2024**: Commencement of the initial roadworks.
- **2025**: Start of the major construction works on the bridges.

Type of Two-phase Approach

A27 North covers the Houten–Everdingen section and was put out to tender as a Design & Construct (D&C) contract. Rijkswaterstaat opted for a hybrid approach: the contract consists of approximately 30% standard scope and 70% a two-phase approach. The tender process was successful, with two high-quality, valid bids submitted. The contract was ultimately awarded to De Groene Waarden consortium, comprising Besix and Mobilis and their partners Van Gelder, Mouk Infra and Besix Infra Nederland.

Participants

Table 5.1 shows all the participants who contributed to this research by filling in the framework as well as discussing the results in an interview.

Table 5.1: Project roles and organizations — Project A27

Project role	Organization
Cost estimator	Joint venture contractor
Design lead	Joint venture contractor
Project director	Joint venture contractor
Phase manager / baseline manager	Joint venture contractor
Project manager	Joint venture contractor
Technical manager	Rijkswaterstaat
Baseline manager	Rijkswaterstaat

The project director has been selected. The project director offers opportunities to contact the right people on the client's side and within the project director's own team. The project director is the person with the highest mandate on the contractor's side and is closely involved in decision-making alongside the contractor's directors.

The design manager has also been asked to participate in this study, as informal conversations identified several issues with the design. His or her view on the reasons for these problems is interesting to include in this research.

The contractor's cost estimator has been selected, as informal conversations indicated that price discussions contributed to issues or delays in the first phase of this case.

The baseline manager from both the client and the contractor has been selected for this research. Both can provide clear insights into how and why baselines were not met, or were unachievable in the first place. In particular, agreements or disagreements among these participants regarding complexity factors are very interesting.

The client's technical manager and his counterpart from the contractor have also been involved in this study. Technical issues may have influenced the duration of the first phase of this project. Again, agreements or disagreements among these participants about complexity factors are especially interesting.

5.3.2. Complexity Profile: Diverging Perceptions Across Technical, Organizational, and External Dimensions

In the following section, the differences between the perspectives of the contractor and the client on perceived complexity are discussed, following the technical, organizational, and external complexity. The most striking differences, as well as the highest scoring elements are described.

Technical Complexity A27 Noord

Figure 5.1 summarizes the average experienced technical complexity by the participants. Overall the Technical complexity is rated higher, on average, by the participants from the side of the contractor than by the participants from the side of the client with a respective average technical complexity score of 3.44 and 2.79.

Overall, the technical complexity is rated by all participants as the most complicating factor, with an average score of 3.25 on the technical complexity scale.

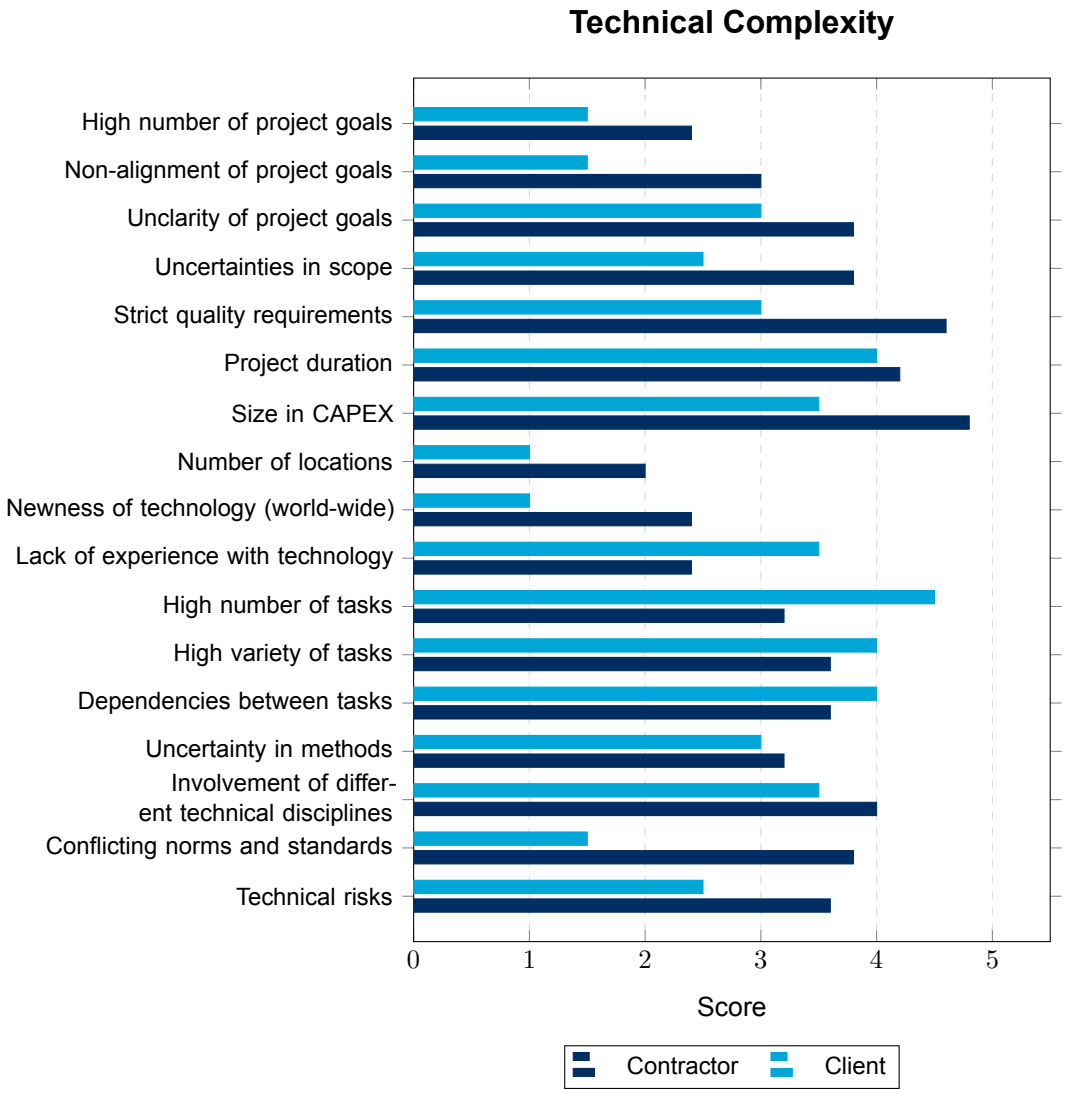


Figure 5.1: Technical complexity scores: contractor vs. Client (A27)

The survey on technical complexity reveals notable patterns in the perceptions of the *client* and the *contractor*. Systematic differences are visible between both parties.

Largest Perception Gaps The most striking discrepancy concerns *conflicting norms and standards*, where the Contractor assigns a score of approximately 3.8 compared to only 1.5 by the client. This is the largest perception gap in the entire chart.

Beyond this, the following notable gaps were identified:

- **Strict quality requirements:** the contractor scores approximately 4.6 compared to 3.0 for the client. The contractor feels the weight of quality demands far more acutely than the client.
- **High number of tasks:** the client scores approximately 4.4 compared to 3 for the contractor, which is completely opposite to the perspective as seen in the strict quality requirements section.
- **Non-alignment of project goals:** the contractor scores approximately 3.0 compared to 1.5 for the client, which indicates that the alignment of these goals was clear for the client, and the opposite for some of the contractor's respondents.
- **Size in CAPEX:** the contractor scores considerably higher approximately 4.8 than the client approximately 3.5.

Shared Perceptions For several factors, the client's and contractor's scores are closely aligned. This applies in particular to:

- *Project duration*
- *Uncertainty in methods*
- *Involvement of different technical disciplines*
- *High variety of tasks*
- *Dependencies between tasks*

Contractor and Client Patterns Across virtually all factors, the contractor assigns higher scores than the client. This is a structural pattern suggesting that contractors 'feel' technical complexity higher, in general, or alternatively, that the clients participants systematically underestimate the technical challenges involved in execution.

Low-Scoring Factors Both the client and the contractor assign relatively low scores to the following factors:

- *Newness of technology (world-wide)*: approximately 1 to 2.5
- *Number of locations*: approximately 1 to 2.0

Both parties agree these are not dominant complexity sources, confirming the project is not technologically pioneering and is geographically contained.

Organizational Complexity A27 Noord

Figure 5.2 summarizes the average experienced organizational complexity by the participants. On average, participants from the contractor side rate organizational complexity higher than participants from the client side, with respective average organizational complexity scores of 3.02 and 2.58. In comparison to the technical complexity factors, this image illustrated by the filled-in TOE Framework gives a more centralized view from both perspectives.

Overall, participants rate organizational complexity as the second most complicating factor, with an average score of 3.0 on the organizational complexity scale.

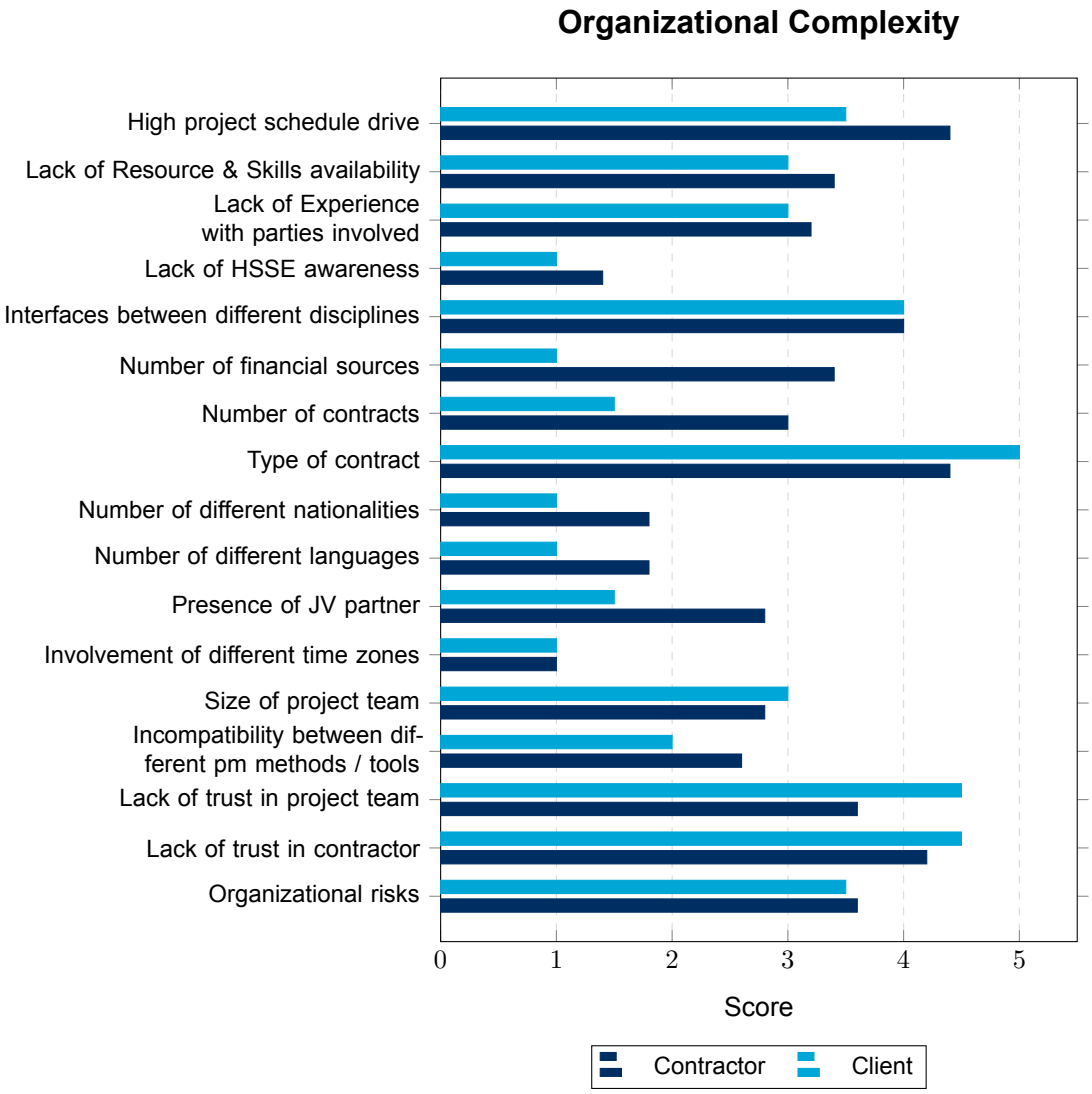


Figure 5.2: Organizational complexity scores: Contractor vs. Client (A27)

Largest Perception Gaps The most striking discrepancy concerns *Number of financial sources*, where the Contractor assigns a score of approximately 3.4 compared to only 1.0 by the client. This is the largest perception gap in the entire chart. Which is an interesting fact, while financing is the client's responsibility.

Beyond this, the following notable gaps were identified:

- **Number of contracts:** the contractor scores approximately 3.0 compared to 1.5 for the client.
- **Presence of JV partner:** the contractor scores approximately 2.8 compared to 1.3 for the client, which indicates that the alignment of these goals was clear for the client, and the opposite for some of the contractor's respondents.

Shared Perceptions Both the lack of trust in the project team and the lack of trust in the contractor are rated considerably high by both of the teams.

Also, the highest-rated complexity factor, Type of contract, for both the client and the contractor is particularly interesting for this research. Furthermore, the collaboration form or contract type is the subject of this research. Also, the way contracts are 'lived' is an essential part of the literal framework of Chapter 3. Also interfaces between tasks is rated highly for both the client and contractor.

Contractor and Client Patterns Unlike the technical complexity chart, where the contractor almost universally scored higher, the organizational complexity chart reveals two competing patterns. The contractor scores higher on factors such as financial sources, number of contracts, JV partners, while the client scores higher on factors such as type of contract, trust in project team, lack of trust in contractor at (4.2 vs. 4.5).

Low-Scoring Factors Both parties rate the involvement of different time zones (1.0 vs. 1.0), the number of different languages (1.0 vs. 1.8), and the number of different nationalities (1.0 vs. 1.8) as negligible complexity factors. Which confirms the predominantly national character of the project.

External Complexity A27 Noord

Figure 5.3 summarizes the average experienced external complexity by the participants. Overall the external complexity is rated higher, on average, by the participants from the side of the contractor than by the participants from the side of the client with a respective average external complexity score of 2.23 and 1.81.

Overall, the external complexity is rated by all participants as the least complicating factor, with an average score of 2 on the external complexity scale. This score is significantly lower in comparison to the other complexity elements.

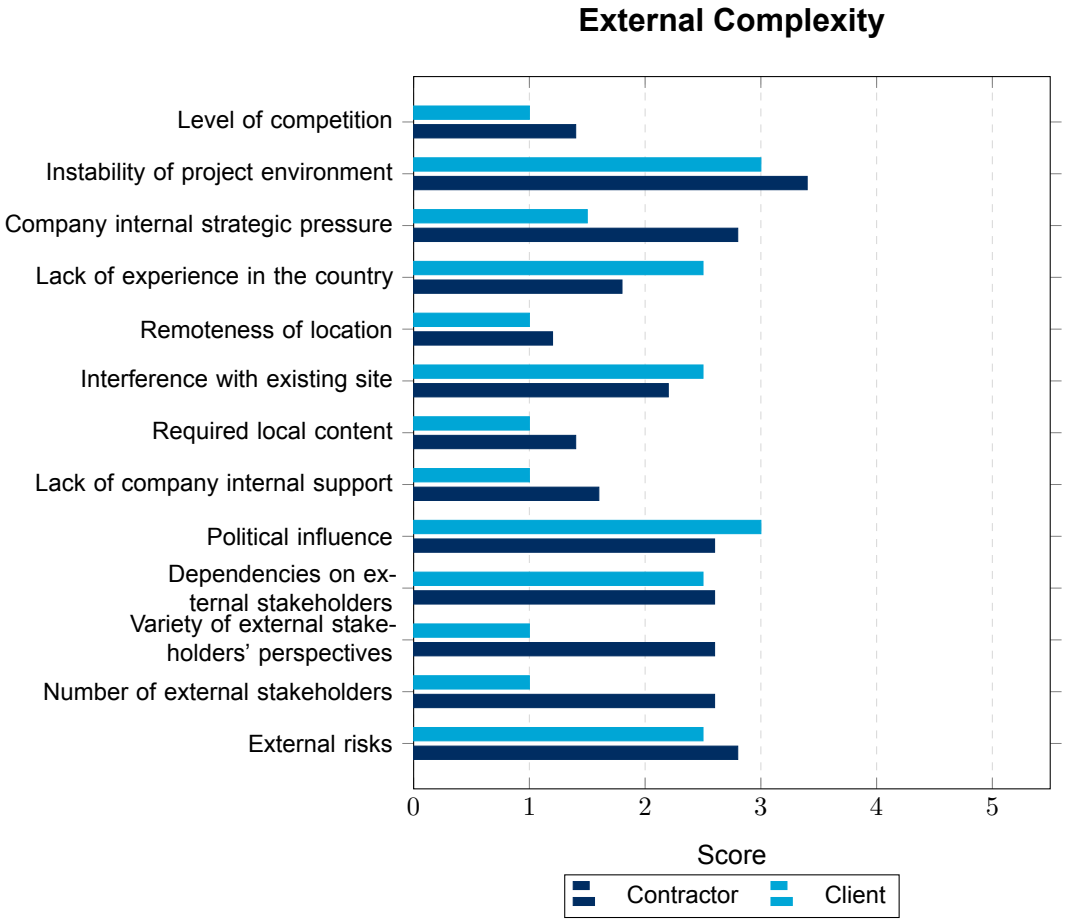


Figure 5.3: External complexity scores: Contractor vs. Client (A27)

Largest Perception Gaps The most striking discrepancy concerns *Number of external stakeholders* and the *variety of external stakeholders* where the Contractor assigns a score of approximately 2.6 compared to only 1.0 by the client. This is the largest perception gap in the entire chart. Both nonexistent for the client and, at some level, existent for the contractor. A possible explanation could lie in the level of experience dealing with external stakeholders in this phase compared to the client's experience.

Beyond this, the following notable gaps were identified:

- **Company internal strategic pressure:** the contractor scores approximately 2.8 compared to 1.0 for the client.
- **Lack of experience in the country:** the client scores approximately 2.5 compared to 1.8 for the contractor. An interesting fact, considering the national character of the project. Although a Portuguese engineering firm was involved, which could explain the existence.

Shared Perceptions Both parties align closely on Dependencies on external stakeholders (2.5 vs. 2.6) and Instability of project environment (3.0 vs. 3.4). The latter being the highest-scoring factor in the entire chart for both parties.

Also Political influence is rated by both the client and the contractor. Which is an interesting factor which is also present in the literal framework of Chapter 3.

Low-Scoring Factors Compared to the technical and organisational complexity charts, scores here are strikingly low across the board. Factors such as Remoteness of location (1.0 vs. 1.2), Required local content (1.0 vs. 1.4), and Level of competition (1.0 vs. 1.4) are considered near-irrelevant by both parties. This strongly suggests that external factors are not perceived as primary complexity drivers in this project context.

5.3.3. Processes that Shaped Phase I Duration

In the section above, the TOE ratings are described, the result of the survey rating exercise that produced the figures above. The next section will describe the processes identified by discussing the individual TOE frameworks with each participant.

Table 5.2 presents the factors most frequently identified across participants represents the primary reference points of the discussions, since the highest rated factors are discussed which each participant. A strict demarcation of presenting the results of the interviews based solely on frequency was deliberately avoided for two reasons. First, certain factors may not have been discussed during the interview, even though the participant ranked them. For instance, when they appeared lower in the individual ranking and time limitations prevented elaboration. In those cases, the ranking itself remained the only source of insight. Second, overlaps emerged where participants used different terms or categories to describe similar underlying processes or phenomena. These conceptual overlaps are examined further in the subsequent sections. Finally, some factors may be rated differently from a contractor's and a client's perspective. Since the client is underrepresented in the respondent pool, it may be relevant to include interview insights in the thesis, even if they are mentioned only once or twice.

Most Frequently Identified Complexity Factors

The respondents in Case A identified 119 instances of complexity (scores above 4)in the first phase of the two-stage contract. This corresponds to more than 16 distinct factors, accounting for over one-third of the total factors considered, a substantial proportion. In total, 36 different elements were identified, representing more than half of all elements included in the TOE framework. Table 5.2 presents an overview of these elements and their frequency of occurrence.

Table 5.2: Frequentie van complexiteitsfactoren (n=7 respondenten) (A27)

Factor	n	Factor	n
Type of contract	7	Non-alignment of project goals	3
High project schedule drive	6	Number of financial sources	3
Interfaces between different disciplines	6	Organizational risks	3
Lack of trust in contractor	6	Political influence	3
Project duration	6	Conflicting norms and standards	2
Size in CAPEX	6	External risks	2
Dependencies between tasks	5	Interference with existing site	2
High variety of tasks	5	Lack of Experience with parties involved	2
Involvement of different technical disciplines	5	Lack of experience with technology	2
Lack of trust in project team	5	Size of project team	2
Strict quality requirements	5	Technical risks	2
High number of tasks	4	Uncertainty in methods	2
Instability of project environment	4	Variety of external stakeholders' perspectives	2
Lack of Resource & Skills availability	4	Company internal strategic pressure	1
Uncertainties in scope	4	Dependencies on external stakeholders	1
Unclarity of project goals	4	Incompatibility between different PM methods / tools	1
		Lack of company internal support	1
		Number of contracts	1
		Number of external stakeholders	1
		Presence of JV partner	1

The single factor mentioned by all seven respondents was *Type of contract*. Six out of seven respondents pointed to *High project schedule drive*, *Interfaces between different disciplines*, *Lack of trust in contractor*, *Project duration*, and *Size in CAPEX*. Five respondents indicated *Dependencies between tasks*, *High variety of tasks*, *Involvement of different technical disciplines*, *Lack of trust in project team*, and *Strict quality requirements* as relevant complexity drivers.

Four respondents mentioned *High number of tasks*, *Instability of project environment*, *Lack of Resource & Skills availability*, *Uncertainties in scope*, and *Unclarity of project goals*. In total, 16 out of 36 identified factors were mentioned by more than half of the respondents, suggesting these are the most widely shared perceived sources of complexity within the project.

Budget Ambiguity and its Consequences for Collaboration

As already discussed in chapter 4, the goal of this research is not merely focusing on the outcomes of the TOE Framework. The TOE Framework also served as the basis for the interviews, wich reveal relevant processes that affected time or the experience of time (Section 5.2). These processes will be revealed by discussing the ones brought forward in the interviews.

During the interviews, the processes that came forward that had an influence on delays or the completeness of deliverables due to the lack of time were, for the most part, perspective issues between the client and the contractor. These perspective issues revolved around several factors: money, trust, contract, work culture, and risks.

One of the most discussed factors, which has been discussed with almost every participant in this case, is budget. Every respondent started discussing this element by itself, without being asked directly about it. The subject was discussed in connection with the following factors: size in CAPEX, Uncertainty in scope, Unclarity of scope, and Political influence by both the client and contractor participants.

Two separate issues came forward regarding budgetary issues. First of all the amount at which the budget was set. Secondly, how this given budget should be interpreted. In the following section the process of drawing up the budget will be discussed, after which the interpretation of this budget will be discussed.

Drawing Up a Budget

Establishing a budget within a two-phase approach presents a fundamental challenge. Although Phase I is intended to collaboratively develop both the design and the corresponding cost estimate, the budget is already fixed before the design is sufficiently known. Financial constraints are thus imposed in Phase 0 on an outcome that is still highly uncertain, creating an inherent paradox: the financial boundaries of the project must be defined before it is clear what exactly will be built. In this case, even the type of bridge to be constructed had not yet been decided when a maximum budget had to be established.

A second issue is that this budget must still rest on some form of cost estimate, even when the available information is limited. As a participant explained, Rijkswaterstaat often commissions external engineering consultancies to prepare these estimates, which generally focus on the end-state of the structure, while temporary works and construction facilities are not analysed in a project-specific way but included as percentage-based mark-ups derived from general benchmarks (Quote 13A). Also other questions are raised on how the budget has been developed (Quote 1C), (Quote 6E).

The development of the figure is, moreover, steered by something beyond its technical foundation, is something that is also argued by a participant. Which suggests that strategic misrepresentation, as described in the framework of Chapter 3, also plays a role: such budgets are structurally set too low because they depend on political will and public support, so the project starts with an amount insufficient for the task (Quote 3A).

Two characteristics sit in this figure at once. As a frozen Phase 0 baseline it is a fixed, blueprint-type condition held in advance, yet it is anchored in elements that are only partially specified and still subject to development, the still-unknown design, down to fundamental aspects such as the bridge type. The only limitedly substantiated cost estimate, in which temporary works are carried as a generic mark-up rather than analysed project-specifically, and the political and public-support considerations that bear on the figure. On that basis the budget is best understood not as a purely structural component but as a fixed front-end condition that generates its own internal uncertainty: the openness of the design and the incomplete elaboration of the underlying cost elements turn the frozen figure into a continuing source of in-time, emergent difficulty. This illustrates how uncertainty can be rooted in a structural front-end decision, a mechanism in line with Brady and Davies (2014), who argue that structural complexity inherently generates its own internal sources of uncertainty as a project unfolds.

The downward bias on the figure is best read as the joint product of two reinforcing behavioural mechanisms rather than one. Alongside the deliberate strategic misrepresentation discussed above, the structural under-sizing of the estimate also carries the marks of the non-deliberate planning fallacy: the cost is set unrealistically close to a favourable scenario, and the temporary works are folded into a generic mark-up rather than confronted. As Flyvbjerg (2021) notes, the deliberate and non-deliberate biases reinforce one another, which here helps explain why a figure that all parties later recognised as too low could nonetheless be fixed and held as the baseline.

With respect to how these components are handled, the frozen figure is subsequently treated as a value to be maintained and controlled, the estimate is produced top-down by the client and its external consultancy, and the not-yet-known design is bounded in advance by that figure. In the terms of the management axis this is a predict-and-control (Type I) handling: a blueprint figure, anchored in the hard value of cost, held through hierarchical steering and with change to be limited. It can be argued that a Type I logic, without a sufficient counter-arrangement, is thus applied to a baseline that itself carries dynamic, internally generated uncertainty, the control-on-emergent-change configuration that P3 associates with reduced predictability later in the phase.

Interpreting a Budget

Not only the amount of the budget was contested. The way it should be interpreted also had a fundamental influence on the first phase. The discussion focused on whether the budget was an indicative value or a ceiling amount, that is, the value at which the total project should have been realised. A separate budget existed for both the first and second phases, and the disagreement between contractor and client centred in particular on the second-phase figure. This misalignment surfaced strikingly early: a participant who joined shortly after the two-week kick-off observed within weeks that not all objectives were aligned (Quote 13C), a conclusion other participants broadly shared (Quote 7D, Quote 10A).

The specific issue concerned the interpretation of a particular annex in the contract. The contractor argued that the value stated in this annex was indicative and could be increased if justified. For instance, where a solution was necessary to achieve the required level of quality, even if it caused the costs to exceed the budget. The client, by contrast, maintained that this value was fixed and should be treated as a strict, non-negotiable amount. It is particularly noteworthy that this disagreement remained unresolved and was not addressed during the project's initial setup. One participant suggested the misalignment may even have been strategic. As another put it, the boundary status of the budget and timeline, including bandwidths such as Annex X, was never explicitly clarified and was treated by the contractor as indicative rather than binding (Quote 13D), which suggests that, from the outset, there was a fundamental lack of shared interpretation regarding key contractual conditions.

The process therefore turns on a single figure carrying two meanings. The budget figure stated in the contract annex (Annex X), and the second-phase budget to which it relates, are read in two divergent ways, one as a hard ceiling, the other as an indicative value open to upward justification. In the absence of any explicit, shared definition of what "indicative" is taken to mean. This interpretive ambiguity surfaced within weeks, was contested between the two actors, and continued to move over time without resolution. On that basis dynamic complexity can be observed: the complexity resides in the emergent, relational uncertainty surrounding the meaning of the figure rather than in a fixed arrangement, and it can be argued that this is precisely the internal uncertainty that the frozen budget component of the preceding process generates over time (Brady & Davies, 2014).

With respect to how these components are handled, the same figure is handled in two different ways by the two parties. The client handles it as a hard ceiling, to be held and not exceeded, which corresponds to limiting change and treating the figure as a blueprint value (Type I). The contractor handles it as indicative and adjustable, which corresponds to keeping the figure functional and facilitating change where quality requires it (Type II). A Type I and a Type II handling are thus applied to the same component and carried forward in parallel rather than reconciled. A sufficient counter arrangement is not present. This is the unreconciled handling of a single parameter that Chapter 3 associates with persistent tension and a deadlock in project progress rather than resolution, and that P3 links to reduced predictability. Here it is visible in an ambiguity that surfaced within weeks yet never converged.

Diverging Views on the Iron Triangle

In two-phase contracts, finding the right balance between a project's scope, time, and budget is an ongoing process: during the initial phases, the parameters inevitably shift as the design becomes more detailed. As the design and early work preparation developed, the parameters changed and cost estimates trended upward toward the ceiling (Quote 8A). When estimated costs approached or exceeded the budget, the contractual requirements became the point at which the trade-off played out. One participant described two ways of working with those requirements: scaling them back, or developing a different design to satisfy them, with the design following as a logical consequence of that choice (Quote 8B). Of these, adjusting the requirements themselves was described as the principal lever for making a project cheaper or faster: *"The main lever in a two-phase contract is … if you want to make something cheaper and faster, you should also be willing to adjust the requirements"* (Quote 8C).

Even if the budget limit had been clear to all parties, decision-making revolved around the 'iron triangle' of project control: time, cost, and quality. With the financial corner held fixed and being contested, the room for adjustment lay in the quality or time parameters, a trade-off one participant summarised as fast, good or cheap, of which one can choose only two (Quote 3B). The client and the contractor, however, held fundamentally different views on how to navigate this triangle. From the contractor's side, staying within time and budget meant relaxing the quality requirements (Quote 7E). Rijkswaterstaat, by

contrast, held that the time and cost in the baseline were overstated and that uncertainties and risks should first be stripped out before the quality requirements were addressed (Quote 7F), and looked to the contractor to work hard to find what was jointly possible the moment the design no longer fit the budget (Quote 13E). The project team was thus not aligned on which corner of the triangle to adjust, and this ambiguity over which parameters were open to adjustment pointed to a more fundamental lack of trust between the parties.

These interacting components, the three parameters of the iron triangle (time, cost and quality), the upward cost trend as the design matures, the contractor's option to reduce the quality requirement or propose an alternative design and the client's preference to first remove uncertainty and risk from the baseline, do not sit in a fixed arrangement. What makes the process significant is that the parameters shift over time while the parties increasingly diverge in how they believe the shifts should be managed. On that basis dynamic complexity can be observed: the complexity does not stem from a fixed set of components but from changing conditions and the emergent disagreement over how to respond to them. That the parameters shift as the design matures is not in itself a failure but the expected condition of the approach.

In handling these components, the contractor treats the trade-off as an adaptive challenge, proposing changes to the scope and quality parameters in order to preserve project viability, a functional, change-facilitating handling consistent with a prepare-and-commit (Type II) approach, in which scope is viewed as flexible rather than fixed. The client, by contrast, seeks to protect time and cost while stabilising the baseline, treating the requirements as a fixed performance floor. This control-oriented handling aligns with a predict-and-control (Type I) logic, designed to overcome uncertainty by freezing the scope and viewing change as undesirable. These are two conflicting management logics applied to the same competing project values, where altering one parameter (such as scope) inevitably has repercussions for the others (time and cost). Because no shared steering direction existed, a sufficient counter arrangement remains absent, regarding which parameter could be adjusted, the approaches were never reconciled, creating a persistent tension that surfaces around key decisions about the management of project parameters. As (Koppenjan et al. (2011);Hertogh and Westerveld (2010)) observe, the failure to carefully balance these contradictory requirements leads directly to a deadlock in project progress and subsequent problems in overall project performance.

Information management and Decision-Making Mandates

Effective collaboration between client and contractor makes information management not merely a supporting process but a core condition for successful project delivery. Particularly in environments where scope, requirements, design choices, and risk positions develop over time, both parties depend on the timely exchange of accurate and interpretable information, and in this case the information asymmetry materialised on multiple occasions.

From the client's perspective: *"As Rijkswaterstaat, we literally opened that box for the first time and … were completely shocked. Because the product costs more money and takes more time"* (Quote 13F).

From the contractor's perspective: *"… only then did they start looking at it seriously. That is a bit like shutting the stable door after the horse has bolted"* (Quote 6B).

This describes a fundamental issue in information sharing: both parties clearly see the same problem and agree the situation is not optimal, yet each locates its root with the other party. At the very least, the information sharing was not aligned at the level at which collaboration can be felt as smooth. The same non-alignment surfaces in discussions about the required quality requirements, which is closely related to steering on the triangle (cost, quality and time). Again the contractor's and the client's perspectives diverge.

The contractor's perspective: *"Can't we adjust that requirement? Yes … but we already told you that back then … if we do it now, it will take a lot of time"* (Quote 7G).

The client's perspective: *"… we let certain things go … it was simply too late to make major changes to the design … otherwise we would have to overhaul everything"*

This tension was further reinforced by differing expectations regarding the scope and depth of the design work actually developed during the preliminary-design stage. What one party perceived as a

reasonable prioritisation within severe time constraints, the other experienced as an incomplete design basis, further increasing uncertainty and information asymmetry.

"An eight-week period had been allocated for the conceptual design, but in practice only the main span was developed as the critical design choice. This deviated from the contract, which called for an integrated conceptual design, and meant that various other critical components only emerged during the preliminary design phase." (Quote 13M)

The process turns on three interlocking components: the flow of information between the two organisations, the timing of inputs and decisions, and the responsibility for managing the interfaces between the parties. These structural interfaces were not adequately agreed upon, and the absence of adequate counter-arrangement left the resulting friction unmanaged, so that it became an embedded part of the project (Koppenjan et al., 2011). On that basis dynamic complexity can be observed.

With respect to how these components are handled, the non-alignment placed the client's predominantly predict-and-control (Type I) approach alongside the contractor's prepare-and-commit (Type II) approach, and the two were never aligned into a single shared way of working.

Decision making

Another noted dynamic is that, within the contractor organisation, a decision is an endpoint: once made, the team moves forward. Within RWS, a decision is provisional until all relevant disciplines have endorsed it, and even then it may be revisited when new information emerges (Quote 3C, Quote 6C). The consequences for Phase I are substantial: design decisions are not finalised when the contractor assumes they are but remain open until the baseline is formally accepted, so the contractor may invest resources in developing a design on the basis of a client commitment that is subsequently reversed, wasting effort, creating schedule pressure, and leaving final agreement neither found nor felt by both parties.

These components differ in their character: the difference in decision conventions is a fixed property of the two organisations, while the rework and reversal it produces over time is the in-time element. On that basis, dynamic complexity can be observed. An emergent unforeseen situation in which the contractor and client both fail to find a counter arrangement to properly address this kind of complexity.

Mandate

The mandate was raised by several participants. Interestingly, both the contractor and the client felt the other party's mandate was not broad enough, a low mandate meaning that project directors can commit only limited amounts of money or make only limited choices, a broader mandate meaning more freedom of choice before permission is required (Quote 3D), (Quote 13G).

The process turns on the allocation of decision rights on each side, the low approval limits for project-level representatives, the supervisory and executive boards to which money and time decisions are escalated, and the limited mutual overview each party has of how the other reaches decisions. This allocation of mandate is, in principle, a fixed and knowable governance arrangement that could have been clarified in advance, which makes it structural in origin. When it is left unmanaged, however, this rigid hierarchical structure cannot effectively accommodate the dynamic needs of the project, and the repeated escalation, decision delays and friction it generates accumulate over time. On that basis the process is best read as structural complexity that generates its own internal uncertainty: a knowable front-end arrangement that develops into a dynamically complex situation during execution.

In complex engineering projects, the allocation of mandate logically depends on the balance between control and flexibility: a narrow mandate and the reliance on hierarchical steering can be associated with a predict-and-control (Type I) approach, whereas a broader mandate and decentralized network steering are more consistent with a prepare-and-commit (Type II) approach (Koppenjan et al., 2011). In this case, both the client and the contractor relied on a governance structure in which key decisions are escalated to senior management, which reflects a predominantly Type I approach, driven by the classical organizational paradox in which the desire for collaborative project delivery clashes with the parent organisations' reflex to retain strict control over cost and time (Bresnen, 2007).

Personnel Turnover and Onboarding

Another process that shaped the first phase, observed by multiple participants, concerns the effect of personnel changes on Phase I dynamics. Personnel changes have a direct effect on time management: new personnel inevitably need to get acquainted with the project, especially one of this size, and one participant estimated that getting up to speed on a project of this scale takes three to four months, during which staff are not yet fully effective (Quote 3E).

That lack of effectiveness can directly affect the time management of the first phase, but the effect of personnel changes was not visible in effectiveness alone. At the same time as a financial setback hit Rijkswaterstaat around the end of the preliminary-design phase, parts of the client team were reshuffled, due to a change in the program organisation of RWS, after which resolving issues became noticeably harder (Quote 13H). Making agreements became more of a hassle. People in their new position needed to get used to their counterpart, hampering decision-making. The arrival had a further consequence: team members had less time to collaborate with their counterparts and were forced to focus on internal processes, such as ensuring that people were trained.

"I had to … drag those guys along … the collaborative perspective largely came to a standstill" (Quote 13I).

The process turns on the incoming and replaced staff, the onboarding period of three to four months during which new staff are not yet fully effective, the disrupted relational continuity between counterparts on each side, and the internal coordination load created by the reshuffle. These components are not a fixed arrangement but a disruption that arises at a particular moment and evolves over time. On that basis, dynamic complexity can be observed: the source of the difficulty is the emergent loss of relational continuity and the subsequent drop in effectiveness, rather than a fixed component count. This perfectly illustrates how internal developments, such as the unavoidable turnover of key personnel, act as powerful triggers that shift stakeholder dynamics and continuously fuel dynamic complexity over the course of a large infrastructure project. A deliberate Type II management-style to absorb this dynamic has not been observed.

The Collapse into Traditional Negotiation at Phase End

The open communication and collaborative approach that were central to the two-phase contract came under pressure during the final phase (Detailed Design, DO), ultimately shifting into a more traditional negotiation dynamic. While the process was intended as a joint search for optimisation, it was ultimately experienced as a classic price negotiation with opposing interests:

"...then suddenly it is called negotiation... then all of a sudden we start negotiating about the price... and we end up playing petty bargaining games about time and money." The disappointment is significant, especially because this outcome contradicts the purpose of the approach (Quote 13J).

A client participant reflected that the intended joint search for optimisation never materialised, and that escalation to weeks of director-level negotiation contradicted the philosophy of the approach (Quote 13J). At the same time, this negotiation dynamic was partly caused by the structural postponement of issues during earlier phases: to maintain progress and pass formal approval gates, unresolved issues were continuously carried forward instead of being solved, leading to an accumulation of problems.

7 '...we always carried remaining issues with us... just to get through the gate... but then of course you don't solve them in the next phase either." (Quote 7H)

These accumulated issues eventually converged in the final negotiation, where they had to be resolved after all: items from the 'to be agreed upon' list were carried through the whole process and ultimately landed on the negotiation table (Quote 7I).

The process turns on the unresolved issues carried forward through successive approval gates (the "to be agreed upon" list), the point of price fixation at the end of Phase I, the state of trust between the parties at that point, and the director-level escalation tables. These components accumulate and degrade over the course of the phase rather than sitting in a fixed arrangement. On that basis dynamic complexity can be observed: the source is the cumulative carry-over of issues and the erosion of trust over time, reinforced by the behavioural moderator of maintaining an optimistic baseline despite accumulating evidence of misalignment. The carry-over mechanism is itself behavioural: maintaining an optimistic baseline while deferring unresolved issues across successive gates is a direct expression

of the planning fallacy, the tendency to keep estimates close to a favourable scenario despite mounting counter-evidence (Flyvbjerg, 2021).

With respect to how these components are handled, the accumulated issues and the price are settled at the end of the phase through conventional, adversarial price claims and through escalation to director level, rather than through the joint, functional search for an optimum that characterised the earlier intent. The handling thus shifts from a functional, change-facilitating mode towards a blueprint, position-holding mode on both sides, so that it can be argued the handling of these components collapses into a Type I approach at the close of Phase I.

Interfaces between Contract Scopes and the KICKs Working Group

The A27 Noord contract is not a pure two-phase contract: it combines approximately 70% two-phase scope and 30% regular scope, with the two-phase scope further split across the main bridge structure, the earthworks, and the road infrastructure, each carrying its own teams, timelines, and contractual logics. This hybrid architecture is a fixed property of the contract, yet the coordination problems it produced only became visible over time, as sub-teams working at different tempos made decisions in one scope before the inputs from another were available. A participant illustrated this with the Hagestein bridge: its width and lane layout sat in the regular scope, yet the bridge team pressed ahead while that width still depended on how the regular scope resolved (Quote 10C). Resolving these integrative questions, together with requirements differentiation, can be seen as the most time-consuming aspect of Phase I (Quote 1E).

"At some point — this also happened during the preliminary design phase — we realized: okay, it's stalling. That trade-off between time, money, and quality. And on top of that, we also had interfaces between the different two-phase components, as well as with the regular scope." (Quote 7J)

The process turns on the hybrid scope split of roughly 70% two-phase and 30% regular, the three two-phase components (the main bridge structure, the earthworks and the road infrastructure), the differing teams, timelines and contractual logics attached to each, the information dependencies between the scopes, and the different tempos at which the sub-teams work. The arrangement of these components and their interfaces is fixed, while the coordination problems that arise because the scopes move at different speeds emerge over time. Dynamic complexity can be observed: the structural hybrid architecture is the source, and the emergent, in-time coordination across its interfaces is the effect. The mechanism by which an unaddressed structural split acts as a catalyst for dynamic complexity, in which a fixed front-end arrangement generates its own internal uncertainty

As these dynamic coordination problems surfaced, a Type II counter-arrangement emerged in the sense of Koppenjan et al. (2011): a dedicated joint working group for Kritische Integrale Keuze Sessies (KICKs, or Critical Integral Decision Sessions) (Quote 1D), (Quote 7L). A horizontal cooperation forum of exactly this kind, a shared interface-management arrangement, is one of the counter-arrangements the literature proposes for restoring relational flexibility where a baseline is dominated by Type I structuring. The KICKs working group was not planned at the start of Phase I but formed organically during the VO phase, when it became clear that the design process was stalling precisely where a choice in one scope had consequences for another.

5.3.4. Effects on time

A Decline in Trust

Read on their own, the processes reconstructed in Section 5.3.3 appear as distinct episodes. Viewed from a higher vantage point, however, a common thread runs through them: each affected the relational basis on which a two-phase contract depends. Trust appears in the framework of Chapter 3 as one of the central conditions for effective client–contractor collaboration (Bresnen, 2007; Suprapto et al., 2015, 2016), and the material of Case A shows how fragile this condition is in practice. The central argument of this section is that the erosion of trust in Case A was not incidental but the relational signature of an unreconciled handling of the same parameters under contradictory management logics: the misalignment between the two approaches did not only stall decisions, it actively eroded the trust on which the collaboration depended. Three observations develop this.

First, the source of the erosion lay in the management approaches themselves. Control and flexibility impose contradictory requirements on the same parameters: control calls for them to be rigidly

specified and held, whereas flexibility calls for those same parameters to be kept open and revisable (Koppenjan et al., 2011). In Case A these requirements were split across the parties, the client steering the budget and the iron triangle under a predict-and-control (Type I) logic and the contractor working from a prepare-and-commit (Type II) logic, without being reconciled into a workable combination. The literature anticipates the consequence: contrasting management styles generate persistent organisational tensions around key decisions, and unless these tensions are actively managed they produce a deadlock in project progress and premature convergence rather than resolution (Hertogh & Westerveld, 2010; Koppenjan et al., 2011). This is what the cross-process analysis shows. The ambiguity between a ceiling and an indicative reading of the budget, compounded by its politically driven undersizing, the unresolved question of which corner of the iron triangle was adjustable, the perceived insufficiency of mandate on both sides, and the mismatch in decision-making culture each degraded mutual trust, either directly or as a side effect of the unmanaged tension between the two logics. Because the misalignment was left unreconciled, it did not merely slow individual decisions. It fed back into the relational basis itself, so that the friction between the two logics translated directly into a loss of mutual trust. This is reflected in the TOE results, where both *lack of trust in contractor* (4.5 on the client side) and *lack of trust in project team* rank among the highest organisational complexity factors.

Second, this erosion did not occur as a single rupture but as a slow accumulation. The interpretive disagreement over the budget was visible within the first weeks of Phase I, yet was never clarified or agreed upon. Presumed 'final' decisions were reopened, designs were developed in directions the client was only able to review close to completion, and personnel changes around the end of the VO phase reset relationships that had only just begun to settle. Taken individually, each episode may have been recoverable. Taken together, they produced a steady erosion of the willingness on both sides to assume good faith in the other party, and arguably evolved into distrust (Quote 7M). This cumulative, organic decay is precisely the fragility that Bresnen (2007) attaches to partnering: trust is not a guaranteed property of the contract form but a fragile 'leap of faith', and attempts to engineer it can paradoxically harden the desire for managerial control once commercial pressure mounts.

Third, and most consequentially for the research question, the loss of trust had direct, observable effects on time, operating through two pathways that are analytically distinct but empirically intertwined. The first is an internal reallocation of attention: as trust declined, both parties spent an increasing share of their effort protecting their own organisational position rather than advancing the joint product, a shift Participant 13 articulated explicitly when describing the internal coordination that staff turnover at Rijkswaterstaat required after the VO phase (Quote 13I). The second pathway is atmospheric: even where participants remained formally engaged in joint activities, the quality of those interactions deteriorated, and discussions that under conditions of trust could have been settled in a single meeting now required repeated cycles of escalation, written confirmation, and back-channel verification.

"tensions over the budget became so high that open cooperation came to a halt" (Quote 10D).

A working atmosphere in which one party suspects the other of strategic positioning is not one in which difficult design choices can be weighed and decided quickly. The dynamic became acute when the budget issue turned critical at the end of the VO phase: the client stated a shortfall of roughly 100 million euros and insisted the project could not proceed without concessions,

"…there's not a word of a lie in this: I genuinely, seriously do not have that money" (Quote 13L)

yet the contractor read this not as a financial reality but as a negotiating tactic, a 'power play'. The episode shows how directly the ambiguity over the budget fed the loss of trust.

The absence of counter-arrangements and interactive management.

Multiple processes have been argued to have a structural root, and due to not being adressed properly deveoping into an dynamic complex situation. This can also argued to be a lack of countrer-arrangements. Where a project baseline is dominated by Type I structuring, Koppenjan et al. (2011) argue that managers must deliberately introduce Type II counter-arrangements, these could include horizontal cooperation forums, shared interface managemen, to restore the flexibility that a control-oriented setup lacks. Hertogh and Westerveld (2010) conceptualise the same requirement as dynamic management, the continuous balancing of Systems (control) and Interactive (interaction) Management, which cannot be run sequentially but must co-exist. Case A shows this remedy applied selectively. For the

technical interface complexity generated by the hybrid scope split, a counter-arrangement did emerge: the KICKs working group functioned as exactly the kind of shared, horizontal interface-management forum the literature prescribes, and through it the cross-scope coordination was brought back under joint control, the aligned (P2) handling of a dynamic process. No equivalent arrangement was established for the relational and governance tensions surrounding the budget, the mandate, and the steering of the iron triangle. Here interactive management was effectively absent: rather than balancing control with interaction, both parties responded to mounting tension by withdrawing into internal control, the Type I reflex visible in the first pathway above. Without a counter-arrangement which the competing Type I and Type II demands could be held together and worked through, the tensions were neither absorbed nor resolved, and the erosion of trust was free to continue. The collapse into traditional price negotiation at the close of Phase I, where both sides retreated into a blueprint, position-holding mode, is the end state of this unmanaged misfit, the control-oriented handling of a dynamic, relational process that proposition P3 associates with extended duration and reduced predictability. The contrast within the case is instructive: where a counter-arrangement was in place, dynamic complexity was contained. Where it was absent, the same dynamic complexity converted into delay.

5.3.5. Summary: Key Processes in Case A

The summary of the projects described above is given in Table 5.3. The table consists of all the processes described in this section above. It is the cumulative result of the tables which are introduced after each process.

Table 5.3: Overview of processes, literature framework and management style – Case A

Process	Literature framework	Management style
Phase 0 budget determination	Strategic scope framing and front-end definition; behavioural biases in time estimation and governance (strategic misrepresentation, planning fallacy); risk allocation and financial exposure.	Type I handling of a baseline that itself carries dynamic, internally generated uncertainty (P3).
Ceiling amount or indicative value	Information management and communication culture; risk allocation and financial exposure; behavioural biases in time estimation and governance.	Unreconciled: client Type I (hard ceiling) and contractor Type II (indicative) applied to the same figure in parallel (P3).
What to steer?	Strategic scope framing and front-end definition; Phase I duration, time governance and perceived predictability.	Unreconciled: contractor Type II (adaptive scope) and client Type I (fixed performance floor).
Non-alignment in project management methods	Information management and communication culture; design iteration as response to complexity; matching complexity to management strategy.	Client Type I alongside contractor Type II, never aligned into a shared way of working.
Decision-making culture and provisional commitment	Client–contractor relational quality and partnering realism; information management and communication culture; design iteration as response to complexity.	—

Continued on next page

Table 5.3 (continued)

Process	Literature framework	Management style
Who decides?	Go/No-Go governance and ‘target date’; Phase I duration, time governance and perceived predictability.	Predominantly Type I on both sides; key decisions on money and time escalated to senior management.
Personnel changes and Phase I dynamics	Client–contractor relational quality and partnering realism; information management and communication culture.	—
Traditional negotiations	Price formation and timing of price fixation; contract form versus relational attitudes and incentives; behavioural biases in time estimation and governance.	Collapse into a Type I, position-holding mode on both sides at the close of Phase I.
Interfaces between contract scopes and the KICKs working group	Structural versus dynamic complexity; design iteration as response to complexity; matching complexity to management strategy; iterative, baseline-driven Phase I process.	Type II counter-arrangement (KICKs working group) layered onto the structural interface split, bringing cross-scope coordination back under joint control (aligned fit, P2).

5.4. Case B: OVT 2 Zuidasdok

Case B is the secondary case in this research. Section 5.4.1 describes the project characteristics. The complexity experienced by the participants is discussed in Section 5.4.2. Finally, the processes that influenced these complexity ratings are examined in Section 5.4.3. The data integration follows the logic described in Section 4.6.1.

5.4.1. Project Description and Context

The second and final case, part of this multiple case study, is the Zuidasdok - OVT terminal project. Being part of the Zuidasdok project, which involves one of the busiest train stations in the Netherlands, one of the busiest highways in the Netherlands as well as the heart of the financial district of the Netherlands, it can clearly be described as a truly complex infrastructure project. The Zuidasdok is a collaboration of Rijkswaterstaat, ProRail and the municipality of Amsterdam.

The Location

Zuidas is known as the new international knowledge and business centre of Amsterdam. But it is also a place to live and relax. That is why the neighbourhood continues to grow, with shops, schools, restaurants, sports facilities and nightlife. The Zuidas is strategically located: close to the city centre and Schiphol Airport, and easily accessible by car, train, metro or bicycle Gemeente Amsterdam, 2026.

The train station is one of the busiest train stations in the Netherlands, as in 2024 it was one of the 10 busiest train stations in the Netherlands Nederlandse Spoorwegen, 2023. The Amsterdam Zuid station is the fastest growing station in the Netherlands, and will become the second biggest station in Amsterdam Mobilis TBI, 2024.

Also the A10 is known as one of the busiest highways in the Netherlands. The A10 has been present in the top 10 traffic jams of the Netherlands for years Rijkswaterstaat, 2026. All things considered the A10 Zuidasdok is an extremely complex project, even described as one of the biggest (complex) projects in the Netherlands. Making it a suitable contender as it includes some of the Two-phase characteristics described in Section 2.1.3.

Project History

The history of the Zuidasdok project began with the ambitious “dokmodel” (dock model) presented in the year 2000, which originally proposed bringing both the A10 South highway and Amsterdam Zuid station completely underground to allow for large-scale construction on top of the tunnels. Following financial feasibility studies, the government and the municipality agreed to this model and established a public-private partnership called the Zuidas-onderneming in 2006.

However, the 2008 credit crisis severely impacted the project. Private parties began to doubt the financial viability of the dock model, and the value of the construction land dropped significantly. This led to a major pivot in 2012: the government decided on a scaled-down variant where only the A10 highway would go underground, while Amsterdam Zuid station would be renewed above ground. This definitive plan became known as the Zuidasdok.

The 2012 Structural Vision for Zuidasdok officially outlined the goals, which included expanding and separating the A10 highway lanes, putting the highway underground in the center to create space, and drastically expanding the public transport station to accommodate more train traffic, including a new platform for high-speed trains.

The realization phase faced significant difficulties. In 2017, the construction consortium ZuidPlus won the tender to build the Zuidasdok. They soon discovered that creating an integrated preliminary design was much more complex than anticipated. To avoid major delays, early construction began on the station’s second passenger tunnel, the Brittenpassage, in 2018. By 2019, progress on the rest of the project was so difficult that ZuidPlus temporarily scaled down its organization, and in 2020, the client officially terminated the contract with the consortium.

Following an investigation into the project’s utility and necessity between 2019 and 2020, Zuidasdok was reorganized from a single project into a broader “program”. The massive undertaking was split into separate sub-packages to be tendered individually, such as the station renewal, the widening of

the A10, and the construction of the road tunnel Zuidas, 2026.

The Program

The project changed towards a program, called the Zuidasdok, in which the renewal of station Amsterdam Zuid as well as the broadening of the A10 South and the realisation of the tunnel are being delivered as separate projects. In August 2021, the Nieuw-Zuid construction consortium (Mobilis, Boskalis and Van Gelder) was awarded the contract for the first two work packages: the construction of the Brittenpassage and the refurbishment of the existing Minervapassage Zuidas, 2026. These projects respectively named OVT 1 and OVT 2 are the cases which the focus lays on Mobilis TBI, 2024.

Type of Two-phase Approach

The Brittenpassage as well as the Minervapassage project within the Zuidasdok programme were executed under a two-phase UAV-GC contract. Mobilis was responsible for both OVT 1 and OVT 2, each of which had its own distinct first phase. The contractual and technical context was exceptionally complex, largely because Mobilis did not enter the project with its own design responsibilities in phase I. Instead, the company was required to work with an existing Definitive Design (DO) that had originally been developed under a previous contract with Heijmans. That contract had been dissolved when it became clear that the design could not feasibly be delivered. Zuidasdok subsequently took over the DO and commissioned Arcadis to complete it. However, the resulting design lacked technical depth, clarity, and adequate substantiation. Both the client and Mobilis struggled to fully understand the design, which led to significant debate and delay early in the process.

In this two-phase contract, the first phase did not revolve around the co-creative design development typically associated with collaborative construction models. Instead, Mobilis's primary task was to analyse and assess the existing DO, identify technical and logistical risks, and develop a price, risk dossier, and contractual framework for the execution phase. This task was made more challenging by the fact that the project was already under considerable schedule pressure. The required phasing and key railway and A10 motorway possessions had been predetermined and could not easily be altered, substantially reducing the room for technical optimization.

During the first phase, the client also issued an additional assignment linked to a planned A10 shutdown. This work had to be tendered and executed separately but fell within the same timeframe, adding further strain to an already pressured planning process.

At the outset of phase 1, the team adopted a process-driven, scrum-like working structure. However, this approach did not produce the necessary technical progress because too little emphasis was placed on engineering content. As the phase progressed, it became increasingly clear that the DO contained substantial gaps in detail, evidence, and constructability. Only after the team shifted from a managerial to a technical focus did meaningful progress begin to occur.

Both OVT 1 and OVT 2 experienced delays of approximately three months during their respective first phases. For OVT 2, the challenge was compounded by the need to conduct phase-1 activities while OVT 1 was already in execution. This requirement was set by the client, while they emphasized the need for the creation of clarification for OVT 2 while the Bouwcombinatie would have preferred a later date, for instance to acquire persons from OVT 1 for the new project. The OVT 1 team was occupied with the realisation of OVT 1 meaning a separate team needed to be created to start phase I of the OVT 2 project.

A major issue that emerged during phase 1 of OVT 2 concerned the construction logistics. OVT 2 had been divided into eight technical disciplines, including train services, metro services, groundworks, and A10-related works, which all had to be carried out within the predetermined sequence. After three months of detailed analysis, the team concluded that the prescribed phasing was physically impossible: the necessary heavy machinery simply could not be manoeuvred within the available spatial constraints. Under the existing assumptions, the project would have required approximately two additional years.

In response, Mobilis and the client jointly developed a temporary solution in the form of a prefab concrete viaduct that created additional working space. Implementing this solution required a major A10 possession. This intervention marked a decisive turning point in the collaboration, producing a more positive working atmosphere as both parties worked constructively toward viable logistical and technical

solutions Zuidasdok OVT terminal expert, 2026.

Participants

Table 5.4: Project roles and organizations — Project OVT 2 Zuidasdok

Project role	Organization
Cost estimator	Joint venture contractor
Technical manager	Joint venture contractor
Project director	Joint venture contractor
Project control manager	Joint venture contractor
Contract manager	Rijkswaterstaat
Project manager Zuidasdok	Prorail

For the OVT 2 Zuidasdok case, the project roles shown in Table 5.4 have been selected for this research. These roles provide insight into the project from both the contractor and client perspective.

The project director has been selected, as this role is closely involved in decision-making and has a broad overview of the project. This makes the project director's insights useful for understanding how the project developed.

The contractor's cost estimator from the OVT 2 Zuidasdok case has been selected, as price-related discussions may have contributed to issues or delays in the first phase of the project. His or her perspective is relevant for understanding how cost considerations influenced the process.

The contractor's technical manager from the OVT 2 Zuidasdok case has been involved as well. Technical issues may have influenced the progress and duration of the first phase of the project, making this perspective valuable for the study.

The contractor's project control manager has been included because this role is closely connected to project control and baseline management.

The client's contract manager has been selected, while contractual issues may have contributed to delays in the first phase of this project.

The client's project manager has also been selected and can provide clear insights into how the project went from the client's perspective, as well as decision-making in an organization with joint commissioning. In addition to providing insight into the history of this project, as it is a special form of Two-Phase contract with a unique project background. An additional consideration was to interview at least two of the three client parties involved in this project.

5.4.2. Complexity Profile: Shared Schedule Pressure and Diverging External Complexity

In the following section, the differences between the perspectives of the contractor and the client on perceived complexity are discussed, following the technical, organizational, and external complexity. The most striking differences, as well as the highest scoring elements are described.

Technical Complexity OVT

Figure 5.4 summarizes the average experienced technical complexity by the participants. Overall the technical complexity is rated higher, on average, by the participants from the side of the contractor than by the participants from the side of the client with a respective average technical complexity score of 3.31 and 2.8.

Overall, the Technical complexity is rated by all participants as the most complicating factor, with an average score of 3.05 on the technical complexity scale. This score is significantly higher in comparison to the other complexity elements.

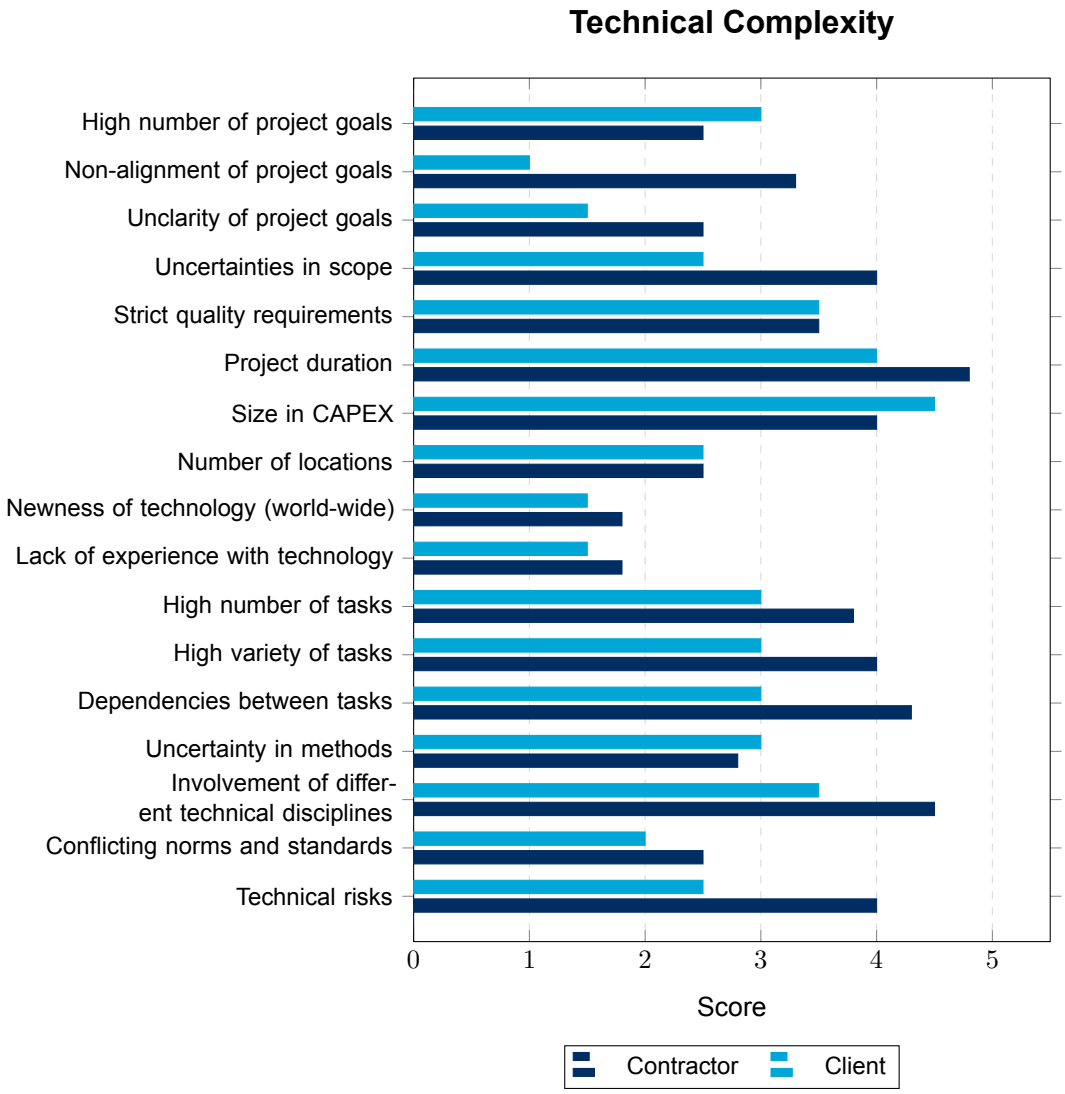


Figure 5.4: Technical complexity: Contractor vs. Client

Largest Perception Gaps The most striking discrepancy concerns *Non-alignment of project goals*, where the contractor assigns a score of approximately 3.3 compared to only 1.0 by the client. Which is interesting considering the importance of clear goals in projects.

Beyond this, the following notable gaps were identified:

- **Uncertainties in scope:** With a 1.5-point gap, the contractor rating is higher. This item follows the same logic as the biggest discrepancy.
- **Unclarity of project goals:** With a 1.0-point gap, the contractor rating is higher. This item follows the same logic as the biggest discrepancy.
- **Technical Risks:** Both the client and the contractor rate these as high, with respective scores of 3.0 and 4.0.

Shared Perceptions Both parties score closely on Strict quality requirements (3.5 vs. 3.5), High number of project goals (3.0 vs. 2.5), Number of locations (2.5 vs. 2.5), and Conflicting norms and standards (2.0 vs. 2.5). The same relatively high score on strict quality requirements is notable.

The following factors are scored high for both the contractor and the Client. Both are slightly higher for the client than for the contractor.

- Size in CAPEX: client 4.5 vs. contractor 4.0
- Dependencies between tasks: client 4.5 vs. cntractor 4.3

This suggests that both the client and the contractor are aware of the size or complication of the scope as well as the financial size of this project.

Low-Scoring Factors Both parties rate Lack of experience with technology (1.5 vs. 1.8) and Newness of technology (world-wide) (1.5 vs. 1.8) as negligible.

Organisational Complexity OVT

Figure 5.5 summarizes the average organizational complexity experienced by the participants. Overall, the organizational complexity is rated equally, on average, by the participants from the side of the contractor and by the participants from the side of the client, with respective average organizational complexity scores of 2.0 and 2.0.

Overall, the Organizational complexity is rated by all participants as the least complicating factor, with an average score of 2.0 on the Organizational complexity scale. This score is significantly lower in comparison to the other complexity elements.

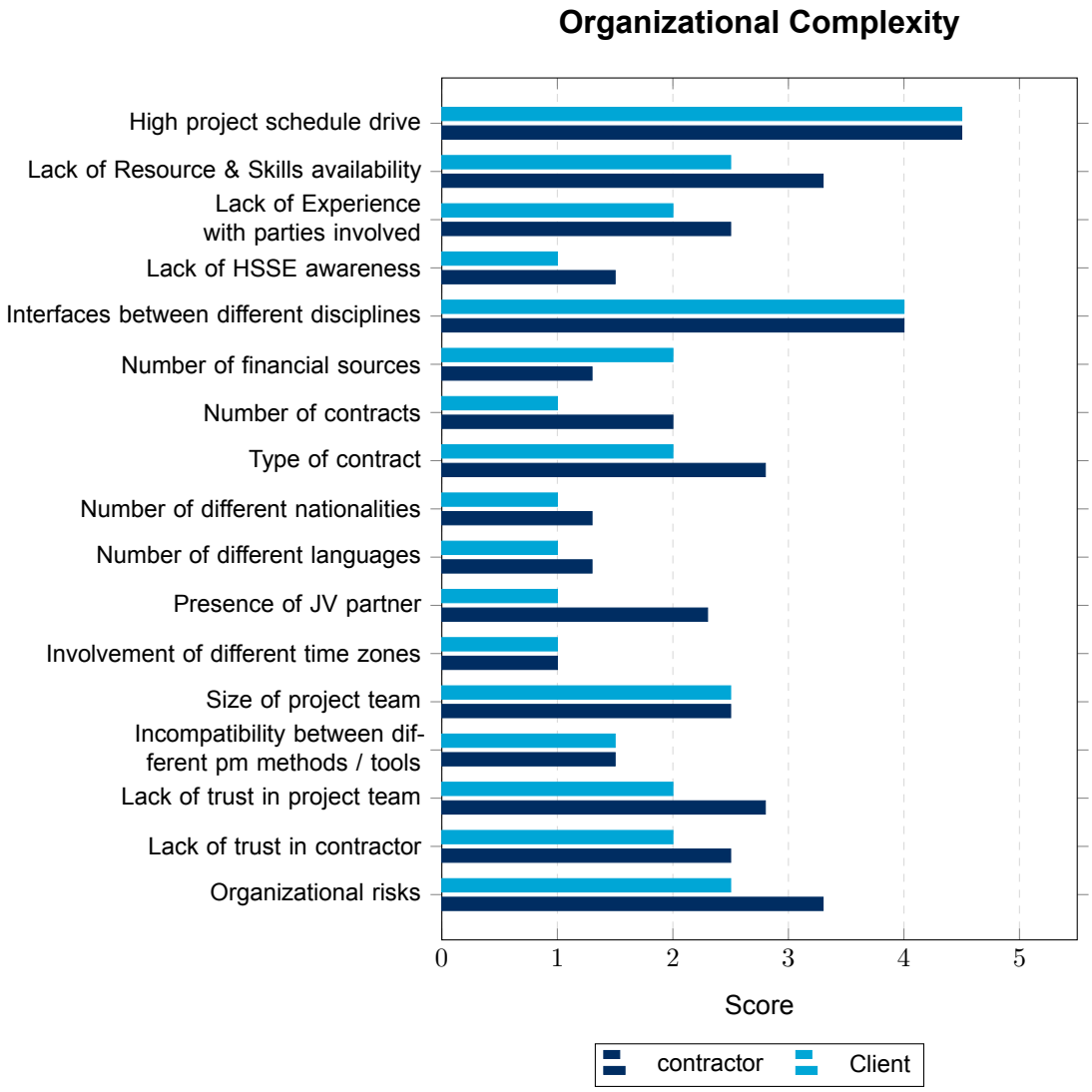


Figure 5.5: Organizational complexity: Contractor vs. Client

Largest Perception Gaps The most striking discrepancy concerns *Presence of JV partner*, where the contractor assigns a score of approximately 2.3 compared to only 1.0 by the client. Possibly because the client barely operates directly with the JV partner.

Beyond this, the following very small but perception gaps were identified:

- **Lack of Resource & Skills availability:** client scores 2.5 vs. contractor 3.3, a gap of 0.8 points. The contractor perceives resource and skills constraints more acutely.
- **Organizational risks:** client scores 2.5 vs. contractor 3.3, also a gap of 0.8 points, suggesting the contractor has a broader awareness of organizational risk exposure.

Shared Perceptions First of all, the overall shared perception is remarkable for the experienced organizational complexity of the OVT case. It gives a consistent view for the client and contractor's perspective.

- **Interfaces between different disciplines:** both score exactly 4.0, the second highest score in the entire chart and a perfect tie.
- **High project schedule drive:** both score exactly 4.5, the highest score across all factors.

Generally Low Scores across the Board Compared to the A27 Noord organizational complexity chart, scores in the OVT case are considerably lower overall. For the OVT case, factors such as Type of contract (2.0 vs. 2.8), Number of contracts (1.0 vs. 2.0), and Number of financial sources (2.0 vs. 1.3) all score well below the A27 equivalents. Especially type of contract has a huge difference while it is discussed as one of the most influential factors in the A27 case.

Low-Scoring Factors Both parties rate the involvement of different time zones (1.0 vs. 1.0), the number of different languages (1.0 vs. 1.3), and the number of different nationalities (1.0 vs. 1.3) as negligible. Despite the JV structure, which often introduces international partners, the project remains effectively national in character from an organizational perspective.

External Complexity OVT

Figure 5.6 summarizes the average experienced external complexity by the participants. Overall, participants from the contractor's side rate external complexity higher, on average, than participants from the client's side, with respective average external complexity scores of 3.0 and 2.7.

Overall, the external complexity is rated by all participants as the most complicating factor after technical complexity, with an average score of 2.85 on the external complexity scale. This score is significantly higher in comparison to the organizational complexity elements.

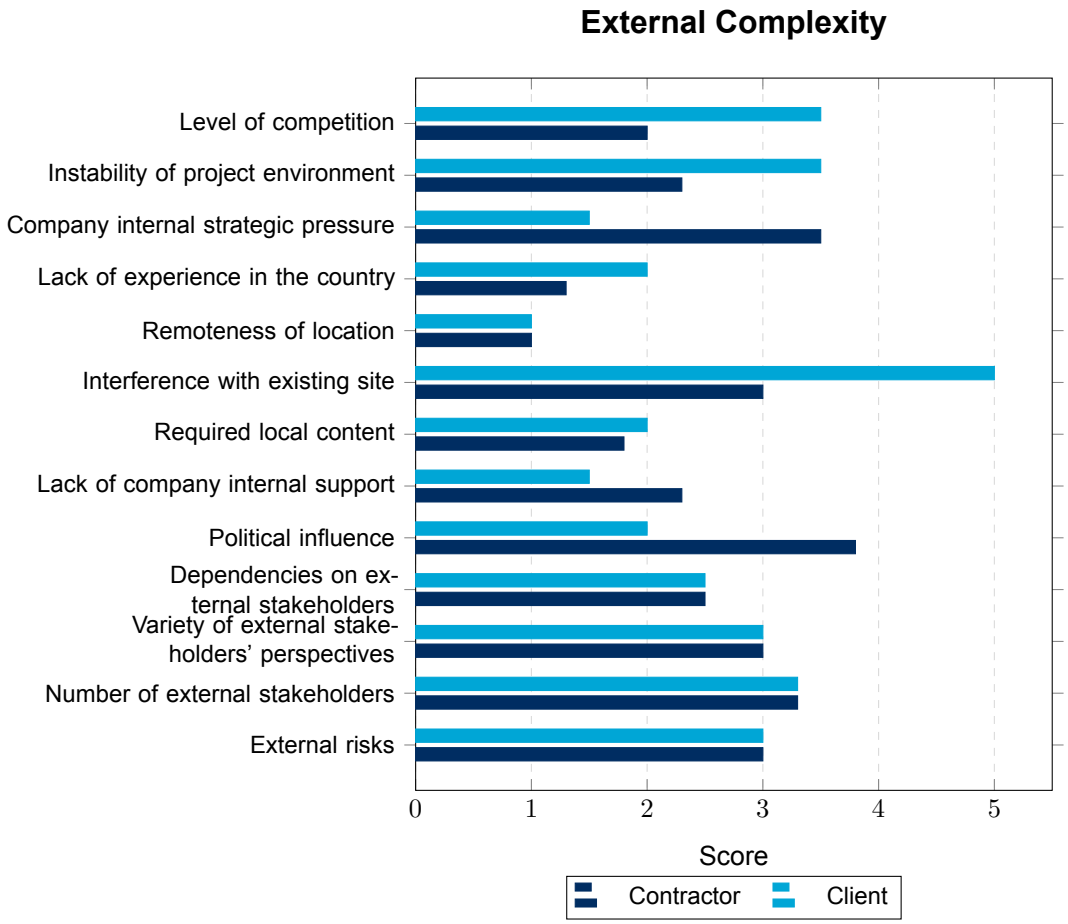


Figure 5.6: External complexity: Contractor vs. Client

Largest Perception Gaps The most striking discrepancy concerns *Interference with the existing site*, where the contractor assigns a score of approximately 3 compared to a 5.0 by the client. Which is a huge difference. Also relevant, considering OVT being a part of the Zuidasdok program.

Beyond this, the following notable gaps were identified:

- **Political influence:** contractor scores 3.8 vs. client 2.0, a gap of 1.8 points. The contractor experiences political pressure as a major external complexity driver, while the client, despite being more exposed to politics, rates it considerably lower.
- **Company internal strategic pressure:** contractor scores 3.5 vs. client 1.5, a gap of 2.0 points.
- **Level of competition:** client scores 3.5 vs. contractor 2.0, a gap of 1.5 points where the client scores higher. Interesting fact: since the tender has already been won, the lack of competition could be an issue. Also, with subcontractors could be an explanation.
- **Instability of project environment:** a gap of 1.2 points, again with the client scoring higher, possibly reflecting broader program-level concerns about the unstable urban environment.

Shared Perceptions Both parties align closely on External risks (3.0 vs. 3.0), Variety of external stakeholders' perspectives (3.0 vs. 3.0), and Remoteness of location (1.0 vs. 1.0).

Low-Scoring Factors Both parties rate Remoteness of location (1.0 vs. 1.0) and Lack of experience in the country (2.0 vs. 1.3) as negligible. Given that the Zuidasdok is located in central Amsterdam and involves experienced Dutch parties, these scores can be easily explained.

5.4.3. Processes that Shaped Phase I Duration

In the section above, the TOE ratings are described as the results of the survey rating exercise that produced the figures above. The next section will describe the processes identified by discussing the individual TOE frameworks with each participant.

Table 5.5 presents the factors most frequently identified across participants, which serve as the primary reference points for the discussions, since the highest-rated factors are discussed with each participant. The same nuances used to demarcate the discussion of TOE elements for the A27 case apply to this case as well.

Most Frequently Identified Complexity Factors

The respondents in Case B identified 83 instances of complexity (scores above 4)in the first phase of the two-stage contract. This corresponds to 8 distinctfactors mentioned by more than half of the respondents, accounting for one-quarter of the total factors considered. In total, 32 different elements were identified, representing roughly half of all elements included in the TOE framework. Table 5.5 presents an overview of these elements and their frequency of occurrence.

Table 5.5: Frequentie van complexiteitsfactoren (n=6 respondenten) (OVT2)

Factor	n	Factor	n
Dependencies between tasks	6	Non-alignment of project goals	2
High project schedule drive	6	Political influence	2
Project duration	6	Presence of JV partner	2
Involvement of different technical disciplines	5	Technical risks	2
Size in CAPEX	5	Type of contract	2
High variety of tasks	4	Instability of project environment	1
Interfaces between different disciplines	4	Lack of company internal support	1
Interference with existing site	4	Lack of trust in contractor	1
High number of tasks	3	Lack of trust in project team	1
Number of external stakeholders	3	Number of contracts	1
Strict quality requirements	3	Number of locations	1
Uncertainties in scope	3	Organizational risks	1
Company internal strategic pressure	2	Uncertainty in methods	1
Dependencies on external stakeholders	2	Variety of external stakeholders' perspectives	1
External risks	2		
High number of project goals	2		
Lack of Resource & Skills availability	2		
Level of competition	2		

The factors mentioned by all six respondents were *Dependencies between tasks*, *High project schedule drive*, and *Project duration*. Five respondents pointed to *Involvement of different technical disciplines* and *Size in CAPEX* as relevant complexity drivers. Four respondents indicated *High variety of tasks*, *Interfaces between different disciplines*, and *Interference with existing site*.

In total, 8 out of 32 identified factors were mentioned by more than half of the respondents, suggesting these are the most widely shared perceived sources of complexity within the project.

An Inherited Design: The Elaborative Nature of Phase I and Joint Commissioning

The absence of a traditional design-development phase, in which the contractor would progress from concept design to preliminary design and then to detailed design, had a significant impact on the first

phase. Instead, the client had already provided the detailed design, a result of the earlier, discontinued collaboration with the ZuidPlus consortium, during which the detailed design had already been prepared. The client assumed the submitted detailed design was complete and correct. During the review phase, however, the contractor discovered that this was not the case, which led to unforeseen issues Quote 9C.

Other participants (Quote 2B, Quote 5C) reached similar conclusions. Although a contractor doubting the design is not in itself strange, the purpose of the design makes it sensible, since one of the aims of the first phase was for the contractor to fully internalise the plan and adopt it as their own:

"… the contractor consortium would fully refine and adopt the construction phasing as its own … the client's 'logo' would essentially be erased" (Quote 12A).

The process turns on the pre-prepared detailed design inherited from the discontinued ZuidPlus collaboration, the client's assertion that this design is complete and correct, the clashes and missing details discovered during the review phase, and the contractor's task of refining the plan and adopting it as its own. Two characteristics are present at once: the design is a technically dense artefact whose components and interdependencies form a fixed arrangement, and its defects are not visible until the review surfaces them. On that basis both structural and dynamic complexity can be observed: the source is the structural density of the inherited artefact together with the emergent, unforeseen uncertainty that appears when its hidden clashes are discovered, a structural artefact that generates its own internal uncertainty (Brady & Davies, 2014).

Fixed Out-of-Service Periods as the Dominant Planning Constraint

As discussed in the case description, the OVT Zuidasdok is located in the heart of Amsterdam South, a highly busy area through which a large number of passengers travel every day. The technical complexity of the project made a number of out-of-service periods for train and highway traffic absolutely necessary. For ProRail, these periods must be requested years in advance. Once secured, they are set in stone and dictate the pace of the project (Quote 11A, Quote 5A). Other strict external conditions, such as the Sail event and the development of Amsterdam Central, further constrained the schedule (Quote 11B).

Initially, these fixed time slots functioned as rigid structural constraints. However, as the project progressed, an emergent situation arose: it became evident that the traditional, sequential process of fully finalizing designs and work plans before construction was practically infeasible within the given timeframe. The impending threat of missing the immovable out-of-service deadlines created a tricky situation. In theoretical terms, this is a clear manifestation of dynamic complexity: an unpredictable, emergent situation in which the project's evolving reality clashes with its fixed front-end conditions, threatening a complete deadlock (Brady & Davies, 2014).

To overcome this impasse, a significant shift in project culture and management occurred. Driven by an immense sense of urgency, the formal sequential process was abandoned. Execution commenced regardless of whether preparations were complete, as illustrated by the observation that designs were sometimes only finalized weeks after the out-of-service period had already taken place (Quote 9A). As one participant put it, at some point you simply have to start, or the deadlines will not be met (Quote 2A). This led to an environment characterized by the pragmatic maxim of putting "execution above all else" (Quote 9A) and prioritizing "technique over contract" (Quote 12B). The parties agreed to solve the technical problems in the field first and settle the contractual consequences later.

This shift can be theoretically understood as a vital transition in management logic. As Hertogh and Westerveld (2010) observe, impending failures or deadlocks create a massive sense of urgency, which acts as a window of opportunity to break through formal rigidities. The initial requirement of an accepted work plan 28 days before execution reflects a traditional, formal predict-and-control (TypeI) logic. However, when this logic proved inadequate for the emergent reality, the parties organically adopted a highly flexible, change-facilitating prepare-and-commit (TypeII) approach (Koppenjan et al., 2011). The "technique over contract" mindset functioned as a crucial relational counter-arrangement: it provided the mutual trust and adaptability needed to absorb the dynamic complexity, ensuring the critical milestones were met without rupturing the collaboration.

Multi-Client Governance and Mandate

The project is further characterised by a joint commissioning structure involving multiple clients: Rijkswaterstaat because of the highway to be placed underground, NS because of the development of the new station, and the municipality because of the project's location. Within this structure, each client must align decisions with its own governance procedures, so all parties must reach agreement on key choices, which can contribute to delays. The technical and political drivers differed substantially between the clients: while one party experienced a strong sense of urgency for a specific subproject, this urgency was entirely absent for another, which potentially slowed internal alignment (Quote 12C).

A formal coordination structure was established to align the three clients (Rijkswaterstaat, ProRail, and the municipality of Amsterdam) and to prevent the negative side-effects of internal misalignment:

"We simply set up a governance structure there that worked … there are different interests at play" (Quote 12D).

OVT 2 is embedded in the Zuidasdok programme, in which Rijkswaterstaat, ProRail, and the municipality of Amsterdam act as joint clients, and this multi-client constellation required a formal coordination structure. The interviews reveal that this structure had two concrete effects on Phase I: it lengthened decision cycles for issues touching on milestone or budget parameters, and it shaped which solutions the project organisation could realistically consider. Key decisions on milestones and on the use of programme budget were not taken at project level but at the programme board, the so-called OCHOO (Opdrachtgeversoverleg Civiel, Hoogbouw en OVT) (Quote 11C).

Rather than treating this governance layer as an external constraint to be managed reactively, the client (the Zuidasdok project organisation) developed a proactive mitigation strategy: recruiting staff who had previously worked inside the parent organisations (such as Rijkswaterstaat and ProRail). This ensured they had a feeling for the rhythm and content of the higher-level decision processes, explicitly taking on this administrative responsibility so the process would be less likely to be hindered, by recruiting people who had themselves worked inside the client organisations, the project organisation avoided being surprised by how long those processes take (Quote 11D). This proactive stance speaks directly to the information management and communication culture dimension and to matching complexity to management strategy: the multilevel clientship and the project's embedding in a broader programme made structured decision-making a key requirement, and the client took an active role in pre-empting its effects.

The process turns on the three joint clients (Rijkswaterstaat, ProRail and the municipality of Amsterdam), the programme board (OCHOO) at which milestone and budget decisions are taken, the embedding of OVT 2 within the wider Zuidasdok program. The participants realise that the project will generate dynimc complexity. How this will emerge remains uncertain. To facilitate this they create a Type II arrangement by developing a strong coalition with a clear governance structure

Alongside this, the project organisation handles the governance complexity through a deliberate counter-arrangement: recruiting staff who have themselves worked inside the client organisations, so that the rhythm of the higher-level decision processes can be anticipated rather than be a source of surprise. This relationally-informed staffing functions as a mindful, change-facilitating Type II arrangement (Koppenjan et al., 2011),

Learning Effects and Work Hypotheses: Adaptive Responses from OVT 1

OVT 2's predecessor was the OVT 1 case. The client in particular had room to run OVT 2 with the same team as OVT 1, and the contractor aimed to do so as well. The evaluation was unusually energetic and practical: normally project evaluations take place when team members have already moved on to other assignments, but here the teams knew they would carry out the same exercise for OVT 2 within six months, which made the evaluation of OVT 1 highly focused and directly relevant, in effect serving as the kick-off for OVT 2 (Quote 12E).

The team also learned a hard lesson about the timing of price agreements. In OVT 1, they tried to finalise the technical plans and the price simultaneously. One of the lessons learned consists of the time it takes to finalize a price when a design is finished. Participants noted that this takes some time. This lesson form OVT-I was taken along into OVT-II

'I think that is really a lesson learned: even if you have technically worked it out, you do not know the price the next day.' (Quote 11E)

Another key point involves the budget. During OVT 1, a massive difference between the client's initial budget and the contractor's calculations caused major friction and nearly derailed the project. By the time OVT 2 started, this "shock effect" was completely gone because both sides already knew the initial budget levels were unrealistic (Quote 4A).

For OVT 2, they also learned to explicitly reserve a dedicated block of time (six weeks) at the very end purely for financial negotiations and finalising the price. In the second round the team scheduled the final pricing in advance, reserving the last six weeks specifically for it (Quote 12E).

In a design phase without competition, contractors try to fully price all uncertainties to avoid making a loss, which turns the contractor into an 'expensive insurance company', as one participant described it. To prevent the bid from becoming unaffordable, unpredictable risks were taken out of the price through working assumptions and (partly) shifted back to the client.

"… we introduced those working assumptions … to lower the base price, and to put the risk back with the client"(Quote 11F).

The work hypotheses were essentially invented to lower the base price and to put an end to complex discussions, which has a positive effect on time as well.

Settable quantities — for example a price per kilo of reinforcement, settled afterwards — kept such items out of the upfront price (Quote 11G).

A similar logic applied to traffic-controller deployment: a budget was set with deviations carried as the contractor's risk, lowering the price while raising the risk profile (Quote 11H).

Some adaptive solutions can also create deliberate time extension in the first phase. When a problem in OVT 1 threatened to affect OVT 2, client and contractor jointly reassigned staff from the OVT 2 scoping team to develop an alternative solution. By deliberately accepting delay in one part of the process, they supported overall project progress. (Quote 5D).

The process turns on the uncertain quantities, such as the weight of reinforcement and the deployment of traffic controllers. The settable units through which they are priced (for example a price per kilogram), the post-execution settlement of the difference, the resulting reduction in the base price and the learning effect carried over from OVT1 to OVT2. This learning effect includes the deliberate continuity of the same team, a factor essential for maintaining relational quality and trust (Suprapto et al., 2015), and the dedicated six-week block reserved for final pricing. These elements concern uncertainty that unfolds over time and is settled afterwards, rather than constituting a fixed, knowable arrangement. On that basis dynamic complexity can be observed.

With respect to how these components are handled, the uncertain quantities are deliberately kept open and settled after execution through settable units. This lowers the base price and shares the associated risk between the parties. The price is formed late and the contract mechanics are kept functional rather than fixed in advance. Working hypotheses of exactly this kind are identified in the literature as mindful Type II counter-arrangements, through which relational flexibility is restored where a baseline would otherwise be dominated by rigid predict-and-control (Type I) structuring (Koppenjan et al., 2011).

t can be argued that the handling of these components follows a prepare-and-commit (Type II) approach enacted jointly, with the contractor proposing the settable structure and the client accepting the corresponding risk-sharing. This mechanism is, moreover, a direct operationalisation of the principle set out by Brady et al. (2012): under high uncertainty about eventual quantities and costs, final commitment should be deliberately delayed to a later stage rather than forced into the base price upfront. The settable quantities keep precisely those uncertain decisions open and settle them after execution, perfectly applying the two-stage approach's core temporal logic to price formation, and forming a marked contrast with Case B's out-of-service periods, where the same logic was overridden by an immovable schedule. Ultimately, the reservation of dedicated pricing time and the continuity of the team demonstrate a highly effective learning effect carried over from OVT1.

Effects on Time

The high volume of activities in the first phase, elaborating on the existing DO, were too many in the first phase, according to some.

"… a scoping period of six or seven months is far too short … you need to be building in order to understand what you are running into" (Quote 5B).

The fixed budget and time constraints of Phase 1 may have implicitly forced prioritization decisions, leaving insufficient room to fully explore the project's complexity. (Quote 12G).

Moreover, OVT 2 could only commence once OVT 1 had started. Delays in the OVT 1 case therefore had a direct impact on OVT 2. The same applied to other developments in the area, which were also affected by delays in OVT 2, primarily because the entire area was being developed as part of a broader program.

5.4.4. Summary: Key Processes in Case B

The summary of the projects described above is given in Table 5.6. The table consists of all the processes described in this section above. It is the cumulative result of the tables which are introduced after each process.

Table 5.6: Overview of processes, literature framework and management style – Case B

Process	Literature framework	Management style
Existing DO and elaborative nature	Design iteration as response to complexity; collaborative design and mutual knowledge integration in Phase I; structural versus dynamic complexity.	—
Out-of-service periods and schedule pressure	Phase I duration, time governance and perceived predictability; Go/No-Go governance and 'target date'; iterative, baseline-driven Phase I process; time management in (extreme) complex environments.	Shift from a Type I formal sequential logic (accepted work plan 28 days before execution) to a change-facilitating prepare-and-commit (Type II) approach; 'technique over contract' as relational counter-arrangement.
Multi-client governance and mandate	Information management and communication culture; matching complexity to management strategy; Go/No-Go governance and 'target date'; Phase I duration, time governance and perceived predictability.	Type I governance backbone (programme board, OCHOO) combined with a Type II counter-arrangement (recruiting client-experienced staff); control-plus-relational fit for structural complexity (P1).

Continued on next page

Table 5.6 (continued)

Process	Literature framework	Management style
Work hypotheses, risk transfer and learning effects	Risk allocation and financial exposure; price formation and timing of price fixation; contract form versus relational attitudes and incentives; relational quality, trust and team continuity.	Prepare-and-commit (Type II) enacted jointly; work hypotheses and settable quantities as mindful Type II counter-arrangement, delaying final commitment.

5.5. Cross case Analyses

Both cases are very different from each other, as already noted in the previous sections. In the upcoming sections, a comparison of characteristics, TOE frameworks, and processes that influence time management in the first phase will be made. This will support the suggestions in Chapter 6.

5.5.1. Characteristics

The projects differ substantially from one another. Although both projects applied a two-stage approach, this is largely where the practical similarities end. Even the specific type of two-stage model applied in each case differs considerably. Each project is characterized by its own objectives, level of complexity, and contextual conditions. a summary is made in Table 5.7.

First, the client organization differs significantly between the cases. The OVT project is characterized by a multi-client structure, involving Rijkswaterstaat, ProRail, and the Municipality of Amsterdam. By contrast, the A27 Noord case has a single client, namely Rijkswaterstaat. In addition, the OVT case is part of a broader programmatic context. The A27 Noord case is also part of a program, although this program is smaller in scale. At the same time, OVT Noord is connected to the wider renewal of the A27 corridor.

The nature of the two-stage approach also differs between the projects. In the OVT case, the process continued from an already existing preliminary design (DO), whereas the A27 case started from“a “blank sheet.” (Quote 6D) Furthermore, the contractual scope differs between the two cases. The A27 case applied a hybrid scope, in which part of the project fell within the two-stage approach and another part followed a more conventional contracting structure. In contrast, the OVT case applied the two-stage approach to the full project scope.

Another important difference is that the OVT 2 case had a predecessor project, which may have influenced both the process design and the perceived complexity of the project. Finally, the external environment differs strongly between the two cases. The OVT case took place in a highly complex environment, characterized by multiple parallel projects in the surrounding area, a densely populated urban setting, and the presence of many external stakeholders and influencing factors.

5.5.2. TOE-frameworks

The perceived complexity from the particpants differ quite a lot. It is important to note that the perception of course is different for each participants. In the upcoming section the differences on the percieved complexity will be disucssed whilst keeping the case characteristics in mind.

Table 5.7: Key differences between the OVT and A27 Noord cases

Aspect	OVT case	A27 Noord case
Client organization	Multi-client structure: Rijkswaterstaat, ProRail, and Municipality of Amsterdam	Single client: Rijkswaterstaat
Program context	Part of a broader program	Part of a smaller program
Starting point of the two-stage approach	Continued from an existing preliminary design (DO)	Started from a “blank sheet”
Type of two-stage approach	Full two-stage scope applied to the entire project	Hybrid scope: partly two-stage, partly conventional contracting
Project history	Had a predecessor project that may have influenced process and perceived complexity	No predecessor project mentioned
External environment	Highly complex urban environment with multiple nearby projects, dense population, and many external stakeholders	Less complex external environment compared to OVT
Contextual complexity	High due to governance structure, surroundings, and stakeholder environment	Lower relative complexity in terms of surrounding context

Table 5.8: Complexityscores: sorted by case, organisation and dimension

Dimension	Case A27 (Contractor #5)	Case A27 (Client#2)	Case A27 (Mean#7)	Case B OVT (Contractor#4)	Case B OVT (Client#2)	Case B OVT (Mean#6)
Technical	3.44	2.79	3.25	3.31	2.80	3.05
Organisational	3.02	2.58	3.00	2.00	2.00	2.00
External	2.23	1.81	2.00	3.00	2.70	2.85

Table 5.8 shows the overall complexity experienced by all participants, sorted by case and organisaiton. Overall, it is remarkable that the organisational complexity is rated higher by the A27 participants then the OVT participants. Whilst the organizational structure, having multiple clients, and being part of a large program, arguably the largest infrastructure program/project of the Netherlands. Whereas the A27 organizational structure looks, at first glance, more clearly organized.

The external complexity is rated higher on average in case B then Case A this is also in ,line with the environment in which these projects take place. In total the sum of the average complexitie are rated higher by the A27 case compared to the OVT case.

Technical Complexity

The averages are close together (3.25 for A27, 3.05 for OVT 2), yet the underlying drivers differ substantially.

In Case A, the highest scores are found for size in CAPEX (4.8 Contactor vs 3.5 Client), strict quality requirements (4.6 Contactor vs 3.0 Client), conflicting norms and standards (3.8 Contactor vs 1.5 Client), high number of tasks (4.4 Contactor vs 3.0 Client), and non-alignment of project goals (3.0 Contactor vs 1.5 Client). The pattern is consistent: the contractor perceives technical complexity more broadly and intensely than the client, with the largest perception gap found in norms and standards. This aligns with the process narrative in Case A, where the fundamental triangle discussion emerged precisely around quality versus budget.

In Case B, the highest points are different. The highest scores are size in CAPEX (4.0 Contactor vs 4.5

Client), dependencies between tasks (4.3 Contactor vs 4.5 Client), and strict quality requirements (3.5 vs 3.5) across all three, scores are equal or higher on the client side. This is noteworthy and suggests that in OVT 2, client and contractor do share a common reading of technical complexity. The largest perception gap here lies in non-alignment of project goals (3.3 Contactor vs 1.0 Client) and uncertainties in scope (a gap of 1.5 points), Possibly pointing to the shared challenge that the contractor is wrestling with an inherited DO that the client presented as finalized.

Organizational complexity

This section likely contains the most surprising comparison. Case A scores an average of 3.00, while Case B scores only 2.00. Moreover, in Case B the scores between Contactor and Client are identical (2.00 vs 2.00), indicating a shared organizational reading, whereas in Case A there is a considerable gap (3.02 vs 2.58).

In Case A, type of contract scores highest and is identified by both Contactor and Client as one of the most complicating factors. Lack of trust in contractor (4.2 vs 4.5) and lack of trust in project team are also rated highly by both parties. The high score on the trust factors is in line with the processes described in case A. The largest perception gaps are found in number of financial sources (3.4 Contactor vs 1.0 Client), number of contracts (3.0 Contactor vs 1.5 Client) and Presence of JV partner (2.8 Contactor vs 1.3 Client)

In Case B, the two highest scores are found for high project schedule drive (4.5 vs 4.5) and interfaces between different disciplines (4.0 vs 4.0). The complete alignment on these two dominant drivers is striking and connects seamlessly to the process narrative: the out-of-service windows were decisive for the project for both client and contractor alike. Type of contract scores considerably lower in Case B (2.0 vs 2.8 in Case A), suggesting that the UAV-GC two-phase structure in Case B was experienced as less of a complicating factor than the hybrid structure in Case A.

A reason for the organizational complexity being this high in the A27 project might be that almost every process discussed in the previous section can be traced back to the organizational complexity factors. Indicating that the participants have exposed the organizational problems that had an influence on the time management in the first phase, by rating the organizational factors highly.

External complexity

External complexity is the dimension on which the two cases diverge most clearly, and in the opposite direction to the organisational picture. In Case A it is the least complicating dimension (mean 2.00; 2.23 on the contractor side against 1.81 on the client side), whereas in Case B it is the second most complicating dimension after technical complexity (mean 2.85 vs3.00 against 2.70). This contrast maps almost directly onto the case characteristics: the A27 corridor is a comparatively contained urban environment, while OVT 2 sits inside the dense, multi-project Zuidasdok node in central Amsterdam, surrounded by live infrastructure, a dense population, and a large field of external parties.

In Case A, the external dimension functions largely as a quiet backdrop rather than an active driver. The only factor that both parties read as genuinely complicating is instability of the project environment (around 3.0 on the contractor side against 3.4 on the client side), which is also the highest-scoring external factor in the case for either party. This could be related to the process surrounding the personell turnover. Dependencies on external stakeholders are rated almost identically (2.5 vs 2.6), and political influence is registered by both, echoing the role it plays in the framework of Chapter 3. The largest perception gap concerns the number and variety of external stakeholders, where the contractor scores around 2.6 against only 1.0 for the client: a stakeholder field that is effectively absent from the client's reading is at least faintly present in the contractor's, plausibly reflecting the contractor's more direct exposure to those parties during the front end. The remaining external factors, remoteness of location, required local content and level of competition, sit close to the floor of the scale (around 1.0–1.4 for both parties), confirming that external forces are not perceived as primary complexity drivers in this context.

In Case B, by contrast, the external dimension becomes a genuine source of complexity, and the pattern of (dis)agreement is itself informative. The most striking single reading is interference with the existing site, which the client rates at the maximum of 5.0 against around 3.0 for the contractor, consistent with operating inside an active programme at one of the busiest station-and-motorway locations in

the country. Two further gaps run the other way and place the pressure on the contractor: political influence (around 3.8 against 2.0) and company internal strategic pressure (around 3.5 vs 1.5) are both felt more acutely by the contractor, even though the client is, in principle, more exposed to the political arena. Where the client scores higher, level of competition (around 3.5 against 2.0) and, more modestly, instability of the project environment, the explanation plausibly sits at program level: with the tender already awarded, residual competitive pressure is felt mainly through the subcontracting market, and broader concernsabout the urban environment are read from the client's wider vantage point.

Taken together, the external footprint reinforces the structural-versus-dynamic reading developed in the synthesis. In Case A external complexity is low and largely uncontested, sitting in the background while the decisive action takes place in the organisational, and predominantly dynamic, domain. In Case B external complexity is high, but much of it is fixed and exogenous, the site, the out-of-service windows, the surrounding program, and is therefore structural rather than dynamic in character. This is consistent with the way Case B's hard boundary conditions directed attention towards delivery within the assignment rather than towards renegotiating it, and with the distribution of the Case B footprint across the technical and external dimensions set out in the synthesis below.

5.5.3. Cross-Case Synthesis: Complexity, Management Approach and the TOE Footprint

Bringing the two footprints together allows the processes of both cases to be read against the framework of Chapter 3. The two cases can be described as differing in the type of complexity that predominates and in the way the building blocks of their processes are handled.

In **Case A**, the processes are observed to be predominantly dynamic in their complexity. Relatively few hard boundary conditions are present, and the components of the central processes, the interpretation of the budget, the steering of the iron triangle, the alignment of project-management methods and decision cultures, are contested and shifting over time. The handling of these components is observed to combine Type I and Type II elements that are applied to the same components by different parties without being brought into a single arrangement, and the trust factors are observed across nearly every process. The sufficient counter arrangements are not present. The footprint is concentrated in the organisational dimension.

In **Case B**, the processes are observed to be both structural and dynamic in their complexity. Hard boundary conditions, the out-of-service periods, the inherited DO and the multi-client program governance, are present, and the building blocks of the central processes are fixed and known. The handling of these building blocks is observed to combine a Type I delivery discipline with Type II adaptive and counter arrangements: "technique over contract", work hypotheses, client-experienced staff, the reserved pricing block and the OVT 1 learning effects. The footprint is distributed across the technical and environmental dimensions, and the trust factors are observed as an enabling condition.

Read against propositions P1–P3, the two cases can be described as follows: Case B, the structural complexity predominates and the components are handled through control combined with counter arrangements, in Phase-I. Case A, in which dynamic complexity predominates and the components are handled through unreconciled Type I and Type II elements, is associated with a Phase I in which trust eroded and the duration extended. These observations are consistent with the framework's expectation that, where the complexity type and the handling of its components are aligned, as in P1 and P2, Phase I duration and predictability are supported, whereas in P3 misalignment is associated with organisational tensions around key decisions which, unless actively managed, lead to a deadlock in project progress, premature convergence rather than resolution, and ultimately extension and reduced predictability.

5.6. Conclusion

This chapter addressed RQ3: *what processes have an influence on time management in the first phase of the two-phase approach?* Two in-depth case studies, A27 Houten–Hooipolder Noord (Case A) and OVT 2 Zuidasdok (Case B), supported by structured TOE complexity assessments and semi-structured interviews with thirteen participants, identified the processes that shape Phase I duration and the experience of time. The key processes are summarised in Table 5.3 for Case A and Table 5.6 for Case B,

and are read together against the alignment framework of Chapter 3 in the cross-case synthesis.

In Case A, the processes form a causal chain rooted in front-end ambiguity and relational erosion. The budget was fixed in Phase 0 on a structurally weak foundation, and its interpretation as either a hard ceiling or an indicative value was contested from the first weeks of Phase I and never explicitly resolved. This ambiguity was compounded by a misalignment between the parties' project-management methods, decision-making cultures and perceived mandates: the budget, the steering of the iron triangle and the scope were governed by the client, most of the time, under a predict-and-control (Type I) logic and by the contractor, most of the time, under a prepare-and-commit (Type II) logic, without being reconciled into a workable combination. The unmanaged misfit that proposition P3 associates with extended and less predictable duration. Personnel changes around the end of the VO phase reset relational continuity, and the cumulative effect was a decline in trust that ultimately produced negotiations at the end of Phase I, contrary to the philosophy of the approach. Although the negotiations can be seen as a measure to positively affect time management. Where a deliberate counter-arrangement was instead established, the KICKs working group, a shared horizontal forum for the dynamic interface complexity generated by the hybrid scope split, that complexity was brought back under joint control, an aligned fit consistent with P2. The Case A footprint is concentrated in the organisational dimension, and its central processes are predominantly dynamic in their complexity.

In Case B, the processes followed a different logic. Phase I began with an inherited Definitive Design that the contractor had to elaborate and adopt as its own, while fixed out-of-service periods for rail and motorway dictated a largely immovable schedule, and a multi-client governance structure required formal coordination through the OCHOO programme board. These hard boundary conditions are predominantly structural in their complexity, and they were handled through a Type I delivery discipline combined with Type II relational and adaptive devices: "technique over contract", the recruitment of client-experienced staff, working hypotheses that kept uncertain quantities open and settled them after execution, and learning effects carried over from the predecessor project. One of those learning effects was a dedicated block of time reserved at the end of Phase I purely for price formation. It kept the price negotiation from colliding with, and overrunning, the technical work, as had happened in the earlier round (OVT1) and in Case A, and so supported the predictability of the phase. Whether reserving such time is advisable as a general measure is a trade-off weighed in Chapter 6 and Chapter 7 rather than a settled good practice. The Case B footprint is distributed across the technical and external dimensions, the trust factors appear as an enabling condition rather than a recurring deficit, and the delays that did occur were more objective and technical in nature.

Read across the two cases, the contrast is consistent with the framework. Case B, in which complexity and the components were handled through control combined with relational/dynamic arrangements. Case A, in which dynamic complexity predominated and the same parameters were handled through unreconciled Type I and Type II logics, saw trust erode and the phase extend. In both cases the relational conditions, and trust in particular, were the channel through which misalignment translated into lost time. This positions trust as the intervening relational mechanism on the pathway from (mis)alignment to time outcomes, rather than as a separate cause acting alongside it.

Taken together, the processes answer RQ3 as follows. Time management in Phase I is shaped by the robustness of front-end preparation, by the explicit or implicit alignment of budget interpretation, steering possibilities and project-management methods at the start of the phase, by the quality of inter-organisational decision-making and the clarity of mandate, and by a mutual understanding of how these differ between the contractor and client organisations, by personnel continuity, and, above all, by the cumulative effect of these factors on trust. Where these processes converge constructively, Phase I retains its collaborative character. Where they diverge, it tends to collapse into adversarial dynamics at the end of the phase, with corresponding consequences for time.

6

Recommendations and Expert validation

6.1. Recommendations

A number of conclusions can be drawn from the results presented in Chapter 5. Several processes appear to exert a significant influence on trust, in particular those related to budgeting. When these processes are read through the alignment framework developed in Chapter 3, a common pattern emerges. The recurring difficulties in both cases can be understood as instances of misalignment in the sense of proposition P3: client and contractor governing the same Phase I parameter under contradictory Type I (predict-and-control) and Type II (prepare-and-commit) logics, without reconciling them into the workable combination that Koppenjan et al. (2011) call mindfulness and Hertogh and Westerveld (2010) call dynamic management. The recommendations developed below are therefore not presented as isolated remedies but as deliberate counter-arrangements (Koppenjan et al., 2011): interventions intended to restore fit between the type of complexity a process exhibits and the management approach through which it is handled, and thereby to support the duration and predictability of Phase I. Each recommendation is grounded in the same body of literature used to build that framework, and is positioned with respect to the two analytical axes (structural versus dynamic complexity; Type I versus Type II management) of figure 3.3.

6.1.1. Kick-off

The intention behind organising a shared kick-off was to create alignment and establish common goals among project partners. The findings suggest, however, that misalignment was either introduced or insufficiently resolved at this stage, which indicates that merely organising a kick-off meeting is not sufficient. Explicit attention should instead be given to sensitive topics such as budget interpretation and time constraints. These should not be avoided but actively discussed. This lays the basis for the first recommendation.

The first and most fundamental recommendation is to organise a substantive kick-off at the beginning of Phase I. Whilst a project kick-off is already common practice, a substantive kick-off should at least explicitly concentrate on the key principles that will guide the Phase I, so that the project organisation is able to rely on these principles, less discussion arises around them during Phase I, and collaboration proceeds more smoothly. In the vocabulary of Chapter 3, the substantive kick-off is a dual-logic instrument. By seeking to fix shared parameters early, it performs the front-end system development that characterises the Type I, predict-and-control logic (Koppenjan et al., 2011). By establishing principles the team can rely on, it simultaneously supplies the rules of play and roles that Koppenjan et al. (2011) identify as Type II front-end deliverables. It is, in other words, an deliberate combination of control and interaction that constitutes dynamic management (Hertogh & Westerveld, 2010).

Three topics deserve particular attention during this kick-off.

- First, the interpretation of the budget. The observation in Case A that a discussion about the nature of the indicative value emerged after only a few weeks and was never explicitly resolved illustrates that this type of ambiguity does not resolve itself naturally during Phase I. By making the interpretation explicit at the outset, while also acknowledging that budgets can be politically sensitive, parties can avoid unintentionally working from different assumptions from day one.
- Second, the steering possibilities within the iron triangle (time, cost, quality). When it is clear at the beginning of Phase I which corner of the triangle is adjustable and which is fixed, this reduces the risk that parties unknowingly adopt conflicting steering strategies. Case A showed how the absence of this clarity led to substantive discussions that remained unresolved throughout the entire first phase.
- Third, the differences in project-management methods between the client and the contractor. Both organisations operate differently, with different decision-making rhythms and different standards regarding the definitiveness of choices. By explicitly discussing these differences at the outset and jointly identifying the risks arising from them, some of the frustrations that emerged in Case A, including those concerning the pace of decision-making and the ability to contribute to design choices in a timely manner, can be prevented. This includes possible unclarity on mandate and (timely) sharing, in the projects within each participating party.

The third topic is, theoretically, the most consequential. Chapter 3 shows that where client and contractor approach the same components under contrasting management styles, the unreconciled tension does not remain latent: it surfaces around key decisions and a deadlock in project progress, and premature convergence rather than resolution (Hertogh & Westerveld, 2010; Koppenjan et al., 2011). By making these differences clear from the start and identifying the risks together, the parties try to balance the need for control with the need for flexibility early on, before these differences lead to coordination problems or damage the working relationship.

Two qualifications from the same literature should temper the design of such a kick-off, however. Bresnen (2007) warns that attempts to engineer trust and collaboration can ironically reinforce a desire for managerial control, and that prescriptive partnering which ignores the paradoxes inherent in collaborative working may deepen rather than resolve conflict. The substantive kick-off should accordingly be framed as an exercise in commercial and organisational realism rather than as a partnering ritual. Suprapto et al. (2015) add that the contract itself is necessary to reduce initial ambiguity but is not sufficient to secure an effective owner–contractor relationship, and that relational attitudes such as shared vision and open, honest communication matter more than procedures alone. The value of the kick-off thus lies less in the meeting as a procedure than in the shared understanding it potentially establishes.

Currently, the combination of misaligned project-management approaches, reduced trust, and budget-related issues appears to affect effectiveness in the first phase negatively. Reduced effectiveness, in turn, hinders effective time management, which often become a central point of tension between client and contractor Particularly when the discussion shifts toward contractual responsibilities and financial consequences, the so-called “Sword of Damocles” hanging over the project.

6.1.2. Staff

A further recommendation that addresses these differing management styles is the deliberate selection of staff with two specific types of experience.

The first type comprises staff who have previously worked within the opposing organisation: contractor employees with experience on the client side, or client employees with contractor experience. Such “translators” understand what the other party needs, and at what pace, and can therefore help to bridge differences in working methods and decision-making rhythms. Theoretically, translators operate on the organisational interface between the parties, precisely that Chapter 3 identifies as a frequent source of contested coordination, since interface management is treated as a hierarchical project-management task under the Type I logic but as a shared task under the Type II logic (Koppenjan et al., 2011). By making each party able to anticipate the other’s decision rhythm rather than be surprised by it, translators help to convert interface management into the genuinely shared task that the Type II approach envisages, and thus function as a relational counter-arrangement to contractual and procedural rigidity (Koppenjan et al., 2011). The measure also follows directly from the collaboration literature reviewed

in Chapter 3. Suprapto et al. (2015) conclude that teamworking, relational attitudes, team integration, and capabilities matter more than joint procedures and contracts, and translators are an investment in exactly that integration and capability rather than in further procedure. Case B illustrates the mechanism: the deliberate placement of people with experience inside the original client organisations (Rijkswaterstaat, ProRail, and the gemeente Amsterdam) reduced the governance pressure of a complex programme at the operational level.

The second type comprises staff “from the middle”: roles that do not belong exclusively to either party but can operate from an independent position, such as independent estimating firms and auditors. An independent estimating firm can be used during the bidding phase to validate bids against market conditions and historical data, mitigating the risk of over-pricing. An independent auditor can be appointed to keep costs transparent (open-book) and to verify contract compliance at completion, removing any non-compliant expenditure at the contractor’s expense. Read through the framework, these neutral roles are a Type I control measure directed at a hard value, cost, which Koppenjan et al. (2011) associate with the predict-and-control logic. Their more specific rationale, however, lies in the behavioural literature of Chapter 3: information asymmetry between client and contractor is the very condition under which strategic misrepresentation operates (Flyvbjerg, 2021), and a jointly recognised, neutral cost position reduces that asymmetry and so narrows the scope for the deliberate distortion of estimates. Part of the information asymmetry and mistrust that emerged in Case A around cost estimates and interpretations of the budget can thus be reduced by creating such neutral third positions (Nalewaik et al., 2015).

6.1.3. Contract

Several of the earlier recommendations help to mitigate these issues, particularly by addressing potential risks and their consequences explicitly and upfront. Contractual arrangements could in addition include measures aimed at accelerating decision-making. A further practical improvement would be to clarify, systematically, the consequences of decisions taken during the first phase: for each alternative considered, the parties should explicitly discuss the expected impact on planning and timelines, and should make the time that each party needs for its own decision-making transparent. Although this may seem self-evident, the findings indicate that the absence of such clarity has been a recurring source of delay and disagreement, especially at the start of the first phase, when the end deadline still seems far away.

This recommendation can be read as an instance of what Wynn and Eckert (2017) call coordinative iteration: a mechanism introduced specifically to manage the complexity of interactions between people and tasks, and to render the design process more effective and predictable through governance and negotiation. Mapping decision consequences is precisely such a coordinative device, applied to the near-term schedule effects of design choices. It is, in the vocabulary of the framework, a Type I control measure directed at the time parameter. Because it operates on knowable, near-term consequences rather than attempting to fix genuinely emergent uncertainty, it is a legitimate control element within an otherwise dynamically complex phase rather than a misfit. The measure also has a debiasing function: by forcing a realistic appraisal of the time and cost implications of each alternative, it works against the optimism bias and the planning fallacy that, as Flyvbjerg (2021) notes, lead planners to adopt estimates that are unrealistically close to the best case.

6.1.4. Creative solutions

Some disputes remained unresolved during the first phase in both cases. In response, both projects adopted working hypotheses to maintain progress despite these uncertainties.Their use demonstrates the capacity of the two-phase approach to manage ambiguity constructively. Working hypotheses perfectly illustrate what Koppenjan et al. (2011) identify as a Type II counter-arrangement, a device for introducing flexibility where a baseline is otherwise dominated by Type I control. They operationalise the prepare-and-commit principle of keeping options open under uncertainty. Also the establishment of the Kick workinggroup is a perfect example of this. Koppenjan et al. (2011) emphasise that a successful Type II approach must deliberately ”allow space” for participants to learn and to collaboratively solve the problems that emerge from uncertainty. By doing so creating ’room’ to pursue creative solutions such as working hypotheses.

The temporary secondment of personnel from OVT 2 to OVT 1 during periods of difficulty illustrates the same prepare-and-commit orientation: a functional flexibility, deployed to keep the work moving forward, that the Type II logic associates with commitment rather than with adherence to a fixed plan (Koppenjan et al., 2011).

Finally, the comparison between OVT 1 and OVT 2 suggests that improvement across successive projects is possible. OVT 2 already performed better, largely because of thorough evaluation of, and learning from, the earlier experience. This underlines the importance of reflection and iterative improvement, particularly in the early phases. At the level of an individual design process, Wynn and Eckert (2017) characterise this kind of learning as progressive iteration: the iteration driven by the fundamental need to create knowledge and resolve uncertainty in ill-structured problems. Extended from the single design process to the maturation of the approach across projects, the same logic implies that knowledge accumulates as parties become familiar with this way of working and with one another's processes and organisational contexts. Such continuous evaluation is, moreover, the reflective practice that the deliberate combination of control and interaction presupposes: the "mindfulness" of Koppenjan et al. (2011) and the "dynamic management" of Hertogh and Westerveld (2010) are not one-off design choices but ongoing adjustments that depend on learning. It should be acknowledged that this cross-project dimension extends somewhat beyond the within-Phase I scope of the alignment framework. The empirical reach of the claim is examined further in the expert validation that follows and in the discussion.

Table 6.1: Linking the recommendations to management approaches and complexity types

#	recommendation	Dominant logic	Complexity primarily addressed	Source anchor
1	Substantive kick-off (budget, iron triangle, PM methods)	Type I front-end control + Type II rules of play (dynamic management)	Structural (shared parameters; stakeholder and PM-method alignment)	(Bresnen, 2007; Hertogh & Westerveld, 2010; Koppenjan et al., 2011; Suprapto et al., 2015)
2	"Translators" (cross-organisational experience)	Type II (interaction; relational counter-arrangement)	Structural (organisational interface)	(Koppenjan et al., 2011; Suprapto et al., 2015)
3	Neutral roles (joint cost expert / audit / open-book)	Type I (control of the cost parameter)	Structural (information asymmetry around cost)	(Flyvbjerg, 2021; Koppenjan et al., 2011; Nalewaik et al., 2015)
4	Decision-consequence mapping	Type I (predict-and-control); coordinative iteration	Dynamic (near-term effects made more predictable)	(Flyvbjerg, 2021; Koppenjan et al., 2011; Wynn & Eckert, 2017)
5	Working hypotheses for residual ambiguity	Type II (interaction; counter-arrangement)	Dynamic (residual, emergent uncertainty)	(Brady & Davies, 2014; Brady et al., 2012; Koppenjan et al., 2011)
6	Iterative evaluation and learning	Type II (learning; reflective practice)	Dynamic and organisational (maturation across projects)	(Hertogh & Westerveld, 2010; Koppenjan et al., 2011; Wynn & Eckert, 2017)

6.2. Expert validation

The recommendations formulated in Section 6.1 were derived from within-case and cross-case analyses of two completed Phase I processes. Before they can be considered useful beyond the studied projects, it is necessary to test whether they are recognised, considered realistic, and considered relevant by professionals in the field who have not been involved in either of the cases. The same goes up for the results in Chapter 5. This section describes how this validation was carried out and what insights it produced.

6.2.1. Method

A focus group was selected as the validation method because the aim was not to collect additional individual judgements on each recommendation, but to test whether the recommendations are in line with the broader practice of Two-Phase contracting at Rijkswaterstaat. Another goal is to discuss whether

the same process are seen in other Two-phase projects.

6.2.2. Participants

The focus group consisted of two practitioners from Rijkswaterstaat: one from the Programma's, Projecten en Onderhoud directorate (, RWS PPO) and one from the Grote Projecten en Onderhoud directorate (RWS GPO). Both experts hold an overarching, portfolio-level view of Two-Phase projects within Rijkswaterstaat and were therefore in a position to compare the findings of this study against a broader set of projects than the two cases analysed in Chapter 5. They will be named at random expert A and B.

In line with the design described in Section 1.4, the participants in this focus group were deliberately selected to be independent of the research: neither was involved in Case A or Case B as a project actor, neither had acted in a supervisory role for this thesis, and neither had been interviewed in the empirical stage.

6.2.3. Findings

The discussion produced reflections on six themes: the interpretation of the TOE complexity profiles, the comparability of the two cases, the role of budget ambiguity, end-of-phase negotiation, the realism of the personnel-related recommendations, and the learning effect across Two-phase projects.

interpretation of TOE complexity profiles

A first observation concerned the inherent subjectivity of the TOE-framework. Expert A stressed that the framework, as a model, ultimately depends on the experience and position of those who fill it in. The participants in this research are people directly involved in their respective projects. an outside observer or a cost adviser working across multiple projects would, in their view, very likely arrive at a different profile, in particular for the organisational and governance dimensions.

A second observation concerns the organisational and technical complexity scores. From their portfolio-level vantage point, the experts noted that Case B is, in their views, considerably more complex than Case A: it concerns an inner-city tunnel and station project with multiple clients, multiple major external stakeholders, and rigid out-of-service constraints, whereas Case A is, in their words, in essence a motorway widening with a number of bridges. During the discussions, the possibility that the relatively high complexity score was an effect of the processes observed in these studies was endorsed.

A third observation concerned a tendency that the experts said they encounter consistently across projects: project teams tend to rate the technical complexity of their own project at the upper end of the scale. Expert B framed this informally: if you ask a hundred project managers to position themselves on a scale from zero to ten, they will almost all place themselves close to ten.

Comparability of the cases

Closely related to the previous theme, both experts independently noted that the two cases differ so significantly in their starting positions that a direct comparison is difficult. Expert A pointed out that Case B stemmed from a failed earlier tender and that the assignment of Phase I was essentially to make an inherited Definitive Design buildable. Case A, by contrast, started at the sketch-design level and offered the contractor a comparatively blank sheet. Expert B added that the governance configurations also differ substantially, with Case B having three commissioning parties and Case A having only Rijkswaterstaat as client.

They explicitly noted that the comparison itself is interesting because the starting points differ: the contrast makes visible how the structural conditions of a project shape project culture and, through it, the dynamics that Phase I produces. The observation in Section 5.4, that these fixed time slots in Case B contributed to a more task-oriented culture (i.e. execution above all culture) and stronger preservation of trust, was recognized as plausible and consistent with the experts' own observations across other projects.

A further nuance was added by Expert B regarding the staffing of the two projects. In their experience, the parent organisations had assigned more senior personnel to Case B from the outset, precisely because OVT 2 had been classified as more complex during preparation. The seniority of the team

is, in itself, a factor that influences how complexity is experienced and how it is managed in practice. This observation does not invalidate the comparison, but it is an additional explanatory factor for the contrast between the two cases that complements the structural arguments developed in Section 5.4.

Budget interpretation and front-end preparation

In Case A, Expert B immediately confirmed that the issue on indicative and ceiling value of the budget is something they heard being an issue in the case, in their words, the principal issue of that project. They described how the pre-tender estimate had been used to set an indicative value, and how the parties had subsequently realised that they had attached entirely different meanings to that term from day one. Expert B summarised the underlying problem in a way that closely mirrors the analysis of Chapter 3 and the first recommendation in Section 6.1: when the boundary conditions, conditions, and assumptions established by the client before tender are not sufficiently robust, the Two-Phase process is inevitably entered with a structural misalignment in place, regardless of how well the kick-off itself is organised.

Both experts noted that this points to a paradox at the heart of the Two-Phase Approach. The model is designed for situations in which the client cannot, by definition, specify the project in detail before involving the market. Yet the experience of Case A, and of other projects familiar to the experts, suggests that the front-end nevertheless needs to reach a certain level of robustness in order for the indicative figures it produces to be usable as a shared reference point. Expert A described this as a fundamental sectoral challenge that is not unique to Two-Phase contracting but appears in any approach that brings the contractor in early under conditions of uncertainty.

The first recommendation of Section 6.1, namely the substantive kick-off in which budget interpretation, the steering room within the iron triangle, and the differences in project management methods are made explicit, was recognised by both experts as addressing a genuine and recurring problem. They added the qualification that a kick-off, however substantive, cannot compensate for a pre-tender estimate that is itself too thin: the substantive kick-off and the robustness of the front-end need to be improved jointly, not as alternatives.

End-of-phase negotiations

The recommendation not to structurally reserve negotiation time at the end of Phase I, which is ellaborated further in Chapter 7 in response to the OVT 2 approach of reserving roughly six weeks for this purpose, resulted in an extended discussion. Expert B opened this part of the conversation by stating that several Two-Phase projects in their current portfolio are at present engaged in what they described as continuous renegotiation at the end of Phase I. The pattern observed in Case A is, in this sense, far from isolated.

The experts endorsed the recommendation's underlying reasoning. Expert B framed the issue explicitly: if a project enters negotiation at the end of Phase I, this is in itself a signal that something has gone wrong earlier in the process, because design loops, milestone moments, and successive baselines should have offered repeated opportunities to steer the project. They added that an end-of-phase negotiation tends to be conducted from a position of distrust, in line with the arguments made in section 5.3.4 which makes it more adversarial than the joint baseline conversations of the earlier phase. Expert B also used the same Dutch proverb that featured in Section 6.1, namely 'vertrouwen komt te voet en gaat te paard' (trust arrives on foot and leaves on horseback), to characterise how quickly the relational basis built up in Phase I can be undone by a poorly handled final negotiation.

At the same time, the experts qualified the recommendation. Expert B distinguished between project size classes. For projects below approximately €150 million, they argued, the information balance between client and contractor is largely restored, and the recommendation not to reserve negotiation space applies straightforwardly. For very large projects, however, the information asymmetry between client and contractor is structural: Rijkswaterstaat as client typically cannot mobilise enough people to mirror the contractor's team one-to-one, and the consultation cycles on the client side are slower than the contractor's. Under these conditions, Expert B argued that the choice made on OVT 2 to reserve negotiation time can be understood, even if they would still characterise it as building in a perverse incentive. Expert A added a related point: the governance asymmetry, where one technical manager on the client side has to receive and process information from several technical managers

on the contractor side, lengthens any end-of-phase process and is itself part of the explanation for the persistence of negotiation at the end of Phase I.

The conclusion of the experts on this point was that the recommendation is correct in principle, but that its straightforward applicability is conditional on project size and on the degree to which the information and capacity asymmetry between client and contractor can be reduced. This qualification refines the recommendation rather than rejecting it, and is further discussed in the discussion in Chapter 7.

Realism of the personnel-related recommendations

The strongest pushback from the experts concerned the recommendations on staffing: the deliberate selection of translators (staff with experience inside the opposing organisation) and the introduction of independent or neutral roles such as a jointly recognised project cost accountant.

The experts did not contest the logic of the recommendation. Expert A explicitly endorsed the idea, in Case B's case, that placing staff with prior experience in the parent client organisations helped to anticipate decision rhythms rather than be surprised by them. The challenge they raised concerns feasibility at scale. Expert B argued that Rijkswaterstaat as an organisation simply does not have, at present, the depth of in-house knowledge required to implement this recommendation broadly. In their formulation, this is also indicared by the expert as the single largest bottleneck for the broader scaling-up of Two-Phase projects.

Expert A added that the issue is not unique to the Netherlands. Across comparable countries, the combination of an ageing workforce and a long-running shift of execution knowledge to the market means that the pool from which translators and neutral cost-expertise can be drawn is structurally shrinking. The implication of this argument is not that the recommendation is wrong, but that it cannot be implemented as a stand-alone measure at the level of an individual project. It requires accompanying measures at organisational level, in particular investment in the training of internal technical staff so that they are able to engage with the contractor at the right level of substantive expertise.

Regarding the concept of an independent project cost accountant, Expert A argued that the institutional position of such an expert, whether embedded on the client side, the contractor side, or operating independently, is ultimately less important than how that expertise is mobilised in practice and how reliance on external engineering consultancies is managed over time. A reflex to procure external capacity for each new project should be avoided, as this approach risks entrenching the very dependency it seeks to resolve. It follows that introducing neutral cost expertise should be part of a broader, deliberate strategy aimed at retaining and building knowledge internally.

Learning effects across Two-Phase projects

The final theme concerned the recommendation that continuous evaluation and repetition contribute to the maturation of the Two-Phase Approach. The researcher illustrated this with the OVT 1 to OVT 2 transition and asked whether the experts observed a similar learning curve across the broader Two-Phase portfolio.

The experts gave a differentiated answer. For repeating object types, such as the renovation program for locks (sluizen), they confirmed that iterative learning is visible: lessons from one object are applied to the next, and process improvements accumulate. For the very large, comparatively unique projects in the same category as Case A and Case B, however, the learning curve is necessarily slower, because the number of completed cases is small and because each project has substantial idiosyncratic features. Expert A added a portfolio-level qualification: where two-object programs such as the A12 IJsselbruggen carry the same contractor across both objects, lessons from the first Phase I are reflected almost immediately in the second, but the realisation effects of those lessons are not yet visible because Phase II of the first object has not been completed. The empirical base for evaluating the learning effect of Two-Phase contracting in the large-project segment is, in their words, still in formation

The implication for the recommendation of iterative evaluation and learning is twofold. It is correct as a direction of travel, and consistent with what the experts observe in their own portfolio. At the same time, the time horizon over which the learning effect can be expected to materialise for the large-project category is substantially longer than the few cases considered in this study, and conclusions about the maturation of the approach should be drawn with appropriate caution.

6.3. Refined recommendations

The six recommendations of Section 6.1 were put to an independent test in the focus group described above and are restated here in their definitive form. The focus group endorsed their direction without overturning any of them. What it changed is how several should be read. Presenting the refined set after the validation makes that effect explicit, separating the recommendations that survive as formulated from those that acquire a boundary condition or need to be repositioned from the project to the organisational level.

6.3.1. Front-end of Phase I

1. A substantive kick-off, paired with a robust front-end. The validation confirmed that the kick-off addresses a genuine and recurring problem, but attached a boundary condition the original formulation left implicit: no kick-off, however substantive, can compensate for a pre-tender estimate that is itself too thin. Because the Two-Phase Approach is entered before the project can be fully specified, the front-end must still reach a level of robustness sufficient for the indicative figures to serve as a shared reference point. Where the client's boundary conditions and assumptions are not robust, Phase I begins with a structural misalignment already in place. The recommendation is therefore a paired one: the substantive kick-off and the robustness of the front-end estimate are to be improved jointly, not treated as alternatives.

6.3.2. Staffing

2. "Translators" and 3. neutral cost expertise, as part of an organisational strategy. The experts endorsed the logic of both staffing recommendations but qualified them on feasibility at scale. Rijkswaterstaat does not at present hold the depth of in-house knowledge to apply them broadly, a shortage identified as the single largest bottleneck for scaling up Two-Phase contracting, and one that is not unique to the Netherlands, since across comparable countries an ageing workforce and the long-running shift of execution knowledge to the market shrink the pool from which translators and neutral cost expertise can be drawn. For the neutral cost role, its institutional position,client side, contractor side, or independent, matters less than how the expertise is mobilised and how reliance on external consultancies is managed over time. The refinement is consequently one of level rather than of substance: as stand-alone, project-level interventions these measures are of limited reach. As elements of a longer-term organisational strategy on knowledge retention and staff development, including training internal technical staff to the level at which they can engage the contractor substantively, they are both relevant and necessary.

6.3.3. Process design within Phase I

4. Decision-consequence mapping and **5. working hypotheses for residual ambiguity** were not the subject of specific qualification in the focus group and stand as formulated in Section 6.1.

6. Iterative evaluation and learning, with a longer time horizon for large projects. The recommendation that continuous evaluation and repetition mature the Two-Phase Approach was confirmed, but differentiated by project type. For repeating object types, the experts cited the lock-renovation programme, iterative learning is visible and process improvements accumulate from one object to the next. For the large, comparatively unique projects of the kind studied here the learning curve is necessarily slower: the number of completed cases is small, each carries substantial idiosyncratic features, and where a programme carries the same contractor across objects the realisation effects are not yet visible because the first object's Phase II is incomplete. The refinement is a caveat on the time horizon rather than on the direction: for the large-project segment the empirical base is still in formation, and conclusions about the maturation of the approach should be drawn with appropriate caution.

The remaining discussion in the focus group concerned the reservation of negotiation time at the end of Phase I. Because this is treated as a conditional trade-off rather than as one of the recommendations above, its refined position, avoid reserving negotiation space wherever the information and capacity asymmetry between client and contractor can be reduced, and treat the reservation as a defensible exception only for the largest projects, is developed in the Discussion (Chapter 7).

Table 6.2: Effect of the expert validation on the recommendations

#	recommendation	Verdict	Refinement after validation
1	Substantive kick-off	Confirmed, refined	Must be paired with a robust front-end estimate; the two are not alternatives
2	“Translators”	Confirmed, repositioned	Limited reach as a project-level measure; requires an organisational knowledge-and-staffing strategy
3	Neutral cost expertise	Confirmed, repositioned	Institutional position secondary to how the expertise is mobilised; part of the same organisational strategy
4	Decision-consequence mapping	Confirmed as stated	Not specifically qualified
5	Working hypotheses	Confirmed as stated	Not specifically qualified
6	Iterative evaluation and learning	Confirmed, caveated	Slower for large unique projects; empirical base still forming

6.4. Conclusion

This chapter addressed RQ4: *what recommendations can clients and contractors use to manage time, and how do experts evaluate them?* Building on the processes identified in Chapter 5, six recommendations were formulated and then tested in a focus group with two practitioners from Rijkswaterstaat who had no prior involvement in either case. Read through the alignment framework, the recurring difficulties in both cases are instances of the misalignment of proposition P3, and the recommendations are accordingly framed not as isolated remedies but as deliberate counter-arrangements intended to restore fit between the complexity a process exhibits and the management approach through which it is handled.

The recommendations cluster around three themes. The first concerns the front-end of Phase I: a substantive kick-off that explicitly addresses budget interpretation, the steering room within the iron triangle, and the differing project-management methods of client and contractor. The second concerns staffing: the deliberate selection of “translators” with experience inside the opposing organisation, and the introduction of neutral roles such as a jointly recognised cost expert. The third concerns process design within Phase I: explicit mapping of decision consequences, the constructive use of working hypotheses to keep residual ambiguity productive, and continuous investment in iterative learning across projects.

The expert validation broadly endorsed the direction of these recommendations while qualifying several of them. The substantive kick-off was recognised as addressing a genuine and recurring problem, the indicative-versus-ceiling-value ambiguity of Case A was confirmed as a pattern seen across the portfolio, but no kick-off, however well organised, can compensate for a pre-tender estimate that is itself too thin: the substantive kick-off and the robustness of the front-end must be improved jointly, not treated as alternatives.

The personnel-related recommendations attracted the strongest pushback, though on their feasibility at scale rather than their logic, which the experts endorsed. Rijkswaterstaat does not at present hold the depth of in-house, contractor-side knowledge required to implement the measure broadly, and this shortage was identified as the single largest bottleneck for scaling up two-phase contracting. The same constraint is visible across comparable countries. These recommendations are therefore repositioned: of limited reach as stand-alone, project-level interventions, but relevant and necessary as part of a longer-term organisational strategy of knowledge retention and staff development. On iterative evaluation and learning, the experts confirmed that learning effects are visible across repeating object types but cautioned that for the large, comparatively unique projects studied here the empirical base is still in formation, so conclusions about the maturation of the approach should be drawn with appropriate caution.

The focus group’s most extended discussion concerned the reservation of negotiation time at the end of Phase I. The experts confirmed the reasoning behind the recommendation but made it conditional on project size: below approximately €150 million, where the information and capacity asymmetry between the parties is largely restored, there is little justification for reserving negotiation space. For the very largest projects, where Rijkswaterstaat cannot mirror the contractor’s team one-to-one and its

consultation cycles are slower, some dedicated negotiation time becomes difficult to avoid. The trade-off this implies, and the incentive that a reserved negotiation builds in, are developed in the Discussion (Chapter 7).

7

Discussion

This chapter reflects on the findings, methodology, and recommendations of this thesis. It is organised in four main sections. First, the findings are interpreted in light of the structural characteristics of the two-phase approach and the behavioural and relational mechanisms observed in the cases. Second, the findings are related to the literature, both to the propositions developed in Chapter 3 and to the prior studies against which the research gap was defined. Third, the methodological choices made in this research are critically reviewed, including their limitations. Fourth, the recommendations developed in Chapter 6 are discussed in terms of their boundaries and the directions they suggest for further research.

7.1. Interpretations of findings

This section interprets the findings by drawing out the mechanisms that, across the two cases, shaped how Phase I time was governed. It begins with the structural position of the parties in the two-phase approach and the incentives this position creates. It then turns to the variable that the comparison brings out most sharply, the presence or absence of deliberate counter-arrangements rather than the contract form itself, and to the role that hard boundary conditions played in containing fundamental disagreement. Building on these, trust is positioned as the relational mechanism through which (mis)alignment translated into time outcomes, after which the reserved negotiation time at the end of Phase I is examined as a trade-off between predictability and strategic incentive. The section closes by reconsidering what time overrun means in this setting.

7.1.1. Positioning the Two-phase approach

In Chapter 2, the two-stage approach was positioned in relation to broader developments within Dutch infrastructure procurement. Rijkswaterstaat developed this approach in response to the declining number of bids for high-risk projects within its portfolio. In doing so, it aimed to prevent situations in which only one bidder would respond under existing procurement approaches, thereby placing Rijkswaterstaat in a weak negotiating position. It is noteworthy, however, that an approach intended to avoid a one-to-one situation in practice also result in a one-to-one relationship during end of the first phase, when a final price needs to be agreed upon. To make a provisionally awarded second phase definitive, when the parties are in agreement with eachother. Naturally, the situation is not entirely black and white, as the first phase also serves broader objectives, such as improving predictability and enhancing collaboration.

Nevertheless, this raises an interesting point regarding the position of Rijkswaterstaat. Apparently, the only way for Rijkswaterstaat to fulfill their most complex infrastructure project is to come into this one-to-one position. On the one hand, the contractor knows that it is by far the preferred party to proceed to Phase II. As illustrated in Case B, a failed collaboration requires substantial time and financial effort from the client, as it must establish a new arrangement, develop a plan to bring another contractor from the detailed design phase to execution, initiate a new tender procedure, and implement that plan. This procedure in itself presents enough problems and concerns. On top of that, other issues may arise

in connection with, for instance something like planned out-of-service periods or the condition of the infrastructure to be replaced imposing pressure on the project. This places the contractor in a relatively strong position, as it can continue identifying and discussing potential risks while knowing that it is unlikely the client will terminate the agreement and seek a new partner.

This creates an incentive for the contractor to identify, clarify, and allocate as many risks as possible during the first phase, even if doing so requires additional time and resources, since the consequences of such risks materializing in a later phase are considerably more severe. Conversely, once the risks have been sufficiently clarified, priced, or assigned, the contractor has an incentive to move the process towards the start of Phase II, as this is the stage at which project revenues can be realized. This incentive, however, only becomes effective once the principal uncertainties have been made transparent and adequately addressed. Some risks are simply too substantial for the potential benefits of an earlier start to outweigh their possible consequences. In this line of reasoning, the client appears to have less power because of its position in a one-to-one relationship. However, the client still retains more influence than it would in a comparable one-to-one arrangement without the collaborative structure of a two-stage contract.

This reasoning is important, as some of the delays that can and do occur during the first phase of two-stage projects may be traced back to this structural position. This does not render the recommendations made in this thesis ineffective. Rather, these recommendations increase the likelihood of delivering the first phase on time, thereby reducing the possibility of deliberate delay.

7.1.2. Counter-arrangements, not contract form, as the operative variable

A lesson runs across both cases that the comparison brings out more sharply than either case alone. What made the difference to how dynamic complexity translated into time was not the contract form. Both cases used a two-phase contract, and in Case A the collaborative contract did not prevent the collapse into traditional negotiations at the end of Phase I. The operative variable was instead whether, for each pocket of dynamic complexity, a deliberate Type II counter-arrangement was put in place to hold control and interaction together.

Case A makes the point internally. For the technical interface complexity generated by the hybrid scope split, such an arrangement did emerge, the KICKs working group, a shared horizontal interface forum, and through it that complexity was brought back under joint control. For the relational and governance complexity around the budget, the mandate, and the steering of the iron triangle, no equivalent arrangement was established, and there the same kind of complexity was free to convert into mistrust and delay. Where a counter-arrangement was present, dynamic complexity was contained. Where it was absent, it possibly extended the phase. Read together with Case B, where devices such as working hypotheses and client-experienced staff accompanied a structurally complex but bounded assignment, this suggests that the practical leverage in governing Phase I time lies less in the choice of contract than in the conscious construction of counter-arrangements. Materializing the recommendations as a counter-arrangement, therefore, illustrates the potential of these recommendations.

7.1.3. The role of hard boundaries

Case B, despite involving more stakeholders more clients and therefore arguably a more complex governance structure, scored lower on organizational complexity than Case A and exhibited a more task-oriented culture. Case A, by contrast, started from a comparatively blank sheet, with a single client and a hybrid contract structure, and exhibited substantially higher organizational complexity scores and a more contested culture.

This contrast is counterintuitive at first sight, but becomes interpretable when the role of constraints is reconsidered. In Case B, the hard boundary conditions, the out-of-service windows, the inherited DO, the multi-client governance structure, left less room for fundamental discussion about the direction of the project. As a result, the project team's attention was directed towards making the assignment deliverable within these constraints, rather than towards renegotiating the assignment itself. In Case A, the relative absence of such constraints created space for fundamental disagreement, in particular on budget interpretation and on the steering possibilities within the iron triangle. Although it is logical that in a 'blank sheet' project these boundaries are absent, it should be of the utmost importance that the boundaries that do exist are clear to the involved parties. Herein lies the potential of the

recommendations, as they focus on making these boundaries clear.

7.1.4. Trust as an intervening relational mechanism

Across both cases, trust emerged as the relational mechanism through which the (mis)alignment between complexity type and management approach translated into Phase I time outcomes. Where the handling of the central parameters was contested and unreconciled (Case A), trust eroded and the misalignment surfaced as traditional negotiation and extended duration. Where the boundary conditions were fixed and the handling combined control with relational arrangements (Case B), trust was preserved and the same pressures were directed towards delivery rather than renegotiation. This positions trust as an intervening relational mechanism on the pathway it describes, in line with the relational project literature (Bresnen, 2007; Suprapto et al., 2015, 2016) and with the observation that a content-focused approach under dynamic complexity tends to erode the trust relationship (Hertogh & Westerveld, 2010).

This suggests that trust within the Two-phase Approach should not only be seen as a relational factor that can be improved through good collaboration practices, but also as a structural factor that is partly shaped by the way the contract setup interacts with the project's front-end preparation. This is an important insight for both research and practice, because it indicates that efforts to strengthen trust should not focus only on behaviour between parties, but also on the structural conditions that may undermine trust in the first place.

7.1.5. Reserved negotiation time as a time-trust trade-off

One of the lessons carried from OVT 1 into OVT 2 was to reserve a dedicated block of time at the end of Phase I purely for finalising the price. Read solely against the objective of this thesis, keeping Phase I within its available time, this is a defensible measure: it acknowledges that a technically worked-out solution does not translate into an agreed price overnight, and it prevents the price negotiation from colliding with, and overrunning, the technical work, as occurred in OVT 1 and in Case A. In that narrow sense, explicitly scheduling negotiation time can support the predictability of the phase. Paradoxically, however, it has not been included in the recommendations respecting the overarching goal of the two phase approach.

This benefit, however, carries a behavioural risk that qualifies the measure rather than simply endorsing it. A contractor that knows in advance that a negotiation will take place at the end of Phase I has an incentive to anticipate it in the way the price is constructed. If the final figure is expected to be negotiated downward, individual cost items may be estimated less sharply, or deliberately on the high side, to create room for the anticipated concession. This is the mechanism of strategic misrepresentation in the sense of Flyvbjerg (2021), a distortion of estimates produced not by optimism but by the incentives that the procedure itself creates. In the terms of the framework, scheduling a formal negotiation operates as a strict Type I control mechanism, an attempt to freeze the budget before execution, that sits in tension with the open information exchange and trust-driven Type II baselining on which the Two-phase Approach depends.

Whether the benefit or the risk dominates appears to depend on the size of the project and on the information and capacity asymmetry between the parties, as the expert validation made clear. For projects below approximately 150 million, where the information balance between client and contractor is largely restored, the perverse incentive dominates and there is little justification for reserving negotiation space. For very large projects the asymmetry is structural, the client typically cannot mirror the contractor's team one-to-one, and its consultation cycles are slower, so that some dedicated negotiation time becomes difficult to avoid in the short term, and the OVT 2 choice can be read as a pragmatic response even though it still builds in the incentive described above. Reserved negotiation time is, in other words, neither simply good nor simply bad practice: it is a trade-off between the predictability it offers and the strategic incentive it creates, and the balance shifts with the structural conditions of the project.

7.1.6. Redefinition of time overruns

One of this thesis's empirical contributions is the conceptualization of time overrun in the first phase of two-stage projects, introduced in Section 5.2. Existing literature on construction project time pressure

(e.g., Yang and Wei, 2010; Amarkhil et al., 2021) predominantly treats time overrun as calendar slippage, that is, a measurable extension of the planned schedule. The findings of this research suggest that, in the context of the Two-phase Approach, this interpretation is too narrow.

Two additional manifestations of time overrun were observed in case A. The first concerns the systematic carryover of unresolved issues across baselines. Project teams advanced to the next design stage without fully resolving outstanding disagreements, creating the impression of being on schedule while accumulating a hidden backlog. The second concerns the compression of work within nominally on-time milestones, in which deliverables such as cost estimates and risk registers were produced under increased time pressure following design delays, thereby compromising their quality and reliability.

7.2. Relation to the literature

The literature used in the theoretical frameworks of this thesis (Tables 2.1 and 3.2) is largely reflected in the results. The framework presented in Table 2.1 was intended to provide an understanding of the expected use of the two-stage approach. Several of the processes observed in the cases correspond to this expected use and, where relevant, these have been discussed in terms of why they occur.

Table 3.2 focuses on practices that are important in client–contractor relationships, as well as on behavioural biases and the management of time. When these dimensions were absent, only limitedly present, or reflected the opposite of what would theoretically be expected, they were identified and discussed accordingly. Particularly with regard to this framework, many additional dimensions could have been included and may also have been recognized in the cases. Due to the scope and limitations of this research, however, the framework was kept at its current size. This constitutes a limitation, as a broader framework might have captured additional relevant dimensions. At the same time, this framework forms the basis for the recommendations, as these are directly linked to the findings from the cases.

7.2.1. The propositions in light of the cases

Proposition P1 holds that structural complexity is expected to be associated with control-oriented (Type I) handling. Case B is broadly consistent with this expectation. Its complexity was predominantly structural, characterised by fixed out-of-service windows, an inherited Definitive Design, and a multi-client governance structure, and its central processes were intitialy governed under a strict Type I delivery discipline. To prevent this one-sidedness from becoming too rigid, this control-oriented baseline was supplemented by deliberate Type II counter-arrangements when the situation asked for it, such as the use of working hypotheses and client-experienced staff, and putting technique over contract.

Proposition P2 holds that dynamic complexity is expected to be associated with interaction-oriented (Type II) handling. The clearest instance is the KICKs working group in Case A, which emerged as a shared, horizontal interface-management forum to address the dynamic interface complexity generated by the hybrid scope split. Through this Type II interaction, cross-scope coordination was brought back under joint control. Where this kind of handling was in place, dynamic complexity was successfully absorbed and contained

Proposition P3 holds that a misalignment between complexity type and management approach, or an unreconciled handling of the same components without deliberate counter-arrangements, extends Phase I duration and reduces its predictability. Case A is broadly consistent with this expectation in the domains where no such counter-arrangements were established. The budget, the mandate, and the steering of the iron triangle were governed by the client under a predict-and-control logic (Type I) and by the contractor under a prepare-and-commit logic (Type II), without being reconciled. The result was stalled decision-making, and eventual collapse into traditional negotiation that the literature associates with an unmanaged misfit

7.2.2. The findings in relation to the research gap

The scientific relevance of this thesis was established in the introduction by reviewing studies of time management in the design and planning phases of infrastructure projects and showing that none of them addressed the open-scope, collaborative, and iterative conditions of Phase I in the Two-phase Approach. It is therefore worth returning to those studies and asking what the two cases reveal about

the mechanisms they identified.

Yang and Wei (2010) identify changing client requirements as the dominant driver of schedule overruns, but derive this from traditional settings in which the client specifies the design. Because requirements in the Two-phase Approach are functional and the scope is developed iteratively, it was an open question whether this mechanism would still operate. The case evidence does not suggest that changing client requirements have been a factor hindering time management in the two phase approach.

O'Connor and Woo (2017) attribute design-phase disruption to untimely stakeholder input and the absence of a scope freeze, problems they situate within Design–Bid–Build. The premise of the Two-phase Approach is that embedding the contractor early mitigates exactly these effects. The cases qualify this premise rather than confirm it. Case B shows that early, jointly governed coordination can keep interface complexity under control, and the KICKs working group performed a comparable function for the hybrid scope split in Case A. Yet the untimely-input problem did not disappear in Case A so much as relocate. The unreconciled coexistence of the client's predict-and-control logic and the contractor's prepare-and-commit logic expressed itself directly in the flow of information between the parties: the contractor felt that it did not receive information in time, while the client felt unable to provide its input and perspectives promptly, and each located the root of the problem with the other. The untimeliness that O'Connor and Woo (2017) ascribe to external stakeholders therefore reappears inside the client–contractor relationship itself, and it runs in both directions, a notable observation, since embedding the contractor early was precisely the mechanism intended to forestall it. Early involvement repositions the untimely-input problem, it does not dissolve it.

Amarkhil et al. (2021) identify slow decision-making and poor communication as critical threats to time management. However, they describe these mainly as general organisational problems and do not relate them to the way parties collaborate. The cases in this study show that, in the context of Phase I, these issues can be explained more specifically. In Case A, the slow and disputed decision-making was not simply a matter of general inefficiency. Instead, it reflected a deeper mismatch between two different ways of working: a control-oriented logic (Type I) and an interaction-oriented logic (Type II). This tension was made worse by limited decision-making authority and declining trust between the parties. In this way, what earlier literature describes as a general risk is explained more precisely in the framework of Chapter 3 as a specific form of misalignment between parties.

Finally, the behavioural studies, optimism bias (Son & Rojas, 2011) and the systematic underestimation of cost through strategic misrepresentation and the EGAP principle (Flyvbjerg et al., 2002), were reviewed without reference to collaborative procurement. The cases indicate that these biases continue to operate in Phase I and are, if anything, given new room by the structure of the approach. Maintaining an optimistic baseline while deferring unresolved issues across approval gates is a direct expression of the optimism bias. The delayed moment of price formation, created a new possility in which strategic positioning over the budget could develop.

Taken together, the cases suggest that the delay mechanisms identified in the traditional and behavioural literature are largely relevant to Phase I of the Two-phase Approach, but that they operate through channels specific to its collaborative and iterative structure. The contribution of this thesis is therefore not to overturn the prior literature but to specify how its mechanisms are transformed by the two-phase setting: client-induced uncertainty shifts from changing requirements to ambiguous front-end parameters. The scope-freeze problem becomes a deferred-freeze problem. Generic slow decision-making is specified as Type I/Type II misalignment and the behavioural biases persist and find new room in the delayed formation of the price.

7.3. Methodological reflection and limitations

The method chosen in this thesis is empirical, in which the structured elements of the TOE framework have been used to identify the processes occurring within the cases. These processes have subsequently been used to describe their possible effects on the TOE elements.

7.3.1. The alignment framework as an abductive outcome

A further reflection concerns the status of the alignment framework itself. The research was positioned within a pragmatic paradigm and proceeded abductively: the TOE elements and the literature of Chap-

ters 2 and 3 provided concepts that sensitised the analysis, while surprising features of the case material prompted the search for the mechanisms that actually shaped Phase I. The framework of Chapter 3 should be read in that light. It was not imposed on the cases as a fixed theory to be confirmed or rejected. Rather, the structured TOE entry made the complexity of each process discussable, the open interviews surfaced how those complexities were handled, and the recurring pattern, the same parameter governed under contradictory Type I and Type II logics, was what suggested the alignment lens in the first place.

7.3.2. TOE framework

The TOE framework has been the model in which the participants did the rating of complexity exercise. The link between complexity and time management has been made in chapter 3. Due to the small subset of respondents not that many conclusions can be drawn. in this subsection the model will be discussed as well as the gaps.

The model

The TOE framework proved to be a useful structured entry point for the interviews, providing a shared rating exercise that allowed participants from different organizations and roles to discuss complexity in a comparable way. At the same time, the focus group made the framework's limitations explicit. Expert A pointed out that the framework, as a model, ultimately depends on the experience and position of those who fill it in. The participants in this research are people directly involved in their respective projects, and an outside observer or a cost adviser working across multiple projects would, in their view, likely arrive at a different profile, in particular for the organisational and governance dimensions.

Differences in perception

Due to the relatively small subset, no firm conclusions can be drawn regarding differences in perceptions. With only two participants from the client side, even a single differing response could substantially affect the findings, meaning these differences cannot be robustly incorporated into the results. Nevertheless, the observed variation in perceptions appears to point toward underlying processes, particularly conflicting norms and standards. Respondents from the contractor side, for instance, specifically noted difficulties related to the steering discussion.

Trust in the client

As discussed in this thesis, trust is one of the most, if not the most important factor in order for collaborative practices to succeed. At least, trust is a substantial factor with respect to organizational complexity. The TOE framework addresses trust through two elements, trust in the contractor and trust in the project team. Although it could be argued that a client is part of the project team, at least in collaborative projects, trust in the client could be included in the TOE-Framework. As the absence of it could be an effect of the processes described in this thesis.

7.3.3. Cases

The cases were chosen in this studies were chosen, with respect to the following requirements.

- Involve a Two-phase contract within the Dutch infrastructure context.
- Have a clearly defined and completed (or sufficiently advanced) Phase 1.
- Exhibit indications of planning challenges or delays in Phase 1.
- Provide access to relevant stakeholders and, where possible, project documentation.

Especially the first and last requirements had a significant influence. The first is relatively straightforward, as only a limited number of projects have been delivered by Rijkswaterstaat using the two-stage approach. The last requirement is also highly influential, since Mobilis, which served as the main point of entry for data collection, is involved in only a small number of these projects.

The project characteristics are particularly interesting, as the cases differ substantially, both in terms of their characteristics and in terms of perceived project complexity. It should be noted that the complexity participants perceived may be traced to the project characteristics discussed in Chapter 5. At the same time, it may also be related to the timing of the studies. In Case A, the finalization of the first phase was still ongoing at the time the TOE frameworks were completed, and the interviews were conducted. In

Case B, by contrast, the project was already nearing the completion of the second phase. This timing difference may have influenced the perceived complexity of the projects.

Participant selection

The participants in these cases were selected based on both their expertise and practical considerations. Participants from the client side had to be approached with the support of the project directors. Gaining their attention for this thesis required time and relational effort, mainly due to their full agendas. Within the timeframe of this thesis, the decision was therefore made to begin by approaching relevant participants from the contractor side. Because of the very high willingness to participate, with all but one invitee agreeing to take part, many interview slots were quickly filled. As a result, less room remained within the available timeframe to include a similar number of participants from the client side. Although it was decided to include at least two participants from the client's side. The imbalance between the parties is discussed further in Section 7.1.1

7.4. Recommendations

The recommendations presented in Table 6.2 are directed at both the client and the contractor. Both parties could take the lead in organizing a substantive kick-off (1), although it would be more logical for the client to take primary responsibility for this recommendation. Hiring staff with experience from the other party is a relevant suggestion for both parties (2). Likewise, both the client and the contractor could take the lead in appointing neutral roles (3). By contrast securing learning loops across projects, are recommendations that should primarily be taken up by the client.

Recommendations 1, 2, 3 and 4 are measures that both the contractor and the client could incorporate to foster a smoother first-phase process. For the contractor, these suggestions could, if further elaborated, become part of its tender strategy. This is particularly relevant because it would not be surprising if clients were to incorporate the ability to avoid exceeding lead times in the first phase into their EMVI criteria in future two-phase projects.

As discussed in this discussion the role of trust between the parties is of vital essence to collaborate effectively in the first phase of the two-phase approach. The recommendations also aim to highlight this. While the substantive kick-off can be seen as a starting point for open and honest communication, mutual respect, and a no-blame culture, which has been described as vital in client-contractor collaboration by (Suprapto et al., 2015).

7.4.1. Boundaries of the recommendations

At the same time, the focus group also clarified the boundaries of the generalizability of these recommendations. Some suggestions, particularly those concerning staffing strategies, such as the use of translators and the introduction of neutral roles, were considered logically sound but constrained in their direct applicability. With regard to neutral roles, the preference was to develop this knowledge in-house rather than to bring in external actors. This argument is valid. At the same time, under current conditions, introducing external neutral actors could initially reinforce existing distrust if they were positioned between the parties. Nevertheless, Rijkswaterstaat could consider involving such actors in future projects to strengthen trust and mutual understanding, particularly while the two-stage approach is still in an early stage of development.

The suggestion to avoid the structural reservation of negotiation time at the end of Phase I was similarly qualified. While endorsed in principle, its applicability was considered more limited in very large projects, where structural information asymmetry between client and contractor may make some form of dedicated price negotiation time difficult to avoid in the short term. From the perspective of Rijkswaterstaat, this information asymmetry stems in part from limitations in expertise in the form of financial capacity. A similar qualification was made regarding the recommendation to hire people with experience on the opposite side, in the case of Rijkswaterstaat, from the contractor side. The experts pointed out that Rijkswaterstaat currently lacks the financial resources to do so. These arguments are valid. However, from the perspective of improving the two-stage approach with regard to time management, as pursued in this thesis, these remain relevant recommendations.

8

Conclusion

This research investigated the main research question: *how can clients and contractors govern time in the first phase of the two-phase approach?* The question was addressed through four sub-questions, each answered in a dedicated chapter. This concluding chapter restates and answers each sub-question in turn, before drawing them together, with the qualifications developed in the discussion, into an integrated answer to the main research question.

8.1. RQ1: What is the intended goal of the two-phase approach?

This question was answered through the literature study in Chapter 2. The two-phase approach was developed in response to the limitations of both traditional Design–Bid–Build and integrated contract forms in complex infrastructure projects. In Design–Bid–Build, contractor input is introduced too late, leading to design changes, delays and additional costs during execution. Integrated contract forms partially address this by involving the contractor earlier, but they introduce problems of their own, including premature pricing, unclear task allocation, information-management issues and an excessive transfer of risk to the contractor, a transfer that itself contributed to a decline in bids for such contracts.

The intended goal of the two-phase approach is to bring market knowledge into the project earlier and more systematically, so that risks and opportunities can be jointly developed during Phase I, the design becomes more feasible, and Phase II can begin with a more realistic, market-based price. In addition, the approach aims to reduce transaction costs, thereby improving both project predictability and the financial robustness of the sector. In short, the two-phase approach is intended to make complex projects more manageable, more predictable and better priced by jointly developing design, risk assessment and pricing before execution begins.

8.2. RQ2: What factors influence time management in infrastructure projects?

This question was answered in Chapter 3, which drew the literature on complexity, collaboration, time management and behavioural bias into an alignment framework. Time management in infrastructure projects is not a purely technical planning task. It is shaped by the types of complexities a project presents and by the fit between the complexity and the way it is managed. Structural complexity, the fixed and knowable arrangement of components and interfaces, lends itself to a predict-and-control (Type I) approach, whereas dynamic complexity, the emergent and changing relations among components over time, calls for a prepare-and-commit (Type II) approach. Because large infrastructure projects inevitably present both types of complexity, successfully managing the project as a whole requires a deliberate combination of the two.

The framework expresses this as three propositions: control (Type I) fits structural complexity (P1), interaction (Type II) fits dynamic complexity (P2) and a misalignment between the two, in particular the same parameter governed under unreconciled Type I and Type II logics, is expected to extend Phase I

and reduce its predictability (P3). Around this core, three further factors bear on Phase I time: the relational quality of the client–contractor collaboration, and trust above all, which weighs more heavily than contract form alone. The scope and design-iteration choices that structure how time is used and the behavioural biases, optimism bias, the planning fallacy, anchoring and strategic misrepresentation, that distort the realism of early estimates. Together these factors explain why Phase I is prone to structural underestimation and why time management cannot be reduced to schedules and deadlines.

8.3. RQ3: What processes have an influence on time management in the first phase of the two-phase approach?

This question was answered through the multiple case study in Chapter 5, covering the A27 Houten–Hooipolder Noord (Case A) and OVT 2 Zuidasdok (Case B), supported by structured TOE complexity assessments and semi-structured interviews with thirteen participants.

In Case A, the identified processes reveal a causal chain rooted in front-end ambiguity and relational erosion. The budget was set in Phase 0 on a structurally weak foundation, and its interpretation as either a hard ceiling or an indicative value was contested from the first weeks of Phase I and never explicitly resolved. The misalignment between the client's and the contractor's project management methods, decision-making cultures, and perceived mandates, or at least the lack of clarity regarding the other party's mandate. Also the way the budget should be governed, the steering of the iron triangle and the scope under unreconciled Type I and Type II logics, the misfit that proposition P3 associates with extension and reduced predictability. Personnel changes hampered relational continuity, and the cumulative effect was a decline in trust that ultimately produced traditional negotiations at the end of Phase I, contrary to the philosophy of the approach. Only where a deliberate counter-arrangement was established, the KICKs working group for the dynamic interface complexity of the hybrid scope split, was that complexity brought back under joint control.

In Case B, the processes followed a fundamentally different logic. Phase I began with an inherited Definitive Design that the contractor had to elaborate and adopt as its own, while fixed out-of-service periods for rail and motorway dictated a largely immovable schedule. The multi-client governance structure required formal coordination through the OCHOO programme board. Yet these hard, predominantly structural constraints, combined with a Type I delivery discipline and Type II relational devices, working hypotheses, client-experienced staff and deliberate learning effects carried over from the predecessor project, produced a task-oriented project culture in which trust was largely preserved, as also reflected in the TOE ratings. The delays that did occur were therefore more objective and technical in nature.

Taken together, the processes answer RQ3 as follows. Time management in Phase I is shaped by the robustness of front-end preparation, by the explicit or implicit alignment of budget interpretation, steering possibilities and project-management methods at the start of the phase, by the quality of inter-organisational decision-making and the clarity of mandate, by a mutual understanding of how these differ between the contractor and client organisations, by personnel continuity and, above all, by the cumulative effect of these factors on trust. Where these processes converge constructively, Phase I retains its collaborative character, where they diverge, it tends to collapse into adversarial dynamics at the end of the phase, with corresponding consequences for time.

8.4. RQ4: What suggestions can clients and contractors use to manage time?

This question was answered in Chapter 6, where six suggestions were formulated on the basis of the cross-case analysis and subsequently tested in a focus group with two practitioners from Rijkswaterstaat who had no prior involvement in either case.

The suggestions cluster around three themes. The first concerns the front-end of Phase I: a substantive kick-off that explicitly addresses budget interpretation, the steering room within the iron triangle, and the differing project-management methods of client and contractor. The second concerns staffing: the deliberate selection of "translators" with experience inside the opposing organisation, and the introduction of neutral roles such as a jointly recognised cost expert. The third concerns process design

within Phase I: explicit mapping of decision consequences, the constructive use of working hypotheses to keep residual ambiguity productive, and continuous investment in iterative learning across projects.

The expert validation broadly endorsed the direction of these suggestions while qualifying several of them. The substantive kick-off was recognised as addressing a genuine and recurring problem, but the experts emphasised that no kick-off can compensate for a pre-tender estimate that is itself insufficiently robust: the substantive kick-off and the robustness of the front-end need to be improved jointly.

On end-of-phase negotiation, the validation refined the suggestion into an explicit trade-off. Reserving a dedicated block for price formation can support predictability, by keeping the price negotiation from overrunning the technical work, but it also creates a behavioural incentive for the contractor to build room for concession into the price. Which consideration dominates depends on project size and on the information and capacity asymmetry between the parties: below approximately €150 million the perverse incentive dominates and there is little justification for reserving negotiation space, whereas for the very largest projects, where the asymmetry is structural, some dedicated negotiation time is difficult to avoid and the OVT 2 choice can be read as a pragmatic response. The personnel-related suggestions encountered the most substantive pushback: the experts did not contest the underlying logic, but argued that Rijkswaterstaat currently lacks personnel with contractor-side experience, and positioned this shortage as the single largest bottleneck for scaling up two-phase contracting.

These suggestions can therefore only be effective as part of a longer-term organisational strategy aimed at knowledge retention and staff development. On iterative evaluation, learning effects are visible across repeating object types, but for the large, comparatively unique projects studied here the empirical base is still in formation and conclusions about the maturation of the approach should be drawn with appropriate caution.

8.5. Answer to the main research question

How can clients and contractors govern time in the first phase of the two-phase approach?

The two-phase approach is designed to make complex projects more predictable by introducing the contractor early and developing design, risk and price jointly (RQ1). Yet time management in infrastructure projects is shaped by complexity, collaboration, management approach and behavioural bias (RQ2), and in Phase I these factors crystallise into a small number of decisive processes: the robustness of front-end preparation, the alignment of budget interpretation and steering possibilities, the compatibility of project-management methods, the quality of inter-organisational decision-making, personnel continuity, and the cumulative effect of all of these on trust (RQ3).

Clients and contractors can therefore govern time in Phase I by acting deliberately on these processes. The six suggestions formulated and validated in this research (RQ4) translate this insight into practice: by organising a substantive kick-off, paired with a sufficiently robust front-end, that resolves the ambiguities which would otherwise erode trust, by selecting personnel that bridges the two organisations and introducing neutral expertise where information asymmetry is structural. By making decision consequences and decision-making time explicit, by treating reserved end-of-phase negotiation time as a conditional trade-off rather than a default to be sought, by using working hypotheses and other creative solutions to keep ambiguity productive rather than blocking and by investing continuously in trust and in iterative learning across projects. The deeper lesson that the cross-case comparison brings out is that the practical leverage lies less in the choice of contract(form),but in the process-by-process construction of counter-arrangements that hold control and interaction together where dynamic complexity arises.

The discussion in Chapter 7 qualified this answer in several ways. First, the two-phase approach structurally ends in a one-to-one relationship between client and contractor at the Go/No-Go moment, which gives the contractor an inherent positional strength. The recommendations cannot eliminate this structural feature, but they do increse likelihood that Phase I is delivered on time, since it produces solutions that mitigate processes that do hinder timemanagement. Second, time pressure in Phase I should not be understood only as a measurable extension of the schedule. The cases revealed two additional manifestations: the systematic carry-over of unresolved issues across baselines, which creates a hidden backlog while the project appears on schedule, and the compression of work within nominally on-time

milestones. Third, trust within the two-phase approach should not be treated only as a relational quality between people but also as a structural condition, partly shaped by how the contract setup interacts with the front-end. Efforts to strengthen it must therefore address both behaviour between parties and the structural conditions that may undermine it in the first place, and trust is best read as the intervening relational mechanism through which misalignment translates into lost time.

The counterintuitive contrast between the two cases reinforces this conclusion. Case B, despite involving more clients and a more complex governance structure, scored lower on organisational complexity and exhibited a more task-oriented culture than Case A, because its hard boundary conditions, the out-of-service windows, the inherited Definitive Design and the multi-client governance structure, directed attention towards delivering within the assignment rather than towards renegotiating it. Case A, starting from a comparatively blank sheet, lacked such constraints and saw fundamental disagreements emerge around budget interpretation and the steering of the iron triangle. Governing time in Phase I is, in that sense, also a matter of ensuring that the boundaries that do exist are made unambiguously clear to all parties from the outset.

Finally, the focus group confirmed that the processes identified in the two studied cases are not isolated to these projects but are recognised across the broader portfolio of two-phase projects within Rijkswaterstaat. End-of-phase renegotiation, in particular, was described as a pattern currently observable in several ongoing projects, which suggests that the processes the suggestions address are inherent to the two-phase approach itself rather than to the circumstances of an individual project. The substantive kick-off, the explicit clarification of steering possibilities within the iron triangle, and the deliberate attention to differences in project-management methods are therefore likely to be relevant for the wider two-phase portfolio, and not only for the two cases studied here.

8.6. Suggestions for future research

This study relied on a relatively small number of participants per case, which limited the analysis to descriptive patterns. Future research could apply the TOE framework across a larger portfolio of Two-Phase projects within Rijkswaterstaat, while ensuring a more balanced number of client- and contractor-side respondents for each case. A larger sample would also enable statistical testing of which complexity factors influence time performance in Two-Phase approaches.

This thesis has focused on the processes that were revealed through guidance from the TOE framework. For some of the projects, it is argued that they have a dynamic root. In future research, the development of dynamic complexity could be captured with the TOE framework by applying it multiple times during the first phase. This will provide interesting insights and the possibility to link the changing TOE ratings with the processes emerging in the cases, over time.

Another suggestion for future research lies outside the infrastructure sector. Other sectors could have used comparable approaches (i.e., with deferred pricing), such as the Two-Phase approach, and could have learned valuable lessons for time governance. For instance, in the ongoing renovation of the Binnenhof in The Hague. The project was not procured through a competitive two-phase tender, no public tender was held, for securityreasons (Den Haag Centraal, 2025), yet it rests on the same logic of deferred price formation that defines Phase I of the two-phase approach. The contractors were engaged early, to develop the design together with the architects and technical advisers (Rijksvastgoedbedrijf, 2020), and the price was not fixed as a lump sum at the outset. Instead, the Central Government Real Estate Agency (Rijksvastgoedbedrijf) agreed target prices with the contractors and external experts and is settling the eventual cost through an open-book, cost-plus arrangement, under which the contractors report their incurred costs and a revised forecast of the final sum each quarter (Den Haag Centraal, 2025). The commercially confidential character of these continuing price negotiations has itself drawn parliamentary scrutiny (Algemene Rekenkamer, 2025).

The Binnenhof therefore offers a rare, high-complexity setting in which deferred price formation is applied to a monumental, structurally uncertain building rather than to a civil-engineering work, and one marked by a decade-long timeline, repeated schedule revisions and substantial cost escalation. This makes it an instructive case for the temporal questions raised in this thesis. Future research could examine: how target prices are revised as latent conditions surface, how the open-book mechanism shapes the pace of decision-making and finally how time is governed during the price-formation stage

of such cost-plus arrangements, and if it these lessons are applicable to the two stage approach.

The final suggestion concerns the involved parties. In both the investigated cases RWS was included as a client. As well as Mobilis being included as a contractor. It could be interesting to asses how big of an influence their contribution is by performing a comparable studies with different participating parties. It would be interesting to asses whether the same processes emerge.

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A

AI Statement

During the preparation of this thesis, I made use of generative AI tools, specifically Claude (Anthropic), Grammarly, Perplexity and Notebook LM to support my work. These tools were used in the following ways:

- Writing and rewriting: to improve the clarity, flow, and readability of passages I had drafted myself.
- Spelling and grammar: to check my text for linguistic errors and to refine phrasing.
- Translation: to help convert text between languages and to verify nuances in terminology.
- Formatting: to make tables and figures and general formatting in Latex Overleaf

All AI-generated suggestions were critically evaluated, edited, and verified by me. The AI tools did not generate the substantive content, arguments or analysis of this thesis; these are entirely my own work. I take full responsibility for the final content of this thesis, including any errors that may remain.

B

Appendix B

Plan Overview

A Data Management Plan created using DMPonline

Title: A Research into Phase I of the Two Phased Approach in Dutch Infrastructure Projects

Creator: Steven de Vries

Principal Investigator: Steven de Vries

Data Manager: Steven de Vries

Project Administrator: Steven de Vries

Affiliation: Delft University of Technology

Template: TU Delft Data Management Plan template (2025)

Project abstract:

This project will focus on the First Phase of the Two Phased approach in Dutch infrastructure projects. The Two-Phased Approach is a collaboration form used for the most complex infrastructure projects found in Dutch infrastructure. The first phase of the two-phased approach is presumed to be unpredictable. The first phase often takes longer then accounted for at the beginning of the project. During the first phase clients and contractors work out a design, together which then is executed in second phase by the contractor. This project aims to gain insights into how phase 1 planning is constructed and why certain deadlines are chosen. What factors contribute to exceeding the first phase? And how can these be mitigated?

ID: 196233

Start date: 26-01-2026

End date: 22-06-2026

Last modified: 10-02-2026

A Research into Phase I of the Two Phased Approach in Dutch Infrastructure Projects

0. Administrative questions

1. Provide the name of the data management support staff consulted during the preparation of this plan and the date of consultation. Please also mention if you consulted any other support staff.

Xinyan Fan, Data Steward at the Faculty of Civil Engineering and Geosciences, has reviewed this DMP on 09-2-2026.

2. Is TU Delft the lead institution for this project?

- Yes, leading the collaboration – please provide details of the type of collaboration and the involved parties below

In this project, TU Delft is leading the research design and developing the research hardware. Mobilis TBI is sharing commercial data on the performance of current tools and the proprietary schematics described in the table in question 3. A UNL agreement has been signed by TU Delft and Mobilis TBI.

I. Data/code description and collection or re-use

3. Provide a general description of the types of data/code you will be working with, including any re-used data/code.

Type of data/code	**File format(s)**	**How will data/code be collected/generated?** *For re-used data/code: what are the sources and terms of use?*	**Purpose of processing**	**Storage location**	**Who will have access to the data/code?**
Project specific documents	Plannings, notes, project decisions	Through Mobilis files	Getting insights into project desicions, plannings, altered plannings	Mobilis database	Mobilis personel, myself
Anonymized Project Specific documents	Plannings, notes, project decisions	Through Mobilis files	Discussing insights of project desicions, plannings, altered plannings	(personal) Onedrive TU Delft	Myself, TU Supervisors

1 = Survey/questionaire	Excel	Approach people through cases (A12 Ijsselbruggen, A27 Noord and OVT Terminal zuid) Software(Qualtrics)	As a starting point for the interviews (questionairre)	(personal) Onedrive TU Delft	Myself
1. Informed consent -> Opening statement	Excel	Qualtircs	To gain informed consent	(personal) Onedrive TU Delft	Myself
1. Opinions on cases (PIRD)	Excel	Qualtrics	As a starting point for the interviews (questionairre)	(personal) Onedrive TU Delft	Myself
1. PID questionairre	Excel	Qualtrics	As a starting point for the interviews (questionairre)	(personal) Onedrive TU Delft	Myself
2. Interviews	Word files	Approach people through cases (A12 Ijsselbruggen, A27 Noord and OVT Terminal zuid)	Getting insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself
2. Informed consent	Word	Written	To gain informed consent	(personal) Onedrive TU Delft	Myself
2. Transcript	Word files	Teams Transcript function, Hand work or Copilot (Net id logged on)	Getting insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself
2. Recording Teams	mp4	Teams	Getting insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself
2. Anonymized Transcript/recordings	Word Files	Hand work or Copilot (Net id logged on)	Discussing insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself, (TU) Supervisors
3. Expert panel	Word files	Approach people through network, network (TU) supervisors	Testing outcomes with field experts	Onedrive TU Delft	Myself
3. Informed consent	Word	Written	To gain informed consent	(personal) Onedrive TU Delft	Myself

3. Transcript	Word files	Teams Transcript function, Hand work or Copilot (Net id logged on)	Getting insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself
3. Recording Teams	mp4	Teams	Getting insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself
3. Anonymized Transcript/recordings	Word Files	Hand work or Copilot (Net id logged on)	Discussing insights into project desicions, plannings, altered plannings and processes in several organizations	(personal) Onedrive TU Delft	Myself, (TU) Supervisors

II. Storage and backup during the research process

4. How much data/code storage will you require during the project lifetime?

- < 250 GB

5. Where will the data/code be stored and backed-up during the project lifetime? (Select all that apply.)

- Another storage system – please explain below, including provided security measures
- TU Delft OneDrive

Mobilis data will also be available. Not all data will be availble for publishing or sharing with the TU. A workaround has already been discussed with mobilis as they described that confidentiallity will in no way hinder my thesis. In rare situations certain specific points may need to be altered from hard numbers to percentages

III. Data/code documentation

6. What documentation will accompany data/code? (Select all that apply.)

- Data – Codebook describing the contents, structure, layout, and variable definitions of the data
- Data – Methodology of data collection

IV. Legal and ethical requirements, code of conducts

7. Does your research involve human subjects or third-party datasets collected from human participants?

If you are working with a human subject(s), you will need to obtain the HREC approval for your research project.

- Yes – please provide details in the additional information box below

I intend to apply for ethical approval from the Human Research Ethics Committee, but have not yet done so.

8. Will you work with personal data? (This is information about an identified or identifiable natural person, either for research or project administration purposes.)

- Yes

9. Will you work with any other types of confidential or classified data or code as listed below? (Select all that apply and provide additional details below.)

If you are not sure which option to select, ask your Faculty Data Steward for advice.

- Yes, confidential data received from commercial, or other external partners

Mobilis data will also be available. Not all data will be availble for publishing or sharing with the TU. A workaround has already been discussed with mobilis as they described that confidentiallity will in no way hinder my thesis. In rare situations certain specific points may need to be altered from hard numbers to percentages

10. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your Faculty Contract Manager when answering this question.

The intellectual property rights are framed by a graduation agreement between Delft University of

Technology, myself and Mobilis TBI.

11. Which personal data or data from human participants do you work with? (Select all that apply.)

- Job title and/or employer
- Telephone number, email addresses and/or other addresses as contact details for administrative purposes
- Video materials
- Proof of consent (such as signed consent materials which contain name and signature)
- Audio recordings
- Names as contact details for administrative purposes

Names, email addresses or Microsoft Teams contact information and data collected in informed consent forms will be stored. When the interviews will be done with Microsoft Teams, a video and audio recording of the interview will be stored as well. After the interviews have been transcribed and the interviewee has no comments, the (video and audio) recording will be deleted. Other personal data can be deleted after the research has finished. I will retain the signed informed consent forms securely for as long as the associated personal data is kept.

12. Please list the categories of data subjects and their geographical location.

Interview participants work or have worked for either RWS or Mobilis(or another contractor) on the respective cases
Expert panel members work or have worked for a big client or a big contractor in the Netherlands

13. Will you be receiving personal data from or transferring personal data to third parties (groups of individuals or organisations)?

- No

16. What are the legal grounds for personal data processing?

- Informed consent

17. Please describe the informed consent procedure you will follow below.

The researcher will inform the potential participants about the goals and procedures of the research project. The researcher will also inform them about the personal data that are being processed and for what purpose. This information will be provided to the potential participants as follows: for the questionarre/suvey as an opening statement. For the interviews through the written consent form. All

participants will be asked for their consent for taking part in the study and for data processing by signing a physical informed consent form before the start of the interview.

18. Where will you store the physical/digital signed consent forms or other types of proof of consent (such as recording of verbal consent)?

The proof of consent (digital copy of signed document) will be preserved on the TU Delft onedrive

19. Does the processing of the personal data result in a high risk to the data subjects? (Select all that apply.)

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a Data Protection Impact Assessment (DPIA). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data in your research project.

If any category applies, please provide additional information in the box below. Likewise, if you collect other type of potentially sensitive data, or if you have any additional comments, include these in the box below.

If one or more options listed below apply, your project might need a DPIA. Please get in touch with the Privacy team (privacy-tud@tudelft.nl) to get advice as to whether DPIA is necessary.

- None of the above apply

23. What will happen with the personal data used in the research after the end of the research project?

- Anonymised or aggregated data will be shared with others
- Personal data will be shared with others – please explain below which personal (pseudonymised) data will be shared, with whom, for what purpose, how and whether you have specified this in the informed consent form

Data will be shared through publication in the Repository.

24. For how long will personal research data (including pseudonymised data) be stored?

- Personal data will be deleted at the end of the research project

25. How will your study participants be asked for their consent for data sharing?

- In the informed consent form: participants are informed that their personal data will be anonymised and that the anonymised dataset is shared publicly

V. Data sharing and long term preservation

27. Apart from personal data mentioned in question 23, will any other data be publicly shared?

Please provide a list of data/code you are going to share under 'Additional Information'.

- Other – please explain below

The most likely scenario is that all data may be used. Data retrieved from the company will probably be selected in such a way that it can be published without violating confidentiality.

29. How will you share research data/code, including those mentioned in question 23?

Select all that apply and provide additional details below.

- I am a Bachelor's/Master's student at TU Delft and I will share the data/code in the body and/or appendices of my thesis/report in the TU Delft Repository

30. How much of your data/code will be shared in a research data repository?

- Not applicable - No data/code will be shared in a repository

31. When will the data/code be shared?

- As soon as corresponding results (papers, theses, reports) are published

32. Under what licence(s) will the data/code be released?

- Other – please explain below

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VI. Data management responsibilities and resources

33. If you leave TU Delft (or are unavailable), who is going to be responsible for the data/code resulting from this project?

My supervisor [Ad Straub, Assosciate professor, Architecture], with email address

- [redacted]

34. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

No extra budget needed

35. Which faculty do you belong to?

- Faculty of Civil Engineering and Geosciences (CEG)

C

Interview Quotations

This appendix reproduces, every interview fragment referenced mostly in Chapter 5 and partially in Chapter 6. Fragments are grouped by participant and labelled per participant: Quote 1A, 1B, … for Participant 1, Quote 2A, 2B, … for Participant 2, and so on. Every fragment is cited at the corresponding point in the running text. Participant numbers are randomised and do not correspond to any table elsewhere in this thesis. All remarks were made on an individual basis and not on behalf of their organisation.

Participant 1

Quote 1A “To get ourselves through the gate, we all had to pull out every trick in the book, but of course that still didn’t get resolved in the next phase either. So in that phase, you ended up with another list of things you were carrying over into the next phase, all the way to the end of the detailed design. Then you’re in trouble, because, well, then you have to solve it.”

Quote 1B ”Many questions, many answers in a short period of time... because the design process ran late. But the submission date usually doesn’t change. So we overran everywhere, and only the calculation [team] gets less, less, less, less, and less time.

Quote 1C ”I still haven’t figured out why they have those low estimates. They estimate, but they don’t estimate the right way. [...] Furthermore, they always calculate as if the sun is shining. The sun is always shining. You need time, but they assume the environmental factors won’t cause any delays.”

Quote 1D ”We priced the critical integral choices upfront. In a normal project, you would run into these issues while engineering and have to solve them during the execution phase. [...] By doing it this way, we prevented a situation where the entire team would come to a standstill later on. Then you are talking about tens of millions in delays.”

Quote 1E ”Ultimately, resolving change requests, KICKS (integral choices), and requirement adjustments... those are real time sinks.”

Participant 2

Quote 2A “At some point, you just have to start — otherwise you won’t meet the out-of-service deadlines.”

Quote 2B ”The design had actually already been completed by ZuidPlus... because the project had initially been tendered, and the plug was pulled right at the detailed design (DO) stage. [...] The client devised the total package, and you have to try to understand it exactly the way the client wrote it down. But some things you touch turns out to be incorrect or needs to be done differently. That creates an immense complexity to figure it all out.”

Participant 3

Quote 3A “Bear in mind that those budgets are always set too low because they require a certain level of political will and public support. Yes. So you start with a budget that is insufficient for the task at hand.”

Quote 3B “You can’t deliver the highest quality for the lowest price—and do it in the shortest time. That just doesn’t work. So, there are three aspects of service: fast, good, or cheap. You can only choose two at the same time.”

Quote 3C “In that consensus culture the whole attitude is that everyone must at least give his or her approval, or at least not raise any objections. But everyone is also still allowed to come back on everything at any time.”

Quote 3D “The delegation of authority is way too high up the hierarchy, isn’t it? [...] The amounts that, so to speak, the client’s colleagues are allowed to approve are very low.”

Quote 3E “On such a large infrastructure project, when you’re not yet familiar with the work—even if you’re highly experienced and know what you’re talking about—it takes at least three to four months. And during those three to four months, you are not yet optimally effective in your role.”

Quote 3F “trust comes on foot and leaves on horseback”

Participant 4

Quote 4A “That was already less of a problem in OVT 2... percentage-wise, probably about the same increase, I think. But yes, the shock effect had worn off. It was already clear that the price level just wasn’t right.”

Participant 5

Quote 5A “There was enormous time pressure on coming to an agreement with each other... Due to the fact that the schedule was set in stone, right? So when the train went out of service, when the highway went out of use, that was all already fixed.”

Quote 5B “If you really want to price a job properly, then a scoping period of six or seven months is far too short... You need to be building in order to understand what you are running into.”

Quote 5C ”A detailed design had been made. However, the designers often only looked at the final situation and not at the intermediate stages. Because you are dealing with a highly complex construction phasing, it means that some design elements are not dictated by the final situation, but rather by the temporary construction phases. That makes it very complex.”

Quote 5D ”We had a problem in OVT 1 that needed to be solved, which would eventually impact OVT 2 in the long run. We realized we simply did not have the manpower within OVT 1 to think about it, but it had to be done; we had to develop an alternative plan. Through mutual agreement, we decided: let’s temporarily pull people—from both the client and the contractor—out of the scoping team [of OVT 2]. They will briefly focus on devising that alternative plan for OVT 1. We deliberately chose to incur some delay there to make this happen.”

Participant 6

Quote 6A “If the design of this project had been done in a traditional way, it would have taken twice as long. I actually am really proud of the result with a minimal extension of the leadtime, 10% out of the top of my head.”

Quote 6B “At the moment when a product was delivered that was almost finished, only then did they start looking at it seriously... That is a bit like shutting the stable door after the horse has bolted.”

Quote 6C “And that decision at our side is a decision. And that decision at Rijkswaterstaat is no decision. […] It is a choice that you can come back on.”

Quote 6D “a “blank sheet.””

Quote 6E ”And the first question we asked was: ’Could you show us your budget?’ And the answer was no. They said, ’Well, we have two A4 pages.’ So the indicative value was determined on just two A4 pages.”

Participant 7

Quote 7A “We actually did that with all the baselines. So the theory is about hard phase transitions, and we’ve always been dragging unresolved issues along with us. So why? To get everyone on board. Even for RWS itself, we actually drew up an action plan for each baseline. It was like, ‘OK, we know we’re not quite there yet, so we’re going to take these actions in the next phase to make amends, so to speak.’ To get us through the gate. I’d say we all had to pull out all the stops, but then, of course, you didn’t get that sorted out in the next phase either. So then, in that phase, you’d have another list of things you’d have to carry over into the next phase and carry through to the end. Then you’re in a bit of a pickle, because then, well, then you have to sort it out.”

Quote 7B “In many cases, they indeed didn’t meet that deadline. [Interviewer: And what happens with the deliverables then? They come from the design, so does the team say, ”We’re moving on to the next phase, but we still have to finish this part”? Or does that just mean everything gets postponed?]”

Quote 7C “Let’s take a look — ignore all the small details for now. On this project, we made a distinction right from the start between technical work and quantitative aspects.”

Quote 7D “And exactly what ‘indicative’ means isn’t very clearly defined. So, yes. For some, it means it’s a ceiling; for others, it means it’s indicative.”

Quote 7E “From the contractor’s side, we basically said: okay, if you want to stay within time and budget—or at least get close to what’s set out in your contract—then you’ll have to adjust the quality requirements. So that means you need to relax that part of the triangle a bit.”

Quote 7F “Well, we actually think the time and cost in your baseline are somewhat overstated. [...] So first make sure all uncertainties and risks are taken out of your schedule and budget. Only then will we look at the quality requirements. So there’s a difference in perspective there. And also a difference in interests in terms of which corner of the triangle you’re willing to adjust.”

Quote 7G “Can’t we adjust that requirement? Yes, we can, but we already told you that back then, either in the preliminary design or in the design development phase. You didn’t want that then, did you? If we do it now, it will take a lot of time.”

Quote 7H “...we always carried remaining issues with us... just to get through the gate... but then of course you don’t solve them in the next phase either.”

Quote 7I “...the items from that ‘to be agreed upon’ list ended up on the negotiation table. So you carry them with you throughout the entire process.”

Quote 7J “At some point — this also happened during the preliminary design phase — we realized: okay, it’s stalling. That trade-off between time, money, and quality. And on top of that, we also had interfaces between the different two-phase components, as well as with the regular scope.”

Quote 7K “And that also meant people were running on empty, and that a great deal of work had to be done in quite a short period of time. [...] So this was really something we kept running into at every baseline. [...] And after the design phase, we still had a whole list of things we needed to do in terms of the risk dossier, planning, budget, [...] all things we could only do properly once the design was truly in good shape, which meant all of that also came under pressure.”

Quote 7L ”During the preliminary design phase, we realized that the process was stalling on the trade-off between time, money, and quality, and the interfaces between different components. So,

'Critical Integral Choices' (KICKS) were formulated, and a separate working group was set up to identify them, find a solution, and make firm decisions to handle it efficiently."

Quote 7M "And every time we had to report: 'We don't think we will make it,' the standard counter-reaction was basically [...] 'Okay, so you don't have things in order? Then you will just have to pay for it yourself if you overrun.' And that is what we called the sword of Damocles here. What is hanging over our heads? So the moment we weren't ready again? You have to deliver an unpleasant message, and you immediately get into the discussion: 'Okay, who is to blame and who pays?'"

Participant 8

Quote 8A "As you design and carry out some initial work preparation, your project develops and you uncover new requirements or insights. As a result, those parameters changed. You typically start with a very rough estimate and gradually refine it. What we observed is that the trend actually moved upward in terms of costs."

Quote 8B "The difficult part is, of course, that we were given a set of requirements through the contract. There are basically two ways you can work with that to influence things: on the one hand, you can modify the requirements and scale them back, on the other hand, you can develop a different design for them. In the end, the design is a logical consequence of that."

Quote 8C "So the main lever in a two-phase contract is actually that, if you want to make something cheaper and faster, you should also be willing to adjust the requirements. In the process we went through, it turned out that Rijkswaterstaat struggled a lot with that and, in practice, could not really do it."

Participant 9

Quote 9A "That led to us putting execution above all else to continuously meet the milestones of the out-of-service periods."

Quote 9B "Contractually we must have an accepted work plan 28 days before the start of execution... we have also had periods where we only finalized designs two weeks after the out-of-service period itself."

Quote 9C " What is notable about this two-phase contract is that the detailed design had already been prepared by the client. The client essentially stated that the detailed design was correct and contained no errors. However, during the review phase, we found that there were in fact many clashes in the design. Not suitable for a detailed design, as we as contractors would recognize it."

Participant 10

Quote 10A

"You're starting off on the wrong foot. You're already at odds with each other on day one."

Quote 10B

"...that we let certain things go and that it was simply too late to make major changes to the design. And Rijkswaterstaat had said all of that. Then we said, never mind, because otherwise we would have to overhaul everything."

Quote 10C

"The width of that bridge, the asphalt, the lane layout — that was part of the regular scope in that contract. Not part of the concrete structure of the Hagestein bridge. The people working on the Hagestein bridge hit the ground running straight away, because they wanted to build their bridge as quickly as possible. While in reality, the width of that bridge was also dependent on what the regular scope would work out."

Quote 10D

"Tensions over the budget became so high that open cooperation came to a halt."

Participant 11

Quote 11A

"You know that for ProRail you need a long-term out-of-service period and then you have to request it two years in advance, at least put it in the agenda and then make it more detailed... put it on a specific date."

Quote 11B

"Amsterdam Central Station is another major project that also involved several large out-of-service periods. In that case, key boundary conditions were clearly defined in advance, such as major events like the 100-year anniversary of SAIL Amsterdam. These provided a clear framework within which the project had to operate."

Quote 11C

"Those decisions were taken at board level – really at programme level – by, among others, the programme director. […] We are a project organisation under a programme; at programme level there is a client meeting, the so-called OCHOO. That is where the three clients sit together."

Quote 11D

"We manage that risk by having people in our organisation who have worked inside those client organisations themselves, or who still do. […] That helps us not be surprised by the time those processes take."

Quote 11E

"I think that is really a lesson learned: even if you have technically worked it out, you do not know the price the next day."

Quote 11F

"And that's why we introduced those working assumptions... basically to also lower the price, the base price, and to put the risk back with the client."

Quote 11G

"Well, if there's going to be a lot more reinforcement, then we have a price per kilo, and if the quantity changes, we can settle that afterwards, so you don't have to include it upfront."

Quote 11H

"If the deployment of traffic controllers turns out lower than expected, then we have a budget for that. If it turns out differently, that is our risk. In that way, the price has gone down again. Of course, our risk profile has increased, but then I simply haven't spent that money upfront."

Participant 12

Quote 12A

"A key part of the review phase in the first stage was that the contractor consortium would fully refine and adopt the construction phasing as its own. In other words, the client would provide a rough plan, which in some parts was already quite detailed, and the consortium would then study it thoroughly, understand it in depth, and ultimately make it their own plan. Put differently, the client's "logo" would essentially be erased, and the plan would continue under the contractor's name."

Quote 12B

"We said here: we do technique over contract. You are going to solve it first. After that we will look at what the consequences are."

Quote 12C

"Rijkswaterstaat is strongly motivated to realize the tunnels in Amsterdam, including at this specific location. For ProRail, however, the situation differs. The southern tunnel is crucial, as it enables the expansion of the station. In contrast, the northern tunnel carries less incentive or sense of urgency for ProRail."

Quote 12D

"We simply set up a governance structure there that worked. What you see above all is that, of course, there are different interests at play, aren't there?"

Quote 12E

"So it is a unique situation in the sense that you basically do the same thing twice with the same group of people. So the evaluation of that first, exploratory phase — that is also the most enthusiastic evaluation I have ever seen... Whereas here, everyone knew: in six months, with the same people, we're going to do the exact same thing again."

Quote 12F

"In the second round, we simply allocated and scheduled time for that in advance... Well, we just need those last six weeks for the final pricing."

Quote 12G

"We set a budget [...] we're never going over it. So that means, maybe even unconsciously, you already have to make choices — where am I going to look, and for how long? [...]"

Participant 13

Quote 13A

"What RWS simply does differently from a contractor is producing a detailed estimate upfront … temporary roads and temporary bridges, that has not been worked out in detail by Rijkswaterstaat and is then included as a percentage, for example 20% on the direct costs. […] That percentage is based on comparable situations. It could just as easily have been 30 or 10, which is precisely why it is an estimate."

Quote 13B

Quote 13C

"The project team started three years ago with a two-week introduction period aimed at team building and familiarisation. Although the project scope and objectives were probably discussed during this phase, it remains unclear whether critical elements such as the contract philosophy, budget constraints and the schedule were explicitly communicated."

Quote 13D

"In particular, it never became fully clear that the budget and the schedule as set by Rijkswaterstaat were hard boundary conditions. Although these constraints (including the stated bandwidths such as Annex X) were acknowledged by the contractor, they were largely interpreted as indicative rather than binding. The prevailing assumption seemed to be that deviations (including those outside Annex X) would be manageable. This lack of alignment in how the terms were understood persisted throughout the project and suggests that, from the very start, there was a fundamental absence of a shared interpretation of key contractual conditions."

Quote 13E

"The contract asks that you make an effort at the moment it does not fit within the budget—which is literally our problem—that you work hard to figure out, together with us, what is actually possible."

Quote 13F

"As Rijkswaterstaat, we opened that 'black box' for the first time, and to be honest we were completely taken aback. Because the product costs more money and takes more time. In the end, about three-quarters of a year later, when the preliminary design was finished, we were suddenly confronted with 100 million extra."

Quote 13G

"…is that the people we are talking to […] cannot take decisions freely with us. When it comes to money and time, they constantly have to go back to their own constituencies, so to speak. The supervisory board, the executive board."

Quote 13H

"At the same time as the financial setback on the project, around the end of the preliminary design (VO) phase, the programme organisation at RWS was changed. As a result, the team at Rijkswaterstaat was also partly reshuffled and new people had to be brought up to

speed. At that point you could really notice that solving problems became more difficult."

Quote 13I "The old guard had to be there to drag the new people along and bring them up to speed. In other words, the collaboration with DGW largely came to a standstill. From that moment on, RWS was busy exclusively internally. […] RWS found that internally it had to work much harder to get things done than the time we actually had left to work together with DGW."

Quote 13J

"…then suddenly it is called negotiating… then all of a sudden we start negotiating about the price… and we end up bickering over time and money."

Quote 13K

"This is what we wanted to do with you for 2.5 years… jointly searching for optimisation… we can honestly say that this did not really work out over those 2.5 years. […] …negotiating for 6 to 8 weeks at escalation tables with directors… that does not fit the theory of the two-phase approach."

Quote 13L

"If this carries on, the project will not go ahead, seriously, because that money is simply not there. […] Not a word of a lie … I mean, I really, seriously do not have 100 million. […] I could read the disbelief in their eyes: this is just a power play, the money will come anyway."

Quote 13M

"De Groenewaarden started with a conceptual design, as had also been offered. An eight-week period had been allocated for this, in which, in substantive terms, only the main span would be worked out as the critical design choice. In practice this deviated from the contract, which in fact called for an integrated conceptual design. Because only the main span was developed further, all sorts of other critical components only came to light during the preliminary design (VO) phase."