Governance
in the Maintain & Operate phase
of Integrated Contracts

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Voorwoord

Zowel de vakgroep als het domein waarin ik afstudeerde waren me onbekend. Het is een route geweest van meer dan een jaar voordat ik in mei 2015 kwam tot een bruikbaar model voor mijn onderzoek en vraagstelling en daarna nog bijna een keer een jaar voordat omstandigheden me toestonden de scriptie af te ronden. Dat vooronderzoek en het afstudeerproces waren leerzaam. Ik wil alle mensen van de OU, de HU, thuis en zij die meewerkten aan de interviews bedanken voor de steun en het geduld.

Jaap Goedegebuur
Summary
The past decade the Dutch government has increasingly employed DBFM(O)- contracts (Design-Build-Finance-Maintain-Operate) for the realization of major public works and buildings. In a DBFM(O)-contract the government specifies the output and service level for the service or the construction, puts the project from design to operation up for tender by private parties and pays a fee during the contractual period of up to 30 years for availability of the service to the winning consortium (Ministerie van Financiën (MoF), 2014). A DBFM(O) essentially delivers a service and seeks to provide better public service against lower life cycle costs.

There are advantages as one party has control over the complete life-cycle of a project. But the number of parties involved, the duration of the contract, the risk and uncertainty, the integrated nature of the contract, the scale of the project (in excess of €25 million) and the complexity of managing it, places a DBFM(O) apart from other types of contracts and calls for appropriate means to control the process.

The 3-C Governance model
The tender phase of a DBFMO contract is dominated by a so-called Competitive Dialogue (CD). In this Competitive Dialogue shortlisted tenderers compete with each other to design a construction that best suits the output specifications of the client. The design is discussed in a series of meetings with the client, but details are disclosed to the client only, not to competitors. A model proposed for understanding the mechanisms in the Competitive Dialogue phase of the DBFMO contracting process, is the Competition, Cooperation and Coordination-model (3C or CCC-model) (Lenferink et al, 2013). Lenferink relates three governance strategies to this model: competition to the market model, cooperation to the network model, and coordination to the hierarchical model (Lenferink, 2013). The CCC-model is attractive, because a governance mix of cooperation, competition and coordination seems to adequately suit all phases of a DBFMO and holds the promise to leave room for adapting the mix according to the characteristics of the separate DBFMO stages.

The aim of this study is to research whether the CCC-governance model can be employed in a wider context than the DBFMO Design phase, viz, in the Maintain & Operate-phase (M&O) of both Building and Infrastructural projects. The research question then is: What is governance with the CCC-model in the (DBF-)M&O phase?

Methodology
Lenferink uses a constructivist approach for his research and formulates the results ex post. In this research the question is whether the findings can be corroborated in other phases and contexts and has a more positivist approach. On basis of literature, propositions will be formulated, which will be tested in a case study of Dutch DBFMO contracts. The empirical research will have an explorative nature and a qualitative methodological framework, in which the Dutch DBFMO contracts are the research domain, the individual actor at client or constructor’s side is the unit of analysis and data will be collected in semi-structured face-to-face interviews. Data will be analysed based on propositions summarized in table A and B below.

Maintenance and Operations in DBFMO-contracts
A DBFMO contract is part of the group of contracts known as Public Private Partnership. Typical for the Dutch DBFMO is that it combines private financing and public funding, whilst ownership over the construction rests with the government. This sets it apart from other front-runners in integrated contracts. Dutch DBFMO practice has a high level of professionalism, implying that that the main source for improving the process is through learning rather than looking abroad for examples.

The government will usually sign a contract with private parties organized in a consortium or a so-called, ‘Special Purpose Vehicle’ (SPV). Public parties transfer tasks and roles to the SPV, and responsibilities are drastically altered requiring new skills and new forms of cooperation in which all parties are learning.
Lenferink uses four groups of complexities for describing the CD-phase, viz Organizational issues; Technical complexity; Financial complexity; Legal complexity. Per category he defines a number of factors that impact these. Researching literature on the factors in the M&O phase, differences appear between the CD phase and the M&O phase. For easy reference they are summarized in Table A below. The factors in grey print in the last column were not confirmed by the case study.

Table A: Definitions and factors of contextual influence on the government mix

<table>
<thead>
<tr>
<th>Influence</th>
<th>Definition</th>
<th>Investigated factors CD Phase; defined ex post</th>
<th>Factors to be investigated in M&amp;O Phase; defined ex ante</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Issues</td>
<td>Issues in the organizational setting and set-up of the CD (Maintain) procedure.</td>
<td>Human resources management, time management, information management.</td>
<td>Relation management, performance management, information management.</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>Complexity can be used by technical, physical project characteristics.</td>
<td>Technical project opportunities, technical solutions discussed, role of technical experts during CD.</td>
<td>Technical performance issues and risk management, role of technical experts during M&amp;O including technical solutions discussed.</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>Complexity can be used by financial project and contract characteristics.</td>
<td>Rewards and compensation in CD, project financing, role of financial experts in the CD phase.</td>
<td>Rewards and compensation in M&amp;O, role of financial experts in M&amp;O phase.</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>Complexity can be used by procurement procedure and contract characteristics.</td>
<td>Legal roles and responsibilities, role of legal experts in the CD period.</td>
<td>Role of legal framework in trust development.</td>
</tr>
</tbody>
</table>

Governance with the 3-C model

It is expected that Public and private parties in the same contract might have a different perspective and apply different definitions of the situation resulting in different governance strategies. Combining the four complexities with the 3-C governance framework results in a hypothesis over the governance structure as summarized in Table B.

<table>
<thead>
<tr>
<th></th>
<th>Proposíons</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>public</strong></td>
<td><strong>private</strong></td>
</tr>
<tr>
<td>Organizational Issues</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>cooperation</td>
<td>cooperation/coordination/competition</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>cooperation/coordination</td>
<td>cooperation/coordination</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
</tbody>
</table>

Table B: Expected dominant governance forms per group of issues and party

Results

Nine propositions were found to be true and three appeared false. Two of these relate to complexity factors (see grey print in table A) and one to governance (technical issues are not to dominated by cooperation, but by coordination.) However, in general Cooperation is by far the preferred governance strategy in the M&O phase. Remarkably both public and private parties opt for the same governance strategy per group of complexity factors.

The 3-C model describes and explains mechanisms for both CD and M&O, but at the same time is too broad in scope for using in the M&O only. Additional complexity factors suggested by the interviewed (project context; operational availability; innovation) appear on scrutiny to be covered in the existing four groups already. Learning however is an aspect that is present everywhere and should have been included in the research. Future studies might look into learning, the relation between governance and complexity, and the mechanisms of cooperation.
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1 Marking the Borders: Governance of Maintenance in DBFM(O)

1.1 Research Interest

The past decade the Dutch government has increasingly employed DBFM(O)-contracts (Design-Build-Finance-Maintain-Operate) for the realization of major public works and buildings. In a DBFM(O)-contract the government specifies the output and service level for the service or the construction, puts the project from design to operation up for tender by private parties and pays a fee during the contractual period of up to 30 years for availability of the service to the winning consortium (Ministerie van Financiën1 (MoF), 2014).

There are a number of reasons for the government to move away from a central top-down role in preparing, financing and controlling a complex public work. Increasing complexity gave rise to cost and time overruns (Lenferink, 2013), a neo-liberal political agenda added to pressure to step away from the dominant position and to outsource roles and tasks to private parties (Heeres et al, 2012; Lenferink et al 2014). In addition, according to some, the need to outsource financing due to depleted government funds, played a part as well. (Siemiatyci, 2012)

The acronym DBFMO does not give an accurate impression of the process stages of an integrated contract. The sequential stages are shown in figure 1. Design and Finance occur simultaneously, followed by Build and Maintain and sometimes Operate. Under Operate activities like facility management and catering are grouped, these apply to buildings only.

Infrastructural projects are referred to as DBFM without the Operate (see also §2.3.3). Both will be studied in this research, if we refer to this group of infrastructural and building contracts, we will use DBFMO. In the acronym DBFMO the position of the F after D and B reflects the historical development of the contract-type rather than the sequential stages of a construction project. Another terminology issue is the distinction integral and integrated2. Strictly speaking a DBFMO is an integral contract, it covers all lifecycle phases and is integrated because it combines disciplines and skills. Most parties use the terms side by side3. We will adopt the common use of referring to DBFMO as “integrated”.

That one entity only, the consortium, is responsible for the whole life cycle of a construction has a number of advantages. There is usually a better service level because the remuneration depends on meeting the agreed performance levels; there is a faster and smoother building process due to the integration in design and build processes; life cycle costs are lower because parties take the whole life cycle into account during design and build; projects remain within budget and within planning, because the consortium bears the financial consequences if it exceeds the contractual terms (Kwak et al, 2009; Verweij, 2015; Siemiatyci, 2012; Iseki, 2012; MoF, 2010). Other DBFM(O)-advantages often mentioned are innovation as a result from the fact that design and operation are coupled (Hansen, 2011; Bemelmans 2012a) and sustainability because the party responsible for overall costs will usually prefer to minimize waste and reduce operational costs by aiming at energy efficiency in the design already (Arts, 2012; Bemelmans, 2012).

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1 Ministry of Finance (MoF)
2 Webster international dictionary 1998 edition defines integral as: “constituting a complete whole” and integrated as “ made whole by combining in systematic order or arrangement the component parts or factors”.
3 For instance in the title of a TNO-report “Integral building, a report on integrated contracts (DBFMO)”
But there are not just advantages. From initiation up to the signing of the contract the process is complex and laborious, designing a complex construction is expensive, the contract requires the input of many specialists, costs of participating in the tender are high, and long-term legal commitment adds to this complexity (van Assem, 2014). Private parties are individually unable to provide all required skills and resources, so they team up in a consortium and gather a network of affiliated parties that at some stage during the average life span of 25 years bring in their specific skills (often new skills due to the new integrated contracts) (Bemelmans, 2012) resulting in the very complex task of managing and controlling the DBFM(O)-contract. Complexity is partly due to the uncertainties of the project, as in the A-15 case where a big Dutch construction company is brought to the edge of bankruptcy after committing itself as a consortium partner to a DBFM(O) where complications during construction required investments in the project that by far exceeded the initial estimates (see enclosure 2). Time and again, complexity appears on top of the list of problems. Another recurring issue is that after the introduction of the integrated contract responsibilities of public and private parties changed, tasks previously performed by the government are now taken over by public parties and both public and private parties are learning to cope with their new roles and to deal with the new situation, but this situation is far from stabilized yet.

1.2 Complexity and Governance

The number of parties involved, the duration of the contract, the integrated nature of the contract, the scale of the project (in excess of €25 million) and the complexity of managing it, places a DBFM(O) apart from other types of contracts and calls for appropriate means to control the process.

One of the complexities is managing the unpredictabilities of a 25 year period, whereas the profitability of the consortium depends on the return of its investments after the money-spend in the build phase. The desired service levels against lowest overall life cycle costs drive the competitive and time pressed design and bidding process. These competitive decisions bear great consequences, and no party has experience yet with this phase of DBFM(O) over the full contractual period (Garsse et al, 2009).

The average life span of installations (heating systems, escalators, engines, etc) for instance is only part of the life span of a building or construction work and their performance is hard to predict over a period of 25 years, the evolution of national and EU regulations are as misty, and for instance the economic survival of the shareholding companies is as unpredictable as appears once more in the case of the A-15 where two major building companies (Strukton and Ballast-Nedam) struggle for survival due to unforeseen mishaps in a DBFM. In the maintenance phase this complexity surfaces in the relation between the client (the government) the consortium, the contractor and subcontractors and is focussed on realizing the contractually agreed performance level. It is the task of the consortium and its contractors to provide the evidence that the agreed service is delivered and in the situation of non-performance they will incur fines or cuts in the remuneration fees. It would appear that the real proof for the success of the project therefore rests in the maintain phase.

Complexity is partly due to the fact that the phases of contracting, realization and operation are distinctly different from each other in purpose, tasks, skills, duration and nature of the Public-Private interaction, making it a very complex task to get a well-functioning management & control system in place suited to each particular phase.

The purpose of the contract phase is to find the Most Economically Attractive Tender (MEAT) through a process of intense competitive interaction between the client and the teams of the contracting parties in a step by step detailing of requirements into a design by a highly qualified multidisciplinary team of technical, financial, legal and other specialists from both the client and the consortium site and might take up to a few years. The purpose of the realization or build process is to realize the construction within budget and time and lasts from contract close up to delivery of the construction for use, it is managed by the consortium and involves many specialist craftsmen and equipment. Interaction is mainly internally
focussed on planning and execution of the project. Depending on the scale of the project this might take up to several years and follows the course of a normal construction project, be it that by definition it is complex and has been completely outsourced to the consortium. The purpose of the operational phase is to provide the best public service against lowest overall costs. It is the real pay back period for the consortium through keeping the contractually agreed service available at the required level, tasks mainly have a routine nature and Public Private interaction is focussed on discussion whether or not performance complies with the contract. As only few contracts have entered this phase the attention from scholars is mainly focussed on the preceding stages.

Only recently, scientific publications around the Dutch DBFM(O) are emerging, literature is yet scarce and reflects the developing practice and the developing knowledge of the practice, and literature regarding governance during this longest DBFM(O)-phase is to date almost non-existent. This makes it an interesting challenge to investigate governance of the Maintain & Operate (M&O) phase of a DBFM(O)-contract.

In view of the overall complexity a governance approach that would help to understand and support control of this complexity in turbulent times would be welcome.

1.3 The Competition, Cooperation and Coordination-model (CCC-model)
The tender phase of a DBFM(O) contract is dominated by the Competitive Dialogue. In a dialogue with the client tenderers compete with each other to develop a design that best suits the output specifications of the client (see also §2.4).

A model proposed for understanding the mechanisms prevailing in the Competitive Dialogue phase of the DBFM(O) contracting process, is the Competition, Cooperation and Coordination-model (3C or CCC-model) (Lenferink et al, 2013). Lenferink relates three governance strategies to this model: competition to the market model, cooperation to the network model, and coordination to the hierarchical model (Lenferink, 2013). The mix of these governance strategies is context and project dependent and is likely to be influenced by project complexity, as complexity is one of the main challenges in the Competitive Dialogue phase.

![Diagram of the CCC-model](image)

**Figure 1.2 Graphical representation of relations in the CCC-model**

Central in the research by Lenferink is how external influences or complexities impact public-private interaction and how the three governance strategies of cooperation, competition and coordination can be mixed to accommodate influences and structure the interactions. In doing so Lenferink brings together themes of two fellow researchers on big infrastructural projects, Leendertse (2014) expanding on public-private interaction and Verhees (2014) on complexities. Lenferink recommends to gain insight into the possibilities to expand public–private interaction beyond procurement to construct and maintain.

1.4 Research Objective
The CCC-model is attractive, because a governance mix of cooperation, competition and coordination seems to adequately suit all phases of a DBFM(O) and holds the promise to leave room for adapting the mix according to the characteristics of the separate DBFM(O) stages.
The aim of this study is therefore to research whether the CCC-governance model can be employed in a wider context than the DBFM(O) Design phase, viz, in the Maintain & Operate-phase (M&O) of both Building and Infrastructural projects.

This thesis will provide insight in complexities in the M&O phase of a variety of DBFM(O) projects in relation to the 3-C governance strategies and their impact on public-private interaction. It will thereby contribute to the theoretical discussion around governance of DBFM(O), which is relevant for disciplines of management accounting and project management. More explicitly it will look at extending the scope of the CCC-model as put forward by Lenferink et al (2013) to include the M&O phase and different types of projects. The study is relevant for practitioners in that it might provide a better understanding of governance in a DBFM(O)-contract.

1.5 Research Questions

What determinants can be identified that influence the mix of cooperation, competition and coordination in this D-B-F-Maintain-Operate phase? In this study we would like to adopt the model by Lenferink et al to meet the characteristics of a DBFM(O) M&O phase. Focussing on DBFM(O), the scope will be extended from just DBFM (infrastructural) to a wider context to include buildings and other constructions as well, with the aim to research the governance mix and complexities in a wider context. It is assumed that complexity will have a different character in the M&O phase and that different conditions will influence the CCC governance mix in the M&O phase. Based on an exploration of the literature on the subject, we will formulate expectations about determinants of the complexities in public private interactions and the governance mix to suit this phase and finally, these determinants and their impact on the governance mix will be empirically tested in case studies. In brief: what CCC-mix captures the governance of the M&O phase of a DBFM(O)-contract best? This leads to the main research question:

*What is governance with the CCC-model in the (DBF-)M&O phase?*

To be able to answer the main question the characteristics of a DBFM(O) need to be understood. The context of DBFM(O) impacts both the maintenance and its governance. This context provides some clues to understand characteristics of the DBFM(O)-M&O phase. The scope, definitions and historical development of DBFM(O) are some of the issues that need to be known. A first question therefore is:

1) *What is DBFM(O)?*

The DBFM(O) characteristics, especially the ones pertaining to the M&O phase, and their impact on the public-private interactions will be explored before a detailed study into governance is undertaken as it is expected that these characteristics will influence the governance mix. What parties are involved, what is the nature of their interactions, what organizational structure prevails, what technical, financial and legal complexity plays a part and what according to the literature are the issues that are typical for the DBFM(O) contracting, realization and operation phases impacting the M&O phase? This sub question will focus on the context of the contract and the issues for management and control that are characteristic in the DBFM(O)-M&O phase:

2) *What are the characteristics of the (DBF-)M&O phase*

The next step requires an orientation on and understanding of the governance concept. What is governance and what actually are the constituent parts of the CCC mixed governance model, what theories is it based on, what literature is available, and how does the CCC-model relate to other governance models and practices? The third sub question will focus on this theoretical framework:
3) **What is the Cooperation-Competition-Coordination mixed governance model?**

Once these first three sub questions have been answered the results based on literature will be brought together:

4) **What is the CCC-governance model in the (DBF-)M&O phase?**

This CCC governance model combined with the theoretical insights from DBFM(O)-contracts will then be tested empirically in a qualitative research. Lenferink attributes a causal relation to complexity factors resulting in a preferred 3-C governance mix. The goal of the empirical research is to study governance through the CCC-model in the M&O phase as compared to the CD phase. The governance model by Lenferink was developed for an infrastructural context, but is supposed to be suitable in other environments as well (Lenferink, 2015). Case studies will therefore relate to building projects (Rijksgebouwondienst), infrastructural projects (Rijkswaterstaat) and rail (ProRail). Those case studies will test the robustness of the model as these projects have a different context and structure. For each case the perspectives of both client and contractor will be included, interviewees are representatives of the client (the government), the consortium, the contractor and subcontractor. Around eight interviews are planned, four from client side and four from contractor side. The results will, where appropriate, lead to recommendations. This results in the fifth and sixth question:

5) **What is governance in the M&O phase of DBFM(O) projects in Dutch building and infrastructural projects?**

6) **What conclusions can be drawn from the confrontation of the model with the material collected empirically of the (DBF-)M&O-phase?**

The structure of the research is outlined in the next paragraph.

**1.6 Structure of the thesis**

This chapter contains the research question. Next the DBFM(O) and M&O phase is described from a theoretical viewpoint. What is DBFM(O), how does it influence maintenance and what are the characteristics of DBF-M&O. The CCC-governance model is central in the third chapter. The fourth chapter will give a methodological examination of the empirical research. The final chapters will deal with the results and conclusions. The structure of this last chapter is to be determined at a later stage depending on the outcome of the study. A final chapter will look back at the research question and summarize conclusions.

*Figure 1.3 Overview of the report*
2 DBFM(O)-contracts

2.1 Introduction

“Time and cost overruns in the construction of big projects illustrate government’s difficulty in dealing with big infrastructure projects” (Lenferink et al, 2013). This chapter will explore these big DBFM(O) projects with a view to answer the first research sub question: what is DBFM(O)?

The national and international positioning of DBFM(O) is the subject of the first paragraphs. Only 20% of the budget of Ministry of Infrastructure (Stuiveling, 2013) is reserved for DBFM(O)-type contracts. This raises a number of questions like: What are the characteristics of the construction industry of which DBFM(O) is only a small part and what is the current position of DBFM(O) in the Netherlands and how does it relate to international developments, in short: how is DBFM(O) positioned in its national and international context?

A bird’s eye view of the process of a DBFM(O) project and the parties involved will be given in §2.4. The two main clients e.g. Rijkswaterstaat (RWS) and Rijksgebouwdienst (RGD) and their contractor (a consortium) will be introduced here as well.

The last paragraph of the chapter will summarize: What is DBFM(O).

2.2 Position of the Construction Industry in the Netherlands

The Dutch construction industry in 2008 held approximately 84,000 companies with a total turnover of €80 billion. More than 90% of these companies have less than 10 employees; still the other 10% of the companies generates 80% of the total turnover, indicating a strong correlation between size of the company and project scope and complexity (Laan, 2008). A further distinction can be made in constructions by differentiating them into buildings (houses and utility such as schools, hospitals or offices) and civil works (bridges, tunnels, dykes, etc). Characteristic for the output of the construction industry is the immobility and uniqueness of its objects. A variety of specialized parties is involved in the process of construction, their role is usually limited to a certain phase of the project or lifecycle (design, build, maintain) or they supply a specific competence like project management, resulting in a unique combination of companies per project. There is a specific order and timing in which these companies get involved in the project and step out again (Eccles 1981; Kadefors et al 2004; Vrijhoef 2011; Laan 2009). The coordination of material, tasks and parties is quite complex given the uniqueness and uncertainty of the project, whilst buffering of capacity or stocks is impossible. Building projects are therefore difficult to plan, organize, manage and monitor (Eccles 1981; Li 2000; Vrijhoef 2011; Laan 2009; Bankvall 2010; Guo 2013). The Latter points at some extra complexity because of risk and uncertainty due to environmental and social factors (stakeholders, press, environmentalists) and the complex interfaces between companies, systems and cultures.

Vrijhoef (2011) describes building projects in a similar fashion as “coalitions of companies” where a number of independent companies work together interdependently as if they were one organisation with the aim of realising a construction project. He states that the characteristics of a construction project viz, immobility, uniqueness and temporary organization are in itself not unique, but the combination of the

<table>
<thead>
<tr>
<th></th>
<th># companies</th>
<th>Total turnover</th>
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<tr>
<td>small</td>
<td>&gt; 75,000 (89%)</td>
<td>€17.5 billion (20%)</td>
</tr>
<tr>
<td>medium</td>
<td>&lt; 7,500 (10%)</td>
<td>€32.5 billion (42%)</td>
</tr>
<tr>
<td>large</td>
<td>&lt; 1,000 (1%)</td>
<td>&lt; 30.0 billion (38%)</td>
</tr>
</tbody>
</table>

Table 1 Construction companies 2008 (Laan, 2008)
three in construction is (figure 2.1). Bemelmans (2012) adds that normal theories and models regarding production control cannot be applied in the context of construction projects.

![Figure 2.1 Characteristics of constructions and their causal relations (Vrijhoef, 2011)](image)

On top of this complexity authors generally are quite sombre when it comes to the maturity of relations in the construction industry and link the poor performance of the sector to a culture of traditional hierarchical top down interactions. The authors emphasize the necessity of collaborative relations in view of the complexity, the strong interdependencies and the on-going specialization, but describe a traditional and cost driven reality. Fearn & Fowles (2006) go as far as classifying the sector as the least integrated of the important industrial sectors and label the relations as “adversarial and disjointed”. Arditi (2005) confirms this, repeating a research by Hinze & Tracey (1994) arriving at the same conclusions as his predecessors 10 years earlier: a traditional hierarchical structure and a big power imbalance: risks and safety issues are transferred to subcontractors, late payments with resulting cash flow problems for subcontractors are normal and subcontractors are contracted only when the main contract has been awarded. Despite this, contractors are paradoxically increasingly dependent on their suppliers, up to 90% of the turnover is spent on the purchase of materials and services (Bemelmans, 2012). In this respect it is peculiar that the relation client-contractor is researched extensively but the relation contractor-subcontractor has remained underexposed in the literature.

That troublesome relations are not an exclusive feature of traditional contracts follows from a study by Smyth & Edkins (2007). In a study concerning trust in over 300 relationships in integrated Public Private Partnership contracts (see next paragraph) they found weak, dysfunctional relationships between the parties both across the organisations and across the range of projects. The category with integrated Public Private Partnership (PPP) contracts was found to be particularly dysfunctional. (Smyth & Edkins 2007).

It would seem therefore that for the infra and building sector as a whole complexity is a characteristic feature. Building projects are always unique, site specific, and constitute a temporary organisation of specialists parties. This makes the project difficult to plan, organize, manage and monitor. Complexity is aggravated by the fact that despite the network of growing interdependencies between the various contributors relations are traditional and dysfunctionally organized in a hierarchical way.

### 2.3 Public Private Partnership (PPP)

Private Finance Initiative (PFI) started in 1992 in the UK and became a primary means to increase investment without exceeding prescribed borrowing limits imposed by the European Union. The policy later evolved into Public Private Partnerships (Smyth & Edkins, 2007). Public Private Partnership (PPP) is described as the “third way” between an entirely public and an entirely private approach. Under a Public Private Partnership the government is principal and retains ownership over the construction, but outsources responsibilities like design, build, maintain and financing to private contractors. Kappeler & Nemoz (2010) report that although the term PPP has been in use since the 1990s, there is no single European model for PPP. The multitude of definitions for PPP reported around the globe (Kwak, 2009; Duffield, 2008; Tang 2010; etc.) confirms that this third way covers many options. The European Investment Bank (2010) proposes as definition: “To be a PPP, a project must be based on a long term, risk
sharing contract between public and private parties based on a project agreement or concession contract. It must also include the bundling of design, construction, operation and/or asset maintenance, together with a major component of private finance. Payments are made over the life of the PPP contract by the public sector to the private partner and are linked to the level and quality of services actually delivered (Kappeler & Nemoz, 2010)."

Although the PPP definitions and partnership variations show a great diversity, there seems to be a shared agreement on the benefits, with the exception from unions. Benefits according to the Dutch government include: parties do what they are good at; PPP projects are more commonly completed on schedule than projects contracted out in the traditional way; the government gives companies the freedom to invest in new technologies and innovative solutions resulting in lower life cycle costs; expenditures and incomes are fixed for a long period.

2.3.1 International Positioning of DBFM(O)
Internationally in Public Private Partnerships, two main variations in integrated contracts are distinguished: DBFM(O) and BOT (Build Operate Transfer) (Verhees, 2013). BOT in fact describes a full transfer from public to private parties. A BOT is financed, built and operated by private parties who receive payment for their investments via toll or similar schemes during a contractually agreed concession period. Upon expiry of the concession period the construction is handed over to the government. A first distinguishing feature between the two systems is the Public funding in DBFM(O) and the Private funding through toll in BOT. The Commissie Private Financiering Infrastructuur (CPFf) more commonly known as the “Commissie Ruding” (2008) concluded once more that a toll-system would clash with Dutch policies. The CPFf distinguishes between financing and funding. Financing refers to the party that puts the money down for the investment, whereas funding refers to the party ultimately bearing the costs (figure 2.2).

The BOT approach seems to be the older of the two. Menheere et al (1996) claim that the revenue-producing Suez Canal, financed by European capital with Egyptian financial support, had a concession to design, construct, and operate assigned to the Egyptian ruler in 1834 already.

Apart from the private financing the other distinguishing characteristic is that the private party under a BOT has ownership over the construction whereas in the DBFM(O) situation the government retains ownership. (Verhees, 2013)

In the literature many other abbreviations are in use (BTO, BKR, BLT, BOO, DCMF, BOM, BLOT etc.), but these can be considered to be derived from the two main contract forms (de Jong et al, 2010; Menheere 1996). The BOT alternative is dominant for integrated contracts in infrastructural projects in the UK, USA and Australia.

Countries having received the level of ‘executorial excellence’ in PPP’s are Australia and the UK (de Jong et al, 2010). Countries in or approaching the maturity status in PPP are now said to face issues related to fine-tuning their practice, viz producing robust business plans, generating an attractive and stable risk allocation, having a transparent and robust tendering process and an effective controlling framework in

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4 Why Public Private Partnerships don’t work. Hall, 2015
6 The report uses the words: Financiering en bekostiging
place. The middle group is working on a robust legal and regulatory framework, clear standards for PPP-models, project selection plus evaluation and effective and capable government organisations (de Jong et al, 2010).

The Dutch DBFM(O) would qualify for ‘executional excellence’ based on these criteria. (Ministry of Finance, 2012). Looking abroad for examples and studies therefore is difficult; countries with an earlier adaptation of integrated contracts use a BOT variant. At present other countries follow developments in the Netherlands closely and accommodate Dutch lessons in the build-up of their own experience (Kuijer, 2007), the international position does not help to reduce complexity. Better understanding of mechanisms and improvements in the system therefore will have to be provided by learning and experience.

The Dutch practice of DBFM(O) combines private financing and public funding and ownership over the construction rests with the government. This sets it apart from other front-runners in integrated contracts. Dutch DBFM(O) practice has a high level of professionalism, implying that that the main source for improving the process is through learning rather than looking abroad for examples.

### 2.3.2 From traditional contract to Integrated Approach in the Netherlands

In a traditionally tendered contract the coordination of the full project rests with the client. (Bemelmans 2012). In the Netherlands the client usually is Rijkwaterstaat (RWS) or the Rijkgebouwendienst (RGD) (Ministry of Finance (MoF), 2010). Specifications for the construction traditionally would be detailed in a technical design (a standard RAW-bestek) with calculations regarding building materials and project lead-time. Contractors are invited to make a bid and the lowest bid wins the contract. After completion of the construction the maintenance usually will be done by the government, or is outsourced based on detailed specifications (Lenferink, 2013b).

<table>
<thead>
<tr>
<th>Planning</th>
<th>Design</th>
<th>Construct</th>
<th>Maintenance</th>
<th>Operate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Design</td>
<td>Specify</td>
<td>Specify</td>
<td>Operate</td>
</tr>
<tr>
<td>Planning</td>
<td>Design</td>
<td>E&amp;C</td>
<td>Specify</td>
<td>Operate</td>
</tr>
<tr>
<td>Planning</td>
<td>D&amp;C</td>
<td>Specify</td>
<td>Operate</td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>DBFM</td>
<td>Operate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>DBFMO</td>
<td>Operate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Possible transfers**

- E&C = Engineering & Construct
- D&C = Design & Construct
- DBFM = Design-Build-Finance-Maintain
- DBFMO = Design-Build-Finance-Maintain-Operate

![Figure 2.3 Integrated contracts (Lenferink, 2013; Arts 2012; Pollalis 1996)](image)

Towards the end of the nineties there was a shift in the role of the government. Based on a neo-liberal agenda, responsibilities were transferred to the private sector (Lenferink, 2013b). Others believe that government budget deficits were a catalyst for the development towards DBFM(O) (Iseki, 2012; Kwak et al, 2009; Wijsman, 2011). In the Netherlands this transfer occurred as from 1999 on, leading to the current DBFM(O)-practice. Developments are summarized in figure 2.3, the white boxes indicating where government still has sole responsibility. Under a DBFM(O)-contract the government specifies the
performance or service level to be realized. A road for instance is no longer specified in terms of a stretch of tarmac, but in terms of transport capacity per time unit (Nagelkerke, 2009). Within constraints, the private party has the liberty to develop a plan how these output criteria could be met in a design and the party that most successfully optimizes the price-quality combination wins the tender (MoF, 2010). The design is accomplished in dialogue with the client and payment is based on the availability of the building, object or system. Strictly speaking DBFM(O) therefore does not provide a construction but a service. Payment is based on the availability of this service delivering the agreed performance (Verhees, 2013). Stressing the service aspects brings the focus to added value not just for the client but for the consumer of the service as well. The ultimate goal of integrated contracts therefore is to provide better public service against lower life cycle costs. Integrated contracts have a short history and are still developing, contracts are few in number, no contracts have served the full period yet and although research is on the increase providing new insights, knowledge is still relatively scarce.

DBFM(O) contracts mark the present state of ongoing development of integrated contracts. A DBFM(O) essentially delivers a service and seeks to provide better public service against lower life cycle costs.

2.3.3 DBFM, DBFMO or DBFMOR
In the Maintain & Operate phase a difference between infrastructures and building contracts becomes apparent. When the contract includes the “Operate” it refers to buildings only. “Operate” may include parts of Facility Management, like cleaning, reception and catering. For infrastructural projects, there is no “operate” and these contracts therefore are usually DBFM. Recently a third form has been introduced, an integrated DBFMO-Redevelop’ contract (DBFMOR). The RGD currently has a number of trials running with a ‘Redevelop’-contract, which is also referred to as maincontracting⁷. Features separating DBFM from DBFMO seem to be covered adequately by the four categories suggested by Lenferink for determining complexities in DBFMO (chapter 3), viz organizational, financial, technical and legal issues.

Table 2.2 DBFM(O) for building and infrastructure compared

<table>
<thead>
<tr>
<th></th>
<th>RWS - Infrastructure</th>
<th>RGD - Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational</td>
<td>apparent absence of external stakeholders in start-up phase; more contracts</td>
<td>users involved as from start.</td>
</tr>
<tr>
<td>Financial</td>
<td>minimum €60 million contracts up to €1.9 billion (MaVA)</td>
<td>minimum €25 million</td>
</tr>
<tr>
<td>Technical</td>
<td>Infrastructural planning issues cause technical and legal complexity</td>
<td>more weight on use of standards</td>
</tr>
<tr>
<td>Legal</td>
<td>DBFM and maincontracting</td>
<td>DBFM and maincontracting, the Operate includes facility management, catering, cleaning</td>
</tr>
</tbody>
</table>

The party missing in DBFM(O) is the rail sector. Although some light-rail trajectories have been tendered as DBFM(O) including rails, passenger cars and operate (f.i. Reims; Bergen; Groningen (withdrawn)), for national lines no DBFM(O) is in place. Fragmentation of safety and liability issues in a shared network, different service operators sharing tracks (government auctions concessions for operating a line), a network that is hardly extended anymore (DBF) and a more conservative attitude of government institutions are some of the reasons why to date only two rail DBFM(O) have been tendered in the Netherlands.

Integrated contracts have developed differently in built environment, infrastructure and rail settings.

⁷ RGD-Nieuwsbericht, 24-04-2012
⁸ Maincontracting refers to a single contractor taking the overall responsibility for management and maintenance of an asset. The client specifies an asset maintenance plan and the maincontractor is responsible for keeping the performance of the asset in accordance with the specified performance margins (Stoker, 2014). Maincontracting can be part of an integrated contract or can be applied on its own.
2.4 DBFM(O) processes

In this paragraph a brief overview will be presented of DBFM(O) from initiation up to the end of the contract. The contract usually is signed between the government and a consortium. The consortium will be introduced first.

2.4.1 Consortium or Special Purpose Vehicle

In terms of the contractual arrangements, the government will usually sign a contract with private parties in a consortium or a so-called Special Purpose Company (SPC) (Pijnappel 2014) Special Purpose Entity (Chowdhury, 2011) or, most frequently, ‘Special Purpose Vehicle’ (SPV) (de Jong 2010; de Schepper 2014; van den Hurk 2015).

An SPV is a ‘project company’ composed of several private parties with differing backgrounds, cultures, tasks and responsibilities (Verhees, 2013). The SPV would typically include companies with the skills required to design, build, finance maintain and service a construction. Shareholders would usually be big construction companies or specialists in big PPP-projects, providing the SPV with equity. Finance companies will provide capital usually at a lower rate (depending on risk profile) than the equity. The ratio equity—loans can be 1:9. Insurers could be involved for limiting liabilities. Agreement between an investor and the SPV is on a “non-recourse” basis.

The actual work of designing, building, financing, maintaining and servicing is subcontracted by the SPV to companies, usually the SPV shareholders. After the design and closing of the contract these take on the responsibility for Engineering, Procurement Construct and Maintain (EPC&M). (Demirag et al, 2011; Verhees, 2013; Klijn, 2010; Heiligers, 2012).

Big construction firms with many subsidiaries, covering all major functions, sometimes are known to provide build, maintain and operate in a DBFMO, as in the case of the National Military Museum - Soeterberg, in which case no consortium is required.

The DBFM(O) process from initiation to build is very complex, with many participants and strict regulations. Tendering is a costly affair and usually contractors are organized in a Special Purpose Vehicle.

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9 The assets remain property of the client, financers therefore rely solely on the periodical payments of the client for the return of their investment and can not take possession of the construction in case contractors fail to meet output criteria.
2.4.2 DBFM(O) from Initiation till contract ends

In the DBFM(O) process from initiation up to and including the contract close, there is a strictly regulated and transparent program in accordance with Dutch and European legislation (Directive 2004/18/EC). The European council has ruled that contracts with a value in excess of €5,186.000 should be tendered in Europe (Directive 2004/18/EC) \(^{10}\). In the Netherlands there is a minimum amount for a DBMFO-tender of €25 million for the Rijksegebouwendienst and €60 million for Rijkswaterstaat (Stuiveleng, 2013). All Dutch DBFM(O) contracts therefore are put up for European tendering.

For a brief discussion of the DBFM(O) phases\(^{11}\) we will use the numbering (0-7) from the top of figure 2.4.

![Figure 2-4 Overview of DBFM(O) process from initiation till contract end](image)

The decision to start a project marks the initiation and preparation (0). If a business case confirms that the planned construction qualifies for a DFMO-tender, the Public-Private Comparator (PPC) compares the costs of a DBFM(O)-contract with a more traditional contract. On basis of the outcome of the PPC a decision is made whether the project will become a DBFM(O) or a traditional tender. In case a DBFM(O) is chosen, the Public Announcement phase (1) includes a European notice of the project, making available documentation specifying the requirements of the project, an invitation to tender, a submission for tender by applicants and a first selection of candidates. Candidates typically are consortia (see § 2.2.3). In CDIs (Competitive Dialogues), public procuring authorities and private bidders engage in pre-bid public-private dialogues over public needs and proposed private solutions (Lenferink, 2013). In the CD consortia compete with one another designing the best solution on basis of the specifications of the client (2). The design is developed in an individual dialogue between a consortium and the client; the particulars of the design remain undisclosed to competing teams. As the aim of an integrated contract is life cycle optimization, the design should aim at the lowest cost of build, maintain and operate over the full life cycle of the construction. (For the CD phase see also § 2.3).

The Competitive Dialogue results in a design with cost estimates, producing input for the Public Sector Comparator (PSC). The PSC contains a risk analysis, a cost and benefit calculation and ends with the PSC-benchmark that provides the basis for assessing the bids and selecting the candidates. The PSC reflects the DBFM(O) benefits from innovation, efficiency and risk transfer as compared to a traditional project. The parties remaining after selection are invited to put forward their bids (3), negotiations may follow which could lead to adjustment of the PSC-benchmark after which a Best and Final Offer (BAFO) may be invited from a first and second best bidder (4).

During the tendering phase the tenderers have to maintain the validity of the Final Submission for up to a year. Contract close (5) follows at the moment that the government and the consortium sign the final contract. Although it would seem logical to complete the Contract Close and Financial Close at the same

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\(^{10}\) zie: http://www.euwiki.org/2004/18/EC

\(^{11}\) For a more extended description including literature references of the process see endosure 1
time, in practice financers wish to receive a copy of the signed DBFM(O) agreement before they are prepared to make a definitive decision to provide the financing. Financial close therefore occurs usually up to a couple of months after the contract close.

The build phase (6) reflects a normal building process, but depending on the contract may include additional risks and tasks for the consortium like: management of the process, obtaining permissions and stakeholder management. From a Management Accountancy perspective maintenance confusingly is referred to as Asset Management in professional circles of maintenance engineers. A definition for Asset Management from the PAS 55\(^2\) standard is: “Systematic and coordinated activities and practices through which an organization optimally manages its assets and their associated performance, risks and expenditures over their lifecycle for the purpose of delivering the organization’s business objectives.” Maintenance in infrastructure may start before the build phase already. The A-15 contract (see intermezzo, enclosure 2) is an example of a situation where the SPV acquired the rights and obligations for maintaining the roads from signing of the DBFM(O) contract on, before any build activity was started. As from the start 20 fte were available to secure that traffic flows and road conditions were in accordance with the agreed performance levels. \(^{13}\)Performance can be defined as the relation between the (financial) means and the required quality of a system, to attain the objectives and targets (van der Meer, 2011). The M&O phase will be discussed in more detail in chapter 4.

A DBFM(O) can be characterized as a situation in which public parties have transferred tasks and roles to private parties and responsibilities are drastically altered requiring new skills and new forms of cooperation in which all parties are learning. Complexity seems to have increased as have risks, but are shared between private and public parties each according to what they are best at.

### 2.5 Characteristics of DBFM(O)

This chapter seeks to provide an answer to the first sub question: *What is DBFMO?* Complexity of planning, organizing, managing and monitoring of a construction project that is always unique and site specific is a characteristic of the construction sector. A traditional hierarchical approach adds to this complexity (§2.2). Although the PPP definitions and partnership variations show a great diversity, there seems to be a shared agreement on the benefits, these include: parties do what they are good at; PPP projects are more commonly completed on schedule than projects contracted out in the traditional way; the government gives companies the freedom to invest in new technologies and innovative solutions resulting in lower life cycle costs; expenditures and incomes are fixed for a long period (§2.3).

The Dutch practice of DBFM(O) combines private financing and public funding and ownership over the construction rests with the government. This sets it apart from other front-runners in integrated contracts. Dutch DBFM(O) practice has a high level of professionalism, implying that the main source for improving the process is through learning rather than looking abroad for examples (§2.3.1). DBFM(O) contracts mark the present state of ongoing development of integrated contracts. A DBFM(O) essentially delivers a service and seeks to provide better public service against lower life cycle costs (§2.3.2).

Integrated contracts have developed differently in built environment, infrastructure and rail settings. The DBFM(O) process from initiation to build is very complex, with many participants and strict regulations. Tendering is a costly affair and usually contractors are organized in a Special Purpose Vehicle. A DBFM(O) can be characterized as a situation in which public parties have transferred tasks and roles to private parties and as a consequence responsibilities have altered drastically, requiring new skills and new forms of cooperation in which all parties are learning. Complexity seems to have increased as have risks, but are shared between private and public parties each according to what they are best at. (§2.4)

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\(^{12}\) Publicly Available Specification (PAS 55) covering management of physical assets was published by the British Standards Institution in 2004 and is replaced by ISO 55000 in January 2014.

3 Maintenance & Operations in DBFM(O)

3.1 Introduction
This chapter is aimed at answering the second research question: *What are the characteristics of the DBF-M&O-phase*. Literature on maintenance is abundantly available, literature on DBFM(O) is emerging, but literature specifically dealing with maintenance in DBFM(O) to date is scarce. No DBFM(O)-contract has served its full contractual period yet, the first contracts to expire are listed below (table 3.1). No definitive conclusions therefore are possible for weighing the economic viability of integrated contracts, but emerging knowledge about it is all the more welcome.

<table>
<thead>
<tr>
<th>Contract</th>
<th>Ends</th>
<th>Contract in million €</th>
</tr>
</thead>
<tbody>
<tr>
<td>A59 Den Bosch - Oss</td>
<td>2020</td>
<td>279</td>
</tr>
<tr>
<td>Tax office Doetinchem</td>
<td>2025</td>
<td>47</td>
</tr>
</tbody>
</table>

The 3C governance model was developed for the Competitive Dialogue phase and, according to Lenferink (2015), suitable for the M&O phase as well. The first paragraph of this chapter will look into the way the investigated factors have been made operational in the CD phase and whether these will hold for the M&O phase as well. Comparing the two phases in detail for complexity factors is the subject of the second paragraph, the last paragraph will list the characteristics of the DBFM(O) M&O phase.

3.2 Theoretical framework: Complexity Factors
The theoretical part of the Lenferink-article is focussed on modelling the control of complexity through a governance mix. In the CD phase complexity is operationalized as technical, legal and financial complexity. These categories of complexity are directly derived from the EU justification for introducing the CD procedure\(^{15}\). Organizational complexity was added to complement the three contextual influences on the 3C-mix (Lenferink, 2013). In a research on governance of complex PPPs in Flanders van Gestel et al (2014) arrive at a similar reasoning “Contextual factors lead to very complex PPP structures, resulting in specific challenges in terms of a.o. governance” (Gestel et al., 2014). (see also table 4.1 and § 4.2.2). The complexities by van Gestel are grouped differently, but contain similar topics as the ones identified by Lenferink, underpinning their relevance for describing DBFMO. Influences are grouped in four categories, defined as complexities and split in subcategories of investigated factors.

<table>
<thead>
<tr>
<th>Influence defined ex ante</th>
<th>Definition</th>
<th>Investigated factors CD Phase; defined ex post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Issues</td>
<td>Issues in the organizational setting and set-up of the CD (Maintain) procedure.</td>
<td>Human resources management, time management, information management.</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>Complexity caused by technical, physical project characteristics.</td>
<td>Technical project opportunities, technical solutions discussed, role of technical experts during CD.</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>Complexity caused by financial project and contract characteristics.</td>
<td>Rewards and compensation in CD, project financing, role of financial experts in the CD phase.</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>Complexity caused by procurement procedure and contract characteristics.</td>
<td>Legal roles and responsibilities, role of legal experts in the CD period.</td>
</tr>
</tbody>
</table>

\(^{14}\) It should be noted that currently new projects typically have a contractual period of between 20-30 years and that the period of outsourcing is usually adjusted according to the technical lifecycle of the object.

\(^{15}\) EC 2004, Directive 2004/18/EC, articles 1.11 and 29
My study aims to research whether the model can be used in other phases than the CD. The four categories of influences or complexities\textsuperscript{16} therefore need to be the same for both the CD and M&O phase.

Proposition 1: The four categories of influence adequately cover the M&O phase as well as the CD phase.

The complexities by Lenferink (table 3.2. and 3.3.) are formulated ex ante, the investigated factors were partly postulated ex ante, partly derived from the research and formulated ex post (Lenferink, 2015). In this research we aim to formulate the characteristics ex ante based on literature.

In answering the research question \textit{what are the characteristics of the DBFM(O)-M&O phase}, characteristics are defined as the influences / complexities and the factors into which they are broken down. The operationalization of these influences in factors is expected to differ between the CD and M&O phase and will be discussed in the next paragraph. The last paragraph will summarize the characteristics to be tested in the empirical research.

Proposition 2: Influences are DBFMO-phase dependent and will differ between CD and M&O-phase.

3.3 Complexity factors in CD and in M&O
The EU directive classifies complex as "where the contracting authorities are not objectively able to define the technical means capable of satisfying their needs or objectives and/or are not objectively able to specify the legal and/or financial make-up of a project."\textsuperscript{17}

What are the issues referred to in the CD phase, and can these issues be expected in the M&O phase as well? Based on a literature study the four issues from the CD phase will be described in this paragraph. Next CD and M&O are compared and expectations for the M&O are discussed, leading to propositions for the factors to be empirically researched in the M&O phase.

3.3.1 Organizational Issues
Factors suggested for the Organizational issues in the CD phase are: time management, human resources management and information management.

Organizational issues during the CD
The CD procedure is the mechanism that structures Public Private Interactions during the design phase, a time pressed episode in the project, requiring time management. Time is an issue due to the political pressure; a missed deadline may impact budget or political approval (Lenferink, 2013). From the viewpoint of Human Resource Management it is challenging to recruit a temporary team with many highly qualified specialists, and to retain them as their expertise is in demand. Professionals are often transferred across projects with detrimental effects on the interaction and trust development (Lenferink et al, 2013). At the government side many representatives are involved ranging from future users to specialists in the field of finance and engineering. At the SPV-side Heiligers (2012) draws up a list

\textsuperscript{16} The four groups of influences are defined as complexities, the term influence and complexity will be used interchangeably.

\textsuperscript{17} Explanatory Note – Competitive Dialogue – Classic Directive - CC/2005/04 _rev 1 of 5.10.2005
of 6 teams with 37 experts concerned with just the technical aspects of one consortium in a DBFMO building project. This is challenging as managing relations across disciplines within a contract is a new role for contractors. Finding and retaining the right staff is therefore complex.

The organizational setting therefore is complex and requires good management for coordinating the teams and for streamlining information flows. Information Management therefore is crucial.

For the public party obtaining all required information including documentation from the decentralised governments is a difficult task, a complicating issue is that many of these documents need to be translated for the sake of foreign tendering parties. At the private side, parties struggle with an information overflow and a mass of unstructured data and documents. Complexity of managing these relations and flows of information within a strict time frame are typical for the organizational side of the CD phase.

Organizational issues during M&O

Once the turmoil of the DBFM phase is over and the construction is in operation, owner, user and contractor can focus on their shared goal: optimal service delivery, with a 25 year perspective where likeminded specialists from different organizations will closely cooperate within the relatively stable frame work of a long-term contract. Issues relating to HRM (Human Resource management) do not seem to have a major role in the M&O. For the contractor, managing the relations with user, contract manager and the Lender’s Technical Advisor is important, a satisfied client in a trusting relation is much easier to manage than an adversarial client or an unwilling contractor (Verhees, 2015). The owner and the user are similarly interested in capable professionals with good understanding of the situation and with an eye for the requirements of owner and user. To jointly work towards the common goal of uninterrupted optimal service delivery requires tight liaison between the parties involved who need to closely cooperate, maintaining good relations and building trust over a period stretching decades. In this setting it is expected that cooperation is vital and that relation management is a central issue.

Compared to the CD, M&O is a less fuzzy lifecycle phase. Relations between consortium and the client are maintained through a contract manager. Availability, quality standards, repair response time and fines and incentives are stipulated in a so-called BOM\(^{18}\) in case of buildings and a mechanism called “interact, check intervene”\(^{19}\) in infrastructure. The system for monitoring and reporting is usually designed by the contractor in accordance with horizontal organization principles (Bakker & Hardjono, 2013; Nooteboom, 1997). The main task of the SPV is to safeguard availability of the construction within the agreed performance standards. Rather than managing deadlines as in the CD phase, attention is focussed on stable delivery of the service and performance management is therefore expected to be important.

In order to accomplish service availability, the issues of risk and uncertainty\(^\text{20}\) will have to be controlled rather than complexity of collecting and distributing information. In order to guarantee a good service, information regarding all assets will have to be meticulously documented, all repair and maintenance information needs to be permanently accessible for many actors, and trustworthy and transparent information is the basis for performance management and for remuneration. Information Management is therefore expected to be important as exchange of information regarding the condition of assets is crucial and are the basis for contractual settlements.

It would seem that two of the three issues as reported by Lenferink to be typical for the CD viz.: human resource management and time management do not characterize the M&O phase. No mention in the literature can be found relating to Human Resource Management issues. The time pressure seems absent

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\(^{18}\) Beta lingsmechanisme, Outputspecificatie en Monitoring  
\(^{19}\) interactie; toetsing en interventie, according to one interviewee in practice similar to cooperate; coordinate and compete.  
\(^{20}\) The difference between risk and uncertainty is that in case of risk the potential outcomes are known and thus can be statistically determined (Broadbent et al, 2008).
in the M&O phase and rather stability and organizing maintenance for maximal availability of the service within the performance bandwidth based on transparent information are the issues at stake in the M&O phase.

Proposition 3: Organizational issues in M&O are: Relation management, Performance management and Information management.

3.3.2 Technical complexity
Technical factors in the CD phase are: technical solutions discussed, technical project opportunities, role of technical experts during CD.

Technical issues during the CD
Private parties regard technical complexity to be the main reason for applying the CD, however in the cases researched by Lenferink (2013) companies report not to have experienced as much interaction as expected on this topic. Technical solutions discussed appeared less important than expected. Reasons for this are: limited complexity of the projects, decreasing expertise by the government due to restructuring and outsourcing of the design, and a cautious attitude by private parties due to the open nature of the discussions. The role of technical experts is therefore mainly oriented towards technical detailing of the architectural designs. It is in the technical detailing that CD and M&O phase are closely interwoven. Incorporation of factors like reliability, maintainability and usability in the system design, supports cost-effective performance over the life cycle. The two main potential savings mentioned in literature are the quality of the design and innovations.

For technical project opportunities, Hansen (2011) seems to confirm that a single DBFM(O) contractor can make better lifecycle optimisation than separate multiple firms. In four case studies of BDFMO for buildings he reports four design choices that can be considered to be innovations on maintenance and energy use. “The innovations detected in the case studies can be considered as the successful transfer of knowledge between departments of one contractor that would have worked independently in case of a traditional procured project.” Lind (2010) challenges the idea that an integrated contract has better communication resulting in optimizations. He claims that this is built around two assumptions. The first assumption is that knowledge about the construction quality is difficult to transfer to other firms, which he argues is incorrect and only depends on the quality of the documentation. The other assumption Lind challenges is that it would be much easier to transfer this knowledge within a firm than between firms. “If different departments and different staff handle construction and maintenance, then it is far from obvious how more informal knowledge about how the road was constructed can be transferred to the operation/maintenance unit, especially concerning things that have long-run effects, e.g. that there might be certain quality problems that the operating/maintenance unit should be aware of.” The observation from Lind is confirmed in the research by Lenferink: Public and private interviewees unanimously acknowledge that transfer within the EPCM causes a loss of tacit knowledge and negatively influences personal trust relations generated during informal moments in the CD process.

In literature no conclusive evidence for either stance (Integrated contracts do / donot stimulate innovation) could be found, partly due to the complex methodological challenge of proving financial success of an innovation.

That innovations can be risky as well is proven in the A-15 case (enclosure 2) where the contract was based on an innovative construction for a new bridge. After the contract close, the Rotterdam harbour council and ProRail denied permissions for the lighter design, resulting in delays forcing the consortium to refinance credit, hiring extra personnel and requiring extra investments in redesign and in substantially more expensive construction. Apart from technical innovation, the innovation in systems of integrated contracts is substantial (e.g. maincontracting and contracts as listed in fig 2.3)
Technical issues during M&O

During the M&O phase technical performance plays a major role in establishing maintenance strategies and refurbishment plans. Maintenance is usually managed on basis of international standards like PAS 55, NEN-ISO 55000\textsuperscript{21} or RAMS\textsuperscript{22}. These international standards are all schemes geared towards controlling and managing risk and uncertainty. They provide extensive procedures, checklists and standards. Central in these maintenance approaches is a structured maintenance plan in which performance and risk are balanced in accordance with the objectives. These objectives may be directed at safety, availability or costs, and per asset a maintenance plan is developed. Maintenance can be triggered on basis of periodic condition checks, the intensity of use or damage to the object, giving rise to an average expected life cycle with an uncertainty bandwidth (figure 3.8). (Arunraj, 2006; Narayan, 2004; etc). On basis of the literature on maintenance it can be observed that risk is the main issue to be controlled. Monitoring the performance, establishing the balance between on one hand risk of unavailability and the other hand life cycle performance and technical alternatives is a major technical issues at stake, making performance issues and risk management an important technical issue. Involvement of technicians is essential but no difficult issues are likely to be discussed by technical experts in conjunction with the normal routine M&O operations.

In the M&O phase, at the end of its life cycle, an object can be replaced by an entirely new object or refurbished to make it fit for use again (Narayan, 2003). Apart from periodic lifecycle issues output specifications may change. Reasons for changing the specifications can be the incompleteness or inexactness of the contract or previous specifications; a change in political preferences; and the implementation of technical innovations (Reynaers, 2014). Both end of life cycle and changed specifications require reassessing the overall situation and designing the best solution to fit the changed context. The relations and interactions between client, SPV shareholders, (EPC)M-company, and the user are decisive for this type of technical interventions (Verhees, 2015). In the interaction the four different perspectives of technical experts from lenders, owners, user and contracting SPV will have to lead to a balanced outcome. It is expected therefore that in M&O the two aspects of role of technical experts and technical issues\textsuperscript{23} discussed are closely interwoven and are limited to renewal activities or contractual changes.

Striking difference between the two phases of CD and M&O in a technical respect is that the technical design has a prominent role in the first phase, whereas managing risk and uncertainty is the main issue in the M&O phase. It is anticipated that for both phases the focus is on balancing costs and technical solution and that interactions on technical and performance issues are decisive for interventions.

\textsuperscript{21} Publicly Available Specification (PAS 55) was published by the British Standards Institute in 2004, and was replaced by the ISO 55000 series of Asset Management Standards in 2014.
\textsuperscript{22} RAMS stands for Reliability, Availability, Maintainability, Safety.
\textsuperscript{23} As technical issues relate to the M&O phase it is expected that both solutions and operational issues are important, the description from the CD phase will be adapted therefore from technical solutions discussed to technical issues discussed in order to reflect the broader issues of the M&O phase.
Proposition 4: Technical issues during M&O are: performance issues and risk management, technical issues discussed by technical experts.

3.3.3 Financial Complexity

Issues listed by Lenferink et al are: Rewards and compensation in CD, project financing, role of financial experts in the CD phase.

Financial issues during the CD

Financial experts are required to calculate the different scenarios and present the best solutions. For the government, establishing whether or not a DBFM(O) is advantageous, is difficult. Crucial in the Net Present Value (NPV) calculations is establishing the right interest rate that reflects the risks involved for the particular project including provisions for the ups and downs of the economic climate during the full contract duration. These interest rates are reflected in the calculations for establishing value for money (VfM) or added value of the integrated contracts as compared to traditional tendering. VfM is defined as ‘the optimum combination of whole life cost and quality (or fitness for purpose) to meet the user’s requirement’ (Verhees, 2013). On basis of 28 PPP projects in Canada and the USA VfM is calculated to be 11% over 28 projects with a total value of 5.5 billion (Siemiatycki, 2012). The Dutch Ministry of Finance arrives at a saving of between 10-15% amounting to approximately 1.3 billion (MoF, 2014). Savings however are based on the design and as suggested by Flyvberg et al (2003) projects often are overrun on costs due to lack of realism in initial cost estimates, motivated by vested interests. Stuiveling (2013) reports that after the contract close, in 5 selected DBFM(O) projects, amendments were made after contract close, amounting to a total of €63 million, fuelling the debate whether or not the DBFM(O) is justified based on economical motives only. Another complication is combining the multiple sources of public funding from municipal, provincial and national governments.

As for the project financing, under new agreements only the preferred bidder is requested to secure finances in the CD already (MoF, 2013), reducing the complexity in the bidding process. A recurring issue regarding rewards and compensation are the transaction costs. “Transaction costs can be called outsourcing costs, relating to search, planning, negotiating, monitoring, and enforcement” (Blomqvist, 2002). Transaction costs thus narrowly defined differ from the definition used in TAEconomics. These transaction costs in a DBFM(O) are significant, and bidders have raised concerns about bidding costs in this procedure. Overall the procurement costs under a strictly regulated DBFM(O) procedure are likely to be higher for both the authorities and for bidders. In a study by the European Investment Bank (Dudkin & Vällilä, 2005) total transaction costs of infrastructural projects during tendering was found to amount to 10% of the contract value. Costs for the client were roughly 2-3%, for the winning consortium between 4-5% and for the losing consortia 2-5%. As well as that, more bidders will be involved in detailed discussions whereas only the party that wins the contract will get a full compensation for its investments. But as all parties are committed to winning the bid they are prepared to invest substantially in the CD. In a Dutch situation comparing 3 building projects, the total transaction costs amounted to approximately 3% of the contract value (Heiligers, 2012).

This controversial issue was handed to a public-private taskforce that reported back that government and market were unable to resolve the differences: allowing fewer candidates to a lighter version of a Competitive Dialogue as suggested by companies appeared not feasible (Ruding, 2008). The recommendation to reimburse bidding parties however has been implemented, bidders for infrastructural projects receive 50% of estimated bidding costs and the RGD has adopted a similar policy which boils down to a compensation of €700.000 to €1.000.000 (Taskforce PPS, 2009). Another reason for the higher costs is that each bidder needs to assemble a consortium.

Participants report as causes for the long and costly design in the Competitive Dialogue: the detailed output specifications requiring detailed technical solutions, the involvement of future users without expertise, the complexity and the detailed designs (van den Assem, 2014). Lenferink et al however report a unanimously positive response by public and private parties: a more transparent process and
transaction costs are lower (Lenferink et al., 2013a). As transaction costs are likely to be higher for individual participants in the bidding process, Public-Private Comparator calculations show that the overall benefits outweigh the effects for the individual bidding party.

**Financial issues during M&O**

Literature on finances in the M&O phase is not available, rather it is about the complex design of the financial mechanisms. Financing companies in the SPV have provided the financial means for the build of the project and get a first big lump sum on basis of the completion certificate authorised by public representatives approving that the construction complies with the contract (MoF, 2012; Handboek DBFM, 2009).

![Figure 3.7 Outgoing and incoming money flows for SPV](image)

Similarly, based on the availability of services after the build phase, fees are paid to the consortium in accordance with performance. Overall profitability for the consortium depends on offsetting life cycle costs against these availability fees (fig 3.7). It is expected that the system of *rewards and compensations* in the M&O phase is a central financial theme.

Financial experts will be involved for settling the complex internal and external SPV settlements and for routine monitoring and management accounting of financial operations and profitability. The involvement of financiers from banks limits the opportunities for interaction and may stifle innovation due to the risk avoidance of the financiers. The financial results for client and SPV shareholders depend on relations between the SPV and (EPC)M-company, how strict the lender’s Technical Advisor operates and the “user” who will have a big influence on evaluating the service level and thereby on maintenance-efforts and thus on financial results (Verhees, 2015). It is expected therefore that financial experts will balance the relation focussed attitude in the category “organizational”.

The issues reported by Lenferink appear of minor importance in M&O. The role of financial actors is important but limited to controlling transactions and profitability. Project financing obviously doesn’t apply, as all big investments have been made. The role of financial experts is limited to monitoring and controlling of the financial situation between client, partners and subcontractors. Real issues seem to be limited to incidents.

**Proposition 5:** Financial issues in M&O are: rewards and compensation and the role of financial experts.
3.3.4 Legal complexity

Legal roles and responsibilities and the role of legal experts in the CD period are the two CD factors under scrutiny in legal complexity.

Legal issues during the CD

Legal roles and responsibilities, according to Lenferink are so strictly adhered to that they smother technical and financial interaction. Strictly bounded stages and a legalistic attitude resulted in a lack of added value and an all too central role for the contract. In addition Lenferink (2013) reports an over-presence of legal experts in the CD-phase. The scope of the project and legal aspects are determined on basis of the public goals (f.i. safe and smooth flow of traffic), the desired output (f.i. safe, sustainable and comfortable roads with minimal hindrance for stakeholders) and the activities necessary to attain the required output (f.i. new top layer, extra lane, new traffic management systems) (MoF – handleiding PPC). Legal matters in the CD dominate the dialogue over financial and technical matters; these legal roles and responsibilities result in a formal rather than a cooperative approach in the CD and a cautious attitude resulting in detailed contracts.

Legal issues during M&O

No direct references to legal issues in M&O can be found in the literature. It is assumed that for both public and private parties legal issues play only in case of contract changes. These changes are required if there is a misfit between design and process, if the purpose of a building is changed or when new laws or regulations become effective (Stuveling, 2013). During a normal M&O process, legal issues play a minor role as big manuals and detailed contracts regulate roles, functions and interactions. These legal regulations are an important precondition for trust as they make the relation more predictable (Costa, 2007) and can play a vital role in managing long-term PPP relationships (Roehrich, 2014). Kamminga (2007) further elucidates the issue by linking contracts to trust as an alternative for legal coordination of (behavioural) uncertainty. In addition trust reduces coordination costs. The legal framework however, is a condition but no guarantee for a trusting relation as a PPP case study in Flanders tells. In a situation with initially low levels of trust, issues over maintenance were not dealt with in a cooperative attitude, but in the rigidity of the legal framework (van Gestel et al, 2012). However as Dutch DBFMO has a longer history and more experience, Dutch DBFMO contracts have a detailed legal framework of which the M&O strategies (dealing with risk and uncertainty) are a part, it is assumed that in the Dutch situation this framework will provide a solid basis to enhance the development of a trusting relation as put forward in previous parts of this chapter. In normal M&O – operations it is expected that legal roles and responsibilities and the role of legal experts are not important, rather the legal framework contributes to stability thereby supporting the development of a trusting relation.

Proposition 6: Legal roles and responsibilities and the role of legal experts are expected to be of minor importance rather the legal framework has a stabilizing role supporting trust development.

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24 Kamminga (2007) distinguishes between uncertainties resulting from an unpredictable environment, f.i. technological changes and uncertainty resulting from behavioural risks.
3.4 Summary and conclusions
A first proposition is that the four categories of organizational, financial, technical and legal complexities adequately cover the factors in the M&O phase.
A second proposition is that complexity is context and phase dependent and therefore complexity factors will differ between CD and M&O-phase. Expected issues in M&O, proposition 3-6, are summarized below in table 3.3 with the differences between the phases highlighted in italics.

Table 3.3 Definitions and factors of contextual influence on the government mix

<table>
<thead>
<tr>
<th>Influence</th>
<th>Definition</th>
<th>Investigated factors CD Phase; defined ex post</th>
<th>Factors to be investigated in M&amp;O Phase; defined ex ante</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational</td>
<td>Issues in the organizational setting and set-up of the CD (Maintain) procedure.</td>
<td>Human resources management, time management, information management.</td>
<td>Relation management, performance management, information management</td>
</tr>
<tr>
<td>Technical</td>
<td>Complexity caused by technical, physical project characteristics.</td>
<td>Technical project opportunities, technical solutions discussed, role of technical experts during CD.</td>
<td>Technical performance issues and risk management, role of technical experts during M&amp;O including technical solutions discussed.</td>
</tr>
<tr>
<td>complexity</td>
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<tr>
<td>complexity</td>
<td></td>
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</tr>
<tr>
<td>Legal</td>
<td>Complexity caused by procurement procedure and contract characteristics.</td>
<td>Legal roles and responsibilities, role of legal experts in the CD period.</td>
<td>Role of legal framework in trust development</td>
</tr>
<tr>
<td>complexity</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4 The 3-C Governance Model

4.1 Introduction
The most frequently reported shortfalls in infrastructure projects are the failure to meet deadlines, exceeding budget and not delivering the specified quality or functions (Flyvbjerg et al. 2003; Klakegg and Haavaldsen, 2010; Lenferink, 2013). The traditional approach in large public construction works in dealing with these issues can be characterized as mainly hierarchical. Governments however increasingly have difficulty in adapting to the changing values and demands of a complex society. Time and cost overruns in infrastructure projects made government look for a dialogue with contractors, exploring differing modes of governance, rather than to continue a hierarchical approach in dealing with complexity (Lenferink, 2013). Lenferink distinguishes three different models of organization and relates the three TCE (Transaction Cost Economics) governance strategies to these models: competition to the market model, cooperation to the network model, and coordination to the hierarchical model. The 3-C governance mix can be traced back to originate from TCE, but seems to have an almost autonomous development in infrastructural planning literature. This 3-C mix model will be discussed in more detail in the next paragraphs, answering the third research question: What is the Cooperation-Competition-Coordination mixed governance model?

This chapter is divided into four parts. The first part will focus on the dynamic model that Lenferink built. It is a dynamic model for it combines complexity and governance in DBFM(O) with a time dimension. Lenferink doesn’t explicitly spell this model out in his article, nor does he provide a detailed background for the governance framework. We therefore need to turn to the sources he uses for a better understanding of the 3-C governance model he proposes, a summary of these will be provided in §4.2, the second part of the chapter. The third part then describes the three governance strategies. The fourth part will go on to discuss governance from the perspective of public and private parties and will finally match the three governance strategies with the four complexities discussed in the previous chapter.

4.2 The 3-C Governance model
The word “governance” is, according to the Oxford English Dictionary, derived from both the Latin gubernare (to steer, to direct or to rule) and from the Greek kubernan (to steer). Governance is sometimes referred to as “the rules of the game” (Verhees, 2013), sometimes as “to regulate” including time, place and manner of functions and sub-functions (James, 2012).

Governance in this research is understood to mean control. Control encompasses the mechanisms and instruments used by government to intentionally influence the decisions and the behaviour of other governments or private parties in order to achieve government objectives (Verhoest et al, 2005).

Governance is a very general concept. This usually means that governance is defined more narrowly associated with a particular type of organization or context, in our case the context of interorganizational relations (IOR) of parties involved in a big integrated construction project or DBFM(O).

To improve understanding of the processes and mechanisms in big construction contracts many researchers have contributed with a diversity of governance schemes. Some of these are: project governance (Too and Weaver, 2013; Williams, 2009; Ahola et al, 2013) network governance (Ruuska et al, 2011; Zaheer et al 2010; Provan and Kenis, 2007) or more general: governance frameworks (Klakegg and Haavaldsen, 2011; Conteh, 2012).

Lenferink only briefly discusses origin and characteristics of the 3-C governance mix, a summary of which will be provided in the next paragraph, followed by an overview of the sources that he builds on.
4.2.1 A dynamic model

A hierarchical approach is not suitable for dealing with complexity. In order to deal with complexity variety is required. Variety theoretically relates to the capability of a system to deal with changes in its environment (Nooteboom, 2007) paraphrasing ‘Only variety can destroy variety’ (Ashby, 1956). Each system, to survive in a larger, ever changing environment, must keep its ‘wholeness’ (its own autonomous existence) as well as its ‘partness’ being part of a larger system. A system depends on the larger system for survival, contributes to this larger system and competes within the larger system for resources with other subsystems (Nooteboom, 2007). Public-private interactions can help to provide more variety for the system in its interaction with the environment, its partness) but these interactions can also increase the capacity to handle variety (requisite capabilities of the system to sustain its wholeness). The increased capacity for variety is caused by a learning effect as a result of interaction. The interaction and the learning effect increase through participation in different projects in which different models of organization are combined (Lenferink, 2013). Three models are generally distinguished in planning and public administration literature: the market model, the network model, and the hierarchical model.

Lenferink relates three governance strategies to these models: competition to the market model, cooperation to the network model, and coordination to the hierarchical model.

The entities and interrelations just discussed are depicted in figure 3.4. The verbs on the arrows indicate an activity or an exchange; both the verbs on the arrows and the phrasing in the boxes are directly taken from the focus article. To be able to operate the three different governance strategies requires considerable professionalism from governments hence the learning circle in public-private interaction.

![Figure 4-1 Schematic overview of themes in the Lenferink-article](image)

It is assumed that an effective combination of coordination, competition and cooperation will balance the objectives of government and the market and result in a situation of coopetition (Lenferink, 2013). Coopetition emphasizes simultaneous cooperative and competitive behaviour among organizational units (Tsai, 2002). The term coined in a social network perspective is currently frequently applied in the context of big (construction) projects (Nooteboom, 2007; Buuren, 2010) and taken by Lenferink (2013) as the position in which the objectives of (market-) parties are balanced and a corresponding mix of governance structures results in an equipoise.

Lenferink provides a dynamic model acknowledging the complexity, but he pays relatively little attention to explicating the model, his sources however do shed light on the ideas brought together in the model. For a better understanding of the model we therefore need to turn to his inspirators.
4.2.2 The 3C governance models in the context of PPP

The core hypothesis of TCE is that one should align transactions (which differ in their attributes) with governance structures (which differ in costs and competencies) in a discriminating way. Similarly Lenferink, seeks to align transactions and a governance mix, discriminating in attributes and competencies, thereby arriving almost by definition at a hybrid form as described in TCE.

For describing the three governance models, however, Lenferink does not refer to TCE but instead draws on several perspectives and sources mainly relating to the context of complex integrated contracts (Nooteboom, 2007; Martens, 2007; Robinson, 2000; Agrawal & Lemos, 2006; Blomqvist, 2002), some of which in turn do refer to TCE and some don’t. All authors however build their own conceptual framework around the 3-Cs. Robinson, a development economist, takes the three ‘ideal types’ as starting point for studying inter-organizational relations and uses the 3C’s as institutional framework for addressing the problems of public action. Agrawal & Lemos (2006) employ the three models to construct a multi-partner governance model to replace the gap left by the receding state. Lenferink proposes to mix the three models to offset complexity and pairs the models with Public-Private Interaction in the Competitive Dialogue. All authors describe the three models as complementary but unrelated entities.

Martens (2007) similarly refers to three types of governance in spatial planning in an attempt to deal with “fuzziness” of governance as a result of integrating elements of competitive and communicative elements into previously coordinative processes resulting in a third communicative or “argumentative” model (in which learning, innovation and knowledge sharing are the main components).

Both Martens and Robinson strive to present three ideal types of governance. Ideal does not refer to what is most desirable, but to a pure form “ideal types are tools for thinking with” (Robinson, 2000). Martens (2007) similarly distinguishes three “prototypes that provide a yardstick to assess the attributes of real life governance processes and the position of various types of actor in those processes”.

Lenferink uses Robinson and Martens as inspiration. Robinson (2000) considers the 3C’s as ways of establishing stable patterns of transactions between people and organization for “structuring inter-organizational relations”. Each of the 3C’s is associated with a particular institutional framework of market, hierarchy and voluntary or reciprocal action (Robinson, 2000). Martens (2007) has a similar approach when relating governance processes and actors to the coordinative model, the competitive model and the argumentative model.

Another source repeatedly referred to by Lenferink is Blomqvist (2002) who in a study relating to partnering in a dynamic environment arrives at an adaptation of the TCE model. The benefits of the TCE governance strategies described by her are listed in table 4.2.

Interestingly Verhoest (2005) developed a comparable governance model in a Flemish context, based on similar mechanisms: market-type mechanisms, network-type mechanisms and hierarchy-type mechanisms. Each of these is a mechanism of coordination implemented by governments to coordinate activities of autonomous (public) organizations, a mechanism here is understood to be a process or system that is used to produce a particular result. Like in the model by Lenferink this results in a situational governance-mix of hierarchy, market and network (see table 4.1).
4.3 The 3-C governance structures

This paragraph will describe the three governance models and then link complexity factors to them. First, combining the insights of TCE, the sources mentioned by Lenferink and the Verhoest-model we arrive at a description of each of the governance strategies. Three elements constitute PPP governance according to van den Hurk en Verhoest (2015): structure; procedure and instruments. Structure is about the constellation of actors and institutions. Procedure regulates decision making during the operational phases. Instruments help to achieve the desired results and objectives.

4.3.1 Coordination

The hierarchical model is the traditional approach within infrastructure and public planning. Coordination is about taking a rational approach in situations where there are a number of centres of power (Lenferink, 2013), or as Martens (2007) puts it: coordination is the response to problems created by a governing body (in a public setting) that is comprised of many departments, sections and factions.

Hierarchic control is closely related to the bureaucratic mechanism, which refers to the principle of the Weberian bureaucracy based on (arbitrary) rules about available inputs, required processes, and/or standards of results and quality (Robinson, 2000; Verhoest et al, 2005; van Gestel et al, 2012). Prerequisite is the inequality between a governing body and the governed. Interaction therefore is based on authority and dominance (Verhoest et al, 2005; Martens 2007). Rule regulated and hierarchically organized a bureaucratic organization exercises authority as a control mechanism and therefore has a strong resonance with traditional views of management (Robinson, 2000). A hierarchy in TCE always trades the benefits of added coordination against the costs of added bureaucracy (Williamson, 1998).

Coordinative approaches require straightforward technical problems that are characterised by consensus about goals and products (Martens, 2007). The suggestion is that suitability of this model is inversely related to complexity. Various authors, observing time and cost overruns in the construction of infrastructure projects, confirm this (Lenferink 2013, Flyvbjerg, 2002). The government must be very knowledgeable about tasks, goals, process, actors and situation to be able to successfully apply this model in a DBFM(O)-context (van Gestel et al, 2012). DBFM(O) is considered to be useful as a project management approach aimed at controlling time, risks and money and for the reduction of uncertainties in complex infrastructural situations (Eversdijk & Korsten, 2009).

The main advantages of a hierarchical model include cost efficiency through economies of scale as a result of exploiting the monopoly position of government and a structured, stable, and directive approach to
planning (Blomqvist 2002). Although coordination could lead to stability and efficiency, it could turn out to be stifling and lead to failure if applied excessively (Lenferink, 2013).

<table>
<thead>
<tr>
<th>Markets</th>
<th>Partnership</th>
<th>Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ economies of scale</td>
<td>+ focus on core competencies</td>
<td>+ economies of scope</td>
</tr>
<tr>
<td>+ less risks</td>
<td>+ ability to coordinate dispersed knowledge</td>
<td>+ economies of scope through learning</td>
</tr>
<tr>
<td>+ less investment in specific assets</td>
<td>+ ability to create incentives for coordination e.g. trust</td>
<td>+ effective management &amp; control through ownership</td>
</tr>
<tr>
<td>+ increased flexibility</td>
<td>+ risk sharing through separate ownership of assets</td>
<td>+ cost-efficiency through economies of joint ownership</td>
</tr>
<tr>
<td>+ increases variety</td>
<td>+ investment in relation specific assets</td>
<td>+ competence enhancing innovations</td>
</tr>
<tr>
<td>+ high power incentives</td>
<td>+ improved quality</td>
<td>+ exploiting of monopoly power</td>
</tr>
<tr>
<td>+ efficiency through fierce competition</td>
<td>+ shorter time to market</td>
<td>+ efficient internal communication network</td>
</tr>
</tbody>
</table>

Table 4.2 Benefits provided by different (TCE) governance structures (Blomqvist et al, 2002)

### 4.3.2 Competition

Competition is correlated to the market model where firms relate to others around a market system based on prices, determined through the free interaction of demand and supply. Competition as a way of organizing is based on the use of price criteria to determine behaviour through the ability to exercise choice (Robinson, 2000). As opposed to coordination in the marketplace there are no rules as to entering in the transaction (Williamson, 2007).

The driver of competition is rent-seeking behaviour of market parties. All (competing) actors are autonomous and operate on a ‘level playing field’ that gets disturbed due to an uneven distribution of resources for power (Martens, 2007). Asymmetries in knowledge and information can dominate competition and lead to cost efficiency only, neglecting opportunities for increasing value through innovation (Lenferink, 2013).

The principal-agent theory points to three strategies to reduce the opportunistic behaviour of the agent (Verhoest 2003). Monitoring by the principal can reduce information asymmetry (by means of: observing; evaluating behaviour; evaluating the results of the agent); bonding safeguards the principal’s interests through close relations; rewards and sanctions stimulate the agent and risk transfer lowers incongruence of goals (van Gestel, 2012). Safeguards like penalties, information disclosure, verification procedures, specialized dispute resolution, will have to be built into the transaction (Williamson, 2007).

The market model seems to be suitable in a situation where the client is able to formulate the required output but finds it hard to specify the transformation process. Its advantages are flexibility, variety, and cost efficiency as a result of actors competing for resources (Lenferink, 2013).

From a TCE perspective the market is the preferred model for shaping transactions.

### 4.3.3 Cooperation

The model related to cooperation is the network model (Lenferink, 2013) partnership model (Blomqvist, 2002) hybrid (Williamson 1998) or communicative model (Martens, 2007).

Trust is fundamental to the idea of cooperation because while price or material gain is the control mechanism in the market and authority or coercion in a bureaucratic organization, trust and a common sense of purpose is the mechanism through which co-operative relationships are controlled (Robinson, 2000). Partnering is a common way of formalizing cooperation. Arditi et al (2005) found that the most cited definition of partnering was developed by the Construction Industry Institute: “Partnering is a long-term commitment between two or more organizations for the purposes of achieving specific business objectives by maximizing the effectiveness of each participant’s resources. This requires changing
traditional relationships to share culture without regard to organizational boundaries. The relationship is based on trust, dedication to common goals, and an understanding of each other’s individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services.25”

From the resource-based perspective, an IOR enables firms to obtain competitive advantage through sharing and combining their resources, thus achieving results that they could not attain on their own (Sánchez et al, 2012). In this respect Verhees (2013) compares companies in a Special Purpose Vehicle with athletes in teams competing in a context of cooperation according to sets of rules. Collaboration is necessary to make the market economy work (Smyth, 2007). Mutual dependence is a characteristic when tasks are decomposed or shared. As tasks become more interdependent or uncertain, the need for coordination, communication and joint decision making increases.

The SPV, which is usually a shell company, in turn sub-contracts the finance, design, construction, maintenance and soft services to companies that are often related to its shareholders. Thus there is a considerable network of linked organisations that together procure and provide the project (Demirag et al, 2011)

Lenferink (2013) adds that too much cooperation could also have some drawbacks, including non-commitment in endless rounds of negotiation, which may result in a lack of transparency, decreased democratic legitimacy of planning processes and distortions of the level playing field.

4.4 Public and private governance strategies for complexity
As Provan and Kenis (2007) argue, “the greater the inconsistency between critical contingency factors and a particular governance form […], the less likely that that particular form will be effective”. The complexity affects PPP governance, as the latter preferably aligns or respects the former (van den Hurk et al, 2015).

To systematically check the complexity-governance combinations, these combinations are ordered in sequence of the complexity factors, combining the ideas described in the previous paragraph and the previous chapter. For easy reference a summary of table 3.2. with complexity factors is provided below (table 4.3)

<table>
<thead>
<tr>
<th>Influence</th>
<th>Factors to be investigated in M&amp;O Phase; defined ex ante</th>
<th>3-C mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Issues</td>
<td>Relation management, performance management, information management</td>
<td>to be established</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>Rewards and compensation in M&amp;O, role of financial experts in M&amp;O phase.</td>
<td>to be established</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>Technical performance issues and risk management, technical solutions discussed, role of technical experts during M&amp;O</td>
<td>to be established</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>Legal roles and responsibilities, role of legal experts in the M&amp;O period.</td>
<td>to be established</td>
</tr>
</tbody>
</table>

Table 4.3 Summary of expected complexity factors in the M&O phase

25 https://www.construction-institute.org/scriptcontent/more/sp17_1_more.cfm visited 30-06-2015
Lenferink however does not use a singular perspective, but distinguishes governance from the perspective of the public and of private parties. We will discuss the legitimacy of this in literature and then proceed to make propositions for the complexity-governance combinations in the M&O phase including the distinction public-private governance. To avoid overly detailing and fragmentation, the differences are discussed per group (organizational, financial, technical and legal) rather than per complexity factor.

4.4.1 Differences in Public and Private Governance structures
Lenferink, being sponsored for the research by Rijkswaterstaat, regards the governance problem from the stance of the public client. Public is here the government or the state rather than an independent, commercial company or “private-party”. The private party is usually the consortium, but could be a (sub-) contractor. Lenferink in the CD phase arrives at coordination as the main strategy for the government and competition as the main strategy for the contractors, thereby introducing different governance strategies for interdependent participants in the same phase.

The original research is focussed on public and private interactions and experiences within the unit of analysis of the CD. Within the categories of investigated complexities, both different and similar experiences are reported by public and private parties. For instance in the case of information management, public parties complain about the difficulties obtaining information from all governmental levels whereas private parties experience a serious information overload. In other situations there are parallel experiences f.i. both parties report stifling effects of legal complexity. Consequently, these different experiences result in different governance strategies “...the framework of governance strategies (....) is dominated by two strategies: coordination (by public parties) and competition (by private parties)”. Parties in the same contract experiencing different complexities or experiencing the same complexities differently apparently can resort to different governance strategies.

In literature co-existence of different governance strategies has been described before, for instance by Chua & Mahama (2007). “The same interfirm alliance can exhibit multiple control patterns — for example, so-called market-based patterns may coexist with bureaucracy-based patterns”. The authors suggest that the neat “matching” between types of contingency factors and control patterns therefore may not hold. Apart from that, Hughes et al (2012) draw attention to the fact that definition is connected to perspective. In order to identify the meaning of “collaboration” within the UK construction industry they drew up a validated list of 48 aspects of collaboration, which was then scored by representatives of client and contractors, resulting in different definitions of collaboration, depending on perspective of client or contractor.

It would seem therefore that two cooperating parties in the same situation might have a different perspective and apply different definition of the situation resulting in different governance strategies.

4.5 Influence-Governance combinations
To systematically check the complexity-governance combinations these combinations are ordered in sequence of the complexity factors, combining the models described in the previous paragraph and chapter 3. Next they are compared for differences in public-private approach, to avoid overly detailing and fragmentation, the differences are grouped per main category of influences.

4.5.1 Organizational complexity
In Organizational complexity, the main issues are expected to be: Relation management, Performance management and Information management.
Relation Management and Cooperation

Trust and a sense of common purpose is the mechanism through which co-operative relationships are controlled (Robinson, 2000). Both trust and a sense of common purpose are part of the M&O phase

Relation management (the practice of building a strong relationship between contractor and client) is expected to be dominant in the interactions between client and contractors. For a strong relationship trust is essential. As pointed out by Sako et al (1998), conditions that facilitate the creation and sustenance of trust (and the containing of opportunism) are: long-term commitment, information exchange, technical assistance and client’s reputation. These conditions seem to be met in DBFM(O) and it would seem therefore that trust is an important aspect in the relation between contractor and client.

The SPC has made a considerable investment, and return on this investment depends on customer satisfaction, which in turn is based on a thorough understanding of the requirements of the owner and user and the need to respond and anticipate to guarantee an uninterrupted availability of the service, thus providing the basis for a trusting relation. For the client and contractor, an open attitude is necessary and the readiness to share information and requirements, confirming the findings of Verhoest (2005) that cooperation and solidarity are the basis of interaction between contractor and client.

Van Gestel (2012) stresses the importance of path dependencies (present and future choices are conditioned by choices made in the past) in early stages of the contract. These are expected to be part of the trust building process in the developing operational relationship.

It is expected that reciprocal dependency for reaching shared goals over a 20+ year period will lead to strong relations with trust at the basis and cooperation as governance mechanism.

Performance management and Cooperation

Performance management is about the formal, procedural and technical fulfilment of the contract and requires a systems approach: monitoring input, process and output, adjusting and intervening in the processes and improving the output (Martens, 2007). Availability of a service is usually easily established, in case of buildings however parts of the building might be operational whereas other parts are only partly unavailable for the required purpose, complicating establishing whether or not contractual obligations are met. Establishing quality of service might be similarly difficult, for instance in the case of cleaning (Reynaers, 2014). It is expected however that these incidental complications usually are dealt with in an attitude to improve the service as part of the learning circle described previously (fig 4.1.).

Consciously designed purposes of the contract, results in shared values, common problem analyses, consensus, loyalty, reciprocity, trust and informal evaluation (Verhoest, 2005). This process requires ability to coordinate disperse knowledge within the consortium, but this coordination is of a standard nature and is itself not complex. According to Blomqvist (2002) the incentive for this type of coordination is trust. In the interaction between public and private parties, building trust through tuning the expectations and meeting the performance criteria is expected to be the real issue, and cooperation therefore the dominant governance strategy.

Performance management is generally not complex in the operational stages and requires collaboration that strengthens trust and a cooperative governance structure.

Sako (1992) distinguishes three types of trust: contractual trust (will the contractor carry out his contractual agreements), competence trust (is the other party capable of doing what it says it will do), and goodwill trust (will the other party make a dedicated commitment to take initiatives for mutual benefit while refraining from unfair advantage taking).
Information management and Cooperation

Information management is conditional, it provides the proof of the performance and, as the database with technical information is transferred from build to operate, requires updating according to M&O interventions. With access to full information by the client, the information- asymmetry between principal and contractor is reduced and thus supports the building of trust.

In private-private relations in projects with a high degree of technical complexity as in DBFM(O), different actors and their expertise are required forming a network with cooperation as strategy for governance with open information flows, generally with cooperation as the preferred strategy for organizational issues for both parties.

Information exchange creates a level playing field for clients, contractors and subcontractors, and is supportive for a cooperative governance structure.

Proposition 7: Organizational -Cooperative

The client’s main concern is operational availability; the SPV’s main concern is guaranteeing operational availability in order to receive a good return on investment. In the stability of a 20+ year contract client and contractor therefore share the same goal, a good service, resulting in shared values, common problem analyses, consensus, loyalty, reciprocity, trust and informal evaluation (Verhoest, 2005). The duration of the contract allows for developing stable and trusting relations. Similarly performance management and sharing of information is part of the M&O teamwork strengthening the trusting relationship. Competition is no issue here. Coordination, if present, is dominated by cooperation.

Proposition 7: Cooperation is for organizational issues the preferred governance strategy for both public and private parties.

4.5.2 Technical complexity

Technical issues during M&O are: performance issues and risk management, technical solutions discussed by technical experts at the time of renewal activities or contractual changes.

Technical performance and risk management and cooperation / coordination

As for performance issues and risk management, optimal operational availability is achieved through flawless technical performance. Technical performance can be hampered by uncertainty (unpredictable) and risk (predictable). In relation to M&O, both risk and uncertainty will be briefly discussed.

Uncertainty relates to what is (yet) unknown. For the duration of the contract the consortium becomes responsible for detecting and repairing malfunctioning or damage, these however are not all predictable. In addition, the responsibility for the operation implies that the consortium must carry out processes in relation to public service delivery; sometimes these may be out of the scope from the contractor regarding know-how (Reynaers, 2014). This leads to uncertainty and requires the contractual partners to explore new avenues. On top of this Roehrich (2014) reports that there is limited understanding of the interplay between performance-based contracts, incentive mechanisms and subsequent service performance; with much of the specific research on incentives being conceptual. For uncertainty then no remedy exists apart from flexibility and alertness, for maintaining a versatile stance, open communication and information sharing are vital, and the accompanying governance would seem to be cooperation.

Technical risks may arise from a fault in the specifications or the design including (intensity) of use (Reynaers, 2014; Ng & Loosemore, 2007). Potential outcomes of risk can be statistically determined (Broadbent et al, 2008) and measures can be taken to control these. Malfunctioning of the construction can be controlled through maintenance strategies that include planned inspections, life cycle
management and failure and reliability control. A strictly planned schedule of maintenance activities and management of the assets reduces service failures. Maintenance, for instance for a road, requires careful planning (during maintenance the asset is not available), strict planning and execution of maintenance. Risks therefore can be controlled. In addition these processes can be streamlined. In two PPP case studies Ng & Wong (2006) report a less bureaucratic system (in comparison to a traditional contract) for operational maintenance activities like: inspection, estimation, measurement, issuance of work orders, without hampering this strictly protocollled program. Efficiency and optimization of (maintenance) workflows in a DBFM(O) lead to a more effective system. Within the consortium and in the interaction with its contractors and subcontractors, coordination is therefore expected to be the preferred governance scheme for controlling risk.

In technical performance and risk management the governance strategy of coordination is expected to be leading in private-private interactions, but in the interaction with the client cooperation is the preferred strategy.

Technical issues discussed and role of technical experts
“While technicians were being fired, contract and process managers were being hired”. This quote from Reynaers (2014) describes the shift in the role of the government from all-round design-build-maintain experts to a role of coordinator and supervisor. The client therefore is increasingly dependent on the contractor for technical expertise. In practice the lender’s technical advisor acts in support of the client. This technical advisor carries out due diligence and reports on technical issues or risks to the financers (Demirag et al, 2011). Financers have a keen interest to secure optimal technical availability as they rely on availability fees only for repayment of their investment. In doing so, at the same time supporting the client in achieving maximum availability of the service. It is in the interest of the SPV however to increase profitability of the contract, they might want to innovate, reducing operational cost (Hansen, 2011) or extend the economical life cycle of an object beyond the estimated technical life cycle. In both cases the lender’s technical advisor is likely to object, as it is his role to minimize risks (stick to proven technology) and to maximize operational availability (keep the assets up to standard).

Another technical issue is the tension between the lifecycle approach and the likelihood of political and opportunistic interferences over time (van den Hurk et al, 2015). Changes in political agenda due to public pressure might intervene in long term life cycle oriented programs.

The focus on managing risk and uncertainty, instrumental for the overall goal of optimal service and reduction of life cycle costs, requires a collaborative attitude of all players. It is assumed that due to the technical developments during the contractual period and the practice of subcontracting a more competitive attitude towards innovative technology and outsourcing might be present at the part of the contractors (van Assem, 2013).

Proposition 8: Technical Cooperation with some Coordination / Competition
Risk of failure and uncertainty stimulate open information exchange between client and contractor to plan maintenance and ensure maximal operational availability. As well as that, the client lost much of the technical know-how over the past years through outsourcing and therefore has become more dependent on the contractor in technical matters. Between Contractor-Client a Cooperative relation is expected. Next to Cooperation, Coordination is expected between the SPV and its many subcontractors. In addition some Competition might be present as the subcontractors are expected to have short-term contracts only.

Proposition 8: Governance on technical issues is dominated by cooperation from both parties. In private-private interactions, next to cooperation, both coordination (risk based maintenance) and competition (innovations and technological developments) are present.
4.5.3 Financial Complexity

Financial issues in M&O are expected to be: *rewards and compensation* and the role of financial experts.

**Rewards and compensation and a mix of Coordination and Cooperation**

In *rewards and compensation* the contract has a coordinating role. The contract stipulates output criteria, and the consortium’s monitoring plan approved by the client provides details of the performance. Monitoring reports and user feedback provide input for weekly, or monthly meetings between the consortium and the procurer, performance is evaluated and, if necessary, adjusted. If the service is not up to standard, the consortium receives a financial discount that is expected to stimulate the performance. (Reynaers, 2014) Rewards and compensation are thus regulated by bureaucratic mechanisms: based on the contract, with strict monitoring systems, with rules about processes, with standards of results and quality, and thus with coordination as leading governance principle for all participants. Despite the bureaucracy-coordination relation, even in this situation cooperation is expected to prevail.

For applying coordination in a DBFM(O)-context, the government must be very knowledgeable about tasks, goals, processes, actors and situation (van Gestel et al, 2012). It is however precisely the problem of a failing hierarchical approach that led to the institution of integrated contracts, a hierarchical approach in a complex contract like DBFM(O) in the past appeared a recipe for failure. Discussions are unlikely to focus on contractual remuneration, rather the interpretation of the service-performance will lead to discussions. In addition, in a study concerning PPP infrastructure projects Zou et al (2008) identified three key issues for structuring the relation between principal and contractor, viz.: balance of interest, value for money and risk allocation and management. Essential for achieving value for money in PPP projects is “protecting the public interests and allowing the private partners to gain reasonable return on their investments”, in the interaction between government and contractors a balance in dealing with issues over the life cycle is conditional for success (Zou et al, 2008).

Summarizing this topic it is established that the contract offers a hierarchical governance structure for performance and financial compensations. In the interactions on this topic however, a network perspective or cooperation is expected to be dominant. It is assumed therefore that on the topic of rewards and compensation a mix of coordination and cooperation applies for both the government and its contractors.

**Financial experts and Cooperation**

*Financial experts* operate on behalf of: the client, the SPV and/or contractor, and the lender. These three positions will be briefly discussed.

The client will have a restrained position, if control and checks from the client increase, the risk exists that the client takes responsibility for the service from the contractor, thereby undermining the DBFM(O) philosophy and creating a dangerous legal precedent (Reynaers, 2014; Wijsman, 2011).

It is the nature of a DBFM(O) that the contractor proves the service output to safeguard a steady flow of income. At the same time, creating difficult calculative models and an extensive system of checks and control by the SPV would increase overall costs. An accessible system that is relatively easy to maintain with the focus on maintaining organizational processes rather than punishing mistakes is therefore the preferred approach in a DBFM(O) (Koster et al, 2008). An effective and efficient competence enhancing governance structure is therefore instrumental to the cooperative approach during M&O.
The financial expert representing the financiers has the keenest interest in safeguarding the flow of remuneration, as the banks have no other means for receiving compensation for their investments. The main interest for this financial expert however is on the technical aspects, reducing risks.

From all three perspectives the financial processes are geared towards a mutually beneficial simple organizational set-up, complexity is expected to be limited, as is the role of public and private financial experts, and governance therefore is expected to be based on cooperation (Zou et al., 2008).

**Proposition 9: Finance-Cooperation**

Financial M&O settlements in a DBFMO are subject to a bureaucratic structure of contractual rules. A hierarchical Coordinative approach therefore would be logical. Literature however, suggests that complexity and hierarchy appear not to be a good match. Instead a “balance of interest”, “protecting public interest and allowing private parties a reasonable return on investments”, (Zou et al., 2008) with flexibility and room for discussion on the interpretation of service performance rather than the financial settlements seems to be the strategy.

Financial experts appear instrumental in situations of contract change only. All parties involved (client, SPV and contractor) are keen on a simple and transparent (cheap) system and rather focus attention and time on the operational processes than on financial settlements.

Proposition 9: In financial matters the DBFMO is expected to have Cooperation as the dominant governance model, mixed with some coordination for maintaining a transparent structure.

### 4.5.4 Legal

Legal issues during M&O play in case of contractual changes, but amendments to the contract are out of scope for standard M&O operations. The situation under study is therefore that the legal framework of the contract and supplementing manuals stabilizes the relation and trust operates to control possible remaining risks and uncertainties.

It is assumed that apart from contractual changes, legal aspects are hardly an issue, that the contract has a coordinating role and that in the interaction trust is vital and therefore cooperation the dominant governance mechanism.

**Proposition 10: Legal-Cooperation**

Proposition 10: Cooperation is the dominant governance structure for Legal.

### 4.6 Summary and conclusions

In the M&O phase an extensive network of actors has a shared focus on achieving the required performance over a prolonged period of time. It is expected that relational aspects prevail, that relationship management will be a decisive organizational influence, and that cooperation will be the dominant governance structure for both public and private parties. Combining the insights of the four complexities in chapter 3 with the understanding of the 3-C governance framework in this chapter, results in a hypothesis over the governance structure as summarized in table 4.4.

<table>
<thead>
<tr>
<th></th>
<th>public</th>
<th>private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Issues</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>cooperation</td>
<td>cooperation/coordination/competition</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>cooperation/coordination</td>
<td>cooperation/coordination</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
</tbody>
</table>

*Table 4.4 Expected dominant governance forms per group of issues and party*
5 Methodology and implications for (Empirical) Research

5.1 Introduction and overview
At the start of the research, two experts were consulted, the author of the 3-C model (Lenferink, may 2015) and a fellow PhD of Lenferink working at the contractor-side (see enclosure 3 for a full list of people interviewed). Both contacts were instrumental in respectively confirming and denying the scientific suitability of the current study and for “developing suitable theories to help understand the logic of the social systems within the domain” (Ahrens & Chapman, 2006).

“A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of the study” (Yin, 2009). This chapter will focus on producing a design for the empirical research and “the iterative process of generating a plausible fit between problem, theory and data” (Ahrens and Chapman, 2006). Step by step we will develop an approach for empirical research from research goal to type of study, the field, unit of analysis, data gathering and analysis and finally reliability and validity.

5.2 The Research Goal and methodology
A governance mix of cooperation, competition and coordination seems to adequately suit all phases of a DBFM(O) and holds the promise to leave room for adapting the mix according to the characteristics of the separate DBFM(O) stages. The aim of this study is to research whether the CCC-governance model can be employed in a wider context than the DBFM(O) Design phase, viz, in the Maintain & Operate-phase (M&O) of both Building and Infrastructural projects. This research goal will be used as the yardstick for constructing and evaluating the methodological framework in this chapter (Wester, 2005; Yin, 2009).

![Diagram of Complexity Factors and Governance-mix](image)

Figure 5.1 The research framework

Lenferink formulated the 3C governance model ex-post, his methodology can be characterised as constructivist. We will continue from Lenferink’s results from a more positivist stance and have opted for ex ante propositions. The theoretical study has resulted in ten propositions. Using propositions is instrumental for results in line with the research question. “Only if you are forced to state some propositions will you move in the right direction” (Yin, 2007). A proposition tells where to look for relevant evidence as well as enabling us to critically evaluate the underlying assumptions of the propositions.

The terms "proposition" and "hypothesis" both refer to the formulation of a possible answer to a specific scientific question. A proposition deals with the connection between two existing concepts: “A statement
in which something is affirmed or denied in terms of something else. A hypothesis is a comprehensive tentative explanation of certain phenomena” (Webster Dictionary of the English Language, 1998 edition). The main difference between the two is that a proposition deals with concepts and traditionally a hypothesis is testable and measurable experimentally (Eisenhardt, 1989). A methodological difference with Lenferink’s research therefore is a more positivistic stance.

5.3 Qualitative Approach

The empirical research has an explorative nature, as there are no earlier studies into governance with the CCC-model in the M&O phase of an integrated contract. A statistical survey would not meet the challenges of studying the phenomena, their complex relations, nor would it be feasible to accommodate these characteristics or find a sample group to draw statistically viable conclusions, which according to Yin (2009) qualifies a study for qualitative research. It will be argued that a qualitative approach is in line with the goal of this research. “The attribute ‘qualitative’ is a question of methodology, the general approach taken to the study of a research topic” (Ahrens & Chapman, 2006). Jansen (2007) defines qualitative research as: “all research in which objects are expressed mainly in qualities and in the analysis a diversity of characteristics and combinations of characteristics are researched, possibly in relation to specific contexts, or in brief “a research into diversity rather than quantity”.

According to Verschuren (2011) some indicators for choosing a qualitative research strategy are as follows. The phenomena are relatively new (governance of DBFMO) and little theory is available yet; impermanence of the situation (quickly developing practice and contract type) calls for an empirical rather than a theory driven approach; there is only a small focus group (relatively few DBFMO contract types have entered exploitation phase) resulting in a small research-population; interrelatedness between members of the population (members of DBFMO community share but also compete for information). Other criteria for qualitative research are that behaviour of those involved in the study cannot be manipulated by the researcher, contextual conditions like type of industry (building; infra; rail; air) scope of contract (D/B/F/M/O/R) or number of parties involved influence the actual phenomenon under study; boundaries between governance, complexity factors and the context in which they are studied cannot de distinctly drawn yet, (Yin, 2009; Baxter, 2008)

In addition Jolink and Niesten (2012) report that a qualitative approach allowed them to identify new and emerging insights on the formation, functioning and implications of hybrids (a hybrid is a collaboration between organizations as in the case of a DBFMO consortium). In addition, such an approach is supposed to provide new information on the dynamics and the institutional environment of these hybrids, because of its focus on process and context.

Exploratory nature

The study contains elements of explanatory, descriptive and explorative research. The study is explanatory in the way that it investigates whether the 3-C concept offers an opportunity for greater understanding the M&O phase. It is descriptive in the sense that it identifies and records the elements of

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27 Webster Dictionary of the English Language, 1998 edition. The full entry reads: A statement in which something (the subject) is affirmed or denied in terms of something else (the predicate). In the proposition grass is green and grass is not red, grass in each case is the subject and red and green are the predicates respectively.

28 Kwalitatief onderzoek is alle onderzoek waarin kenmerken van objecten voornamelijk in kwaliteiten worden uitgedrukt (soorten dingen, manieren van doen), en in de analyse van soorten, combinaties van kenmerken worden onderzocht (categorieën, typen), al dan niet in relatie tot specifieke contexten (causale analyse).

29 “Organizations have come to realize that joining forces, resources or market presence can be a successful strategy for growth and performance. Scholars of business organizations have recognized this development and have included these collaborative efforts into their research agenda. They study the specificities of joint ventures, franchising, licensing, networks, cooperation, trade associations, or the like. These varieties of organizational forms have come to be known as hybrid organizations or hybrids” Jolink and Niesten 2012.
a phenomenon, both in the extensive preliminary work to gain familiarity with the phenomena and their context (Sekaran, 2010) and in the reporting of the results (enclosure 5). Its main focus however is explorative. “In essence, explorative studies are undertaken to better comprehend the nature of a problem since very few studies are conducted in that area” (Sekaran, 2010). Although a case study is an appropriate research strategy for exploring how and why questions, Yin (2009) indicates that “what” research type questions as in this study are suitable to be researched with all research methods. We will further investigate this in the next paragraphs.

5.4 The “Field”, Domain or Case and contextual constraints
According to Ahrens & Chapman (2006), the shape of the field depends on its usefulness for answering the research question. Yin (2009) rather talks about case studies, which he defines as an “empirical enquiry into a contemporary phenomenon in a real life context over which the researcher has no control, without clear boundaries between phenomenon and context”. Yin uses “unit of analysis” as a synonym for “case study” This is underpinned by other authors: “The unit of analysis is the major entity to be analysed in a study; the phenomenon to be investigated” (Provan & Kenis, 2007). This unit of analysis can be the subject (the who or what) of study about which a researcher may generalize (Long, 2004).

The goal is to research the 3-C model in a context broader than its original infrastructural and CD-setting. In chapter two it ensued from theory that both Building and Infrastructural projects should be included as together these account for the Dutch DBFM-O-market. The Dutch situation furthermore can be regarded as having a set of shared characteristics that sets it apart, viz. it combines private financing and public funding whilst ownership over the construction rests with the government. Another characteristic is that the Dutch DBFM(O) practice has a high level of professionalism, implying that the main source for improving the process is through learning rather than looking abroad for examples (§2.3.1). The research domain or case therefore can be scoped as the Dutch (DBF-) MO contracts. This meets the criteria from Ahrens & Chapman but more importantly in our study, from Yin as well.

In the theory a distinction has been found in governance from the perspective of the client and from the contractor. These issues were deliberated on in chapter 4. Both groups therefore need to be included in the sample group. As we seek corroboration of the 3-C governance mix as mechanism in different DBFM(O) situations, we will use replication i.e., testing the same set of propositions in all groups and cases to be studied. It should be noted that participant organizations are active in multiple cases.

![Figure 5-2 Overview of interviews in the “Domain”](image)

The matrix 5.2. shows both the planned and, for easy reference, the realised contacts. Combining these variables (building and infrastructural contracts from the perspective of client and contractor), two interviews (see § 5.5) per combination are planned, viz in the infra and in building two interviews with clients and two with contractors, i.e. a total of 8 interviews. A second reason for more
than one interview per quarter (see figure 5.2) is to look for (in-) consistencies per combination between the interviewed. In order to qualify for an interview, both the organization and the interviewee will have to be involved in the exploitation of a DBFMO contract.

5.5 Producing data, the methods.
Data are the result of an intentional intervention from the researcher and therefore “produced” in the study. Effectively describe the data that will be necessary for an adequate testing of the hypotheses and explain how such data will be obtained.

The data to be produced therefore will relate to the propositions and the study will be of a qualitative nature with the individual actor as unit of analysis. An interview then seems to be the obvious method for producing data. The ten propositions will be either accepted or rejected, and when feasible remarks will be included.

Table 5-1 Data to be produced from the interviews

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<thead>
<tr>
<th>Propositions</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>The complexity factors in the CD and the M&amp;O phase</td>
<td>To be established</td>
<td>To be established</td>
</tr>
<tr>
<td>3 – 6</td>
<td>The issues pertaining to complexity factors in the M&amp;O phase</td>
<td>To be established</td>
<td>To be established</td>
</tr>
<tr>
<td>7 – 10</td>
<td>Governance of complexity factors</td>
<td>To be established</td>
<td>To be established</td>
</tr>
</tbody>
</table>

The interviews will be conducted face-to-face at the interviewee’s office and will be semi-structured. Interviewees will be informed by telephone or e-mail on the purpose of the study and the themes to be discussed. If asked to do so a brief written introduction will be e-mailed before the interview. This introduction with the main concepts of the research is also to be handed over at the start of the interview (see enclosure 4). The complexity factors will then be introduced and the interviewee will be asked to provide characteristics of the complexities in his (DBFMO is a man’s world) particular M&O context. At the end of the exploration of the complexity factor the interviewee will be asked what governance form is / are present in relation to the complexity factor. When this has been sufficiently clarified the interview will move to the next complexity factor. At the end interviewees will be invited to introduce whatever information they feel to be relevant, add to the categories or comment on them. Newly emerging topics will be explored during the interview to generate descriptions and interpretations from the perspective of the participant.

The interviews will be recorded and (partially) transcribed for use by the researcher. Results will be grouped in four categories: Infra-client; infra contractor; built-client; built contractor. In enclosure 3 the roles and organizations of the interviewees are coded to these four categories. These will then be matched with the propositions linking complexity and governance, and based on the findings can be either accepted, rejected or adapted. Results will be reported in the next chapter based on the propositions summarized in table 3.3 and 4.4.

5.6 The issues of reliability and validity
Yin (2003) contends that researchers should explicitly pay attention to the issues of validity and reliability when designing and conducting a case study. He identifies four tests that are relevant to case studies: construct validity, internal validity, external validity and reliability

Construct validity, has to do with establishing and applying the correct measures for concepts being studied. The first test is to provide a “sufficiently operational set of measures”, a criterion met by defining the complexity factors, and formulating propositions about the combination of these factors and governance patterns. The process of data collection has been spelled out in the previous paragraphs (the
field; unit of analysis and method for data production) with 8 interviews planned, thereby providing “multiple sources of evidence”, a second condition according to Yin. Finally, “a chain of evidence” is provided by developing step by step the theoretical chain from research question to DBFMO and its context, to defining M&O, to governance in M&O, to propositions to empirical research and analysis of the data.

Internal validity is supposed to be most important when researching causality of relations. Figure 5.1 shows the four complexity factors resulting in a governance mix. A causal relation is assumed here because the “cause” precedes the “effect” and because “cause” and “effect” are related. Yin (2009) poses a number of additional conditions. If there are plausible alternative explanations relating “cause” and “effect” and when they are based on inferences, internal validity is important. Yin however states, “this logic is inappropriate to descriptive or exploratory studies”. In view of the exploratory nature of this study (§5.5), analytic tactics will not be included.

External validity refers to the extent to which a study’s findings can be generalized to other populations or settings (Yin, 2009). It is precisely this type of validity that started this research, seeking to extend the findings of Lenferink’s study to a wider population. This validity is supported by the fact that several infrastructural and building contracts will be part of the study and that several representatives of clients and several representatives of contractors will be asked to provide data.

The fourth issue, reliability, requires the researcher to demonstrate that the case study could be repeated producing the same results. ‘The objective is to be sure that if a later investigator followed the same procedure as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions” (Yin, 2009). Here, Yin suggests that investigators present a case study plan, use a case study protocol and develop a case study database. In the present study, these measures were implemented in order to improve the reliability of the study.

5.7 Summary and Conclusions
The empirical research will have an explorative nature and will follow research lines as formulated by Ahrens & Chapman (2006) and Yin (2009). A qualitative methodological framework, in which the Dutch (DBF-) MO contracts are the research domain, the individual actor at client or constructor’s side is the unit of analysis and data will be collected in semi-structured face-to-face interviews. Data will be analysed based on propositions summarized in table 3.1 and 4.4.

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30 Inference is the act or process of deriving logical conclusions from premises known or assumed to be true. (Webster international dictionary 1998 edition)
6 Research & Analysis

6.1 Introduction
In eleven interviews (enclosure 3) a variety of integrated contracts were discussed, from museums and government offices to infrastructural projects like airport runways, locks, roads and railways with input from clients, contractors, experts and scholars. These different perspectives will provide an answer to the 5th sub question.

*What is governance with the CCC-model in the case studies in the DBF-M&O phase?*

This chapter will provide a comprehensive summary of the findings only with the aim of “organising field data in a meaningful contribution” (Ahrens & Chapman (2006). Results will be presented in a more descriptive way in enclosure 5. In the next paragraphs we will focus on establishing a true or false of the 10 propositions formulated in the previous chapters. In doing so we will follow the course of the interviews where first the four overall complexity categories of Organization, Financial, Technical and Legal issues were on the agenda. Next per complexity factor the constituent parts of the influences were discussed. Once it was established whether or not the issues per complexity factor represented the situation of the interviewed, per complexity factor the prevalent governance mix describing the situation from the perspective of the interviewed was established.

At the end of this chapter we will discuss any additional issues suggested during the interviews.

6.2 The four Complexity Factors & their Governance-mix

Proposition 1: *The four categories of complexity adequately cover the M&O phase as well as the CD phase.*

All interviewed confirm the relevance of the four factors of Organization, Financial, Technical and Legal issues for describing the M&O phase and are able to provide examples of each factor in their own context. It can be confirmed therefore that the model can be successfully applied in the M&O phase outside the initial scope of the Competitive Dialogue phase.

Proposition 2: *Influences are DBFMO-phase dependent and will differ between CD and M&O-phase.*

Discussing the sub-elements of the M&O phase, all interviewed report to recognize the elements as relevant and giving a complete and covering overview of issues in the interaction. However upon discussing them in more detail their degree of relevance seem to differ substantially.

Propositions and findings are summarized below in table 6.1

**Table 6-1 Overview of factors per Influence**

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The four categories of complexity adequately cover the M&amp;O phase as well as the CD phase</td>
<td>True</td>
<td>na</td>
</tr>
<tr>
<td>2</td>
<td>Influences are DBFMO-phase dependent and will differ between CD and M&amp;O-phase</td>
<td>True</td>
<td>Degree of relevance differs</td>
</tr>
</tbody>
</table>

6.2.1 Organizational issues

Proposition 3: Organizational issues in M&O are: Relation management, Performance management and Information management.
All interviewed are unanimous that the three issues cover the M&O organizational complexities adequately. No suggestions for additions or supplements were put forward.

It is undisputed furthermore that management of relations is the main feature pervading all interactions between private and public parties. There is a strong belief in cooperation as the most beneficial interaction strategy between client and contractor to shape the long-running contract. In the private-private interaction however, interactions are not always harmonious.

Complexities in performance management appear to be relatively limited. No major disputes are reported over differences between Output Specifications and Performance. “Performance management is a way of checking right understanding” and “performance management and information management are the means to establish a good relation”. All parties agree that just after the construction becomes operational, performance issues peak, but these decrease gradually and managing them is reduced from a full time occupation to a few minutes per week. “There is trust, we inform each other, and we know the issues involved”.

In information management no structural organizational complications have emerged in the cases studied.
Sometimes in operation information management is crucial, for example for instance Information Management includes all up-to-date operational travel information for passengers.

Proposition 7: Cooperation is for organizational issues the preferred governance strategy for both public and private parties.

Below follows a summary of the findings from the interviews. A “1” means the preferred strategy, a “2” the second and sometimes “3” for a third preferred government structure. Sometimes there will be several 1’s, 2’s or 3’s from one party, this means that the interviewed considered them equally important. Enclosure 3 provides the details for client and contractors.

**Table 6.2 Overview of Governance mix for Organizational Issues.**

<table>
<thead>
<tr>
<th>Organizational Issues</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooperation</td>
</tr>
<tr>
<td>1 client</td>
<td>4 x 1</td>
</tr>
<tr>
<td>2 contractor</td>
<td>7 x 1</td>
</tr>
</tbody>
</table>

Following the summary in table 6.2 it would seem there is consensus regarding Cooperation as the dominant governance strategy. Most striking is the consensus from public and private parties, strongly voiced in the interviews that in all complexity aspects cooperation is the dominant governance mechanism.

**Table 6.3 Overview of Organizational Issues and governance-mix**

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Organizational issues in M&amp;O are: Relation management, Performance management and Information management.</td>
<td>True</td>
<td>na</td>
</tr>
<tr>
<td>7</td>
<td>Cooperation is for organizational issues the preferred governance strategy for both public and private parties.</td>
<td>True</td>
<td>Cooperation is deemed dominant in all aspects.</td>
</tr>
</tbody>
</table>

Noteworthy is that relations between partners within the consortium can be adversarial. Disputes are reported but show a capacity for learning. It is not just the private-private relation that can be problematic; some clients report that it is often easier to reach understanding and agreement with contractors than within their own organization. Apart from these issues however, cooperation between
private companies thrives. For instance knowledge sharing initiatives are in place for all branches and project types.

6.2.2 Technical Issues
Proposition 4: Technical issues during M&O are: performance issues and risk management, technical issues discussed by technical experts.

Performance issues and risk management. For the contractor, risk is accepting that objects will not perform according to specifications or have a shorter lifecycle than expected. All cases report a strict maintenance regime laid down in a maintenance plan per object. The objective is keeping assets available within control limits. Prevention, including theft and accidents, is generally more expensive then correction. Risk is reduced by prevention, but too much prevention is costly, creating a financial dilemma that impacts contractual performance. Generally M&O staff operates prudently aiming at controlling costs while guaranteeing availability of the asset. The subject of performance issues and risk management is recognised and reported as relevant by all interviewed.

For technical issues, contractors and clients report that during M&O the contractor has all the necessary expertise available. Technical experts are called in only for support at the end of the life cycle of installations or when new investments need to be made. Problems encountered at operational level are solved in dialogue between technical staff and representatives of the owner or user. In some contracts however technical complexity extends beyond the know-how of the contractor, requiring specialised equipment or service, in which case knowledge is bought or hired. In general all parties acknowledge a loss in technical know-how by the owner, who manages the contracts through output specifications. One of the ways to create dialogue about technical issues therefore is implementing so called “kennistafels” and other opportunities for knowledge sharing between experts. It can be concluded that technical exchanges between experts are limited to end of life cycle issues and that generally speaking exchanges on technical issues is not a part of routine operations in M&O.

Proposition 8: Governance on technical issues is dominated by cooperation from both parties. In private-private interactions, next to cooperation, both coordination (risk based maintenance) and competition (Innovations and technological developments) are present.

<table>
<thead>
<tr>
<th>Technical Complexity</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooperation</td>
</tr>
<tr>
<td>1 client</td>
<td>2 x 1</td>
</tr>
<tr>
<td>2 contractor</td>
<td>2 x 1</td>
</tr>
<tr>
<td></td>
<td>5 x 2</td>
</tr>
</tbody>
</table>

* At the time a competitor (Intech, about to collapse) was in the partnership.

In 3 interviews Cooperation is reported to be the main governance strategy, in 7 interviews however Coordination is reported to be dominant and in 1 they are deemed of equal importance

Table 6-5 Overview of Organizational Issues and governance-mix

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Technical issues during M&amp;O are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) performance issues and risk management,</td>
<td>a) True</td>
<td>na</td>
</tr>
<tr>
<td></td>
<td>b) technical issues discussed by technical experts.</td>
<td>b) False</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>a) Governance on technical issues is dominated by cooperation from both parties.</td>
<td>a) False</td>
<td>In 3 out of 11 only Cooperation is dominant</td>
</tr>
<tr>
<td></td>
<td>b) True</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

31 Kennistafels is a platform for the four big rail contractors in the Netherlands, but similar initiatives are in place for other infrastructural areas and for buildings.
b) In private-private interactions, next to cooperation, both coordination (risk based maintenance) and competition (innovations and technological developments) are present.

From the interviews it emerged that a reason for the strict M&O regime is that, multiple subcontracted parties are required to perform within a planned and coordinated framework on which service and ultimately remuneration depends.

6.2.3 Financial Issues

Proposition 5: For finances, the rewards and compensation and the role of financial experts are expected to be the two major influences.

The general opinion on these two influences appears however that they are not complex: “I am not inclined to call this complex, it is more a matter of balancing, how to spend the available resources”. In the interviews, financial mechanisms irrespective of their impact are accepted as “the rules of the game” not controversial, not requiring experts, but part of the contract.

Once the contract is closed the rewards and compensations are no longer a source of complexity in interaction, instead attention is focussed on clear communication, transparent information and good management. Meetings between client and contractor are typically scheduled weekly on basis of which financial settlements follow, monthly or per quarter. Top management routinely discusses standard operations with financial experts, but generally experts are only called in when the contract is changed. Overall Financial issues are acknowledged as important, but monitored as part of the routine operation: “Financial complications are settled in the contract, not in M&O”.

Proposition 8: In financial matters the DBFMO is expected to have Cooperation as the dominant governance model, mixed with coordination for maintaining a transparent structure.

<table>
<thead>
<tr>
<th>Financial complexity</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 client</td>
<td>Cooperation</td>
</tr>
<tr>
<td></td>
<td>4 x 1*</td>
</tr>
<tr>
<td>2 contractor</td>
<td>6 x 1</td>
</tr>
<tr>
<td></td>
<td>1 x X****</td>
</tr>
</tbody>
</table>

* One client asked to include “quite straightforward; contractually arranged, is not too complicated”
** Within client organization.
*** With partners in other contracts
**** Operations manager deemed himself unsuitable for making statements on financial issues

Table 6-6 Overview of Governance mix for Financial Issues.

Although in the discussion the contract is given a co-ordinative role, once asked to name the dominant governance structure all involved resign to “cooperation”.

Table 6-7 Overview of Organizational Issues and governance-mix

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>For finances the two major influences are expected to be:</td>
<td>a) True</td>
<td>na</td>
</tr>
<tr>
<td></td>
<td>a) the rewards and compensation and</td>
<td>b) False</td>
<td>Financial experts have no role in</td>
</tr>
<tr>
<td></td>
<td>b) the role of financial experts.</td>
<td></td>
<td>operational M&amp;O affairs.</td>
</tr>
<tr>
<td>9</td>
<td>In financial matters the DBFMO is expected to have Cooperation as the dominant governance model, mixed with coordination for maintaining a transparent structure</td>
<td>True</td>
<td></td>
</tr>
</tbody>
</table>
6.2.4 Legal Issues

Proposition 6: Legal roles and responsibilities and the role of legal experts are expected to be of minor importance (rather the legal framework has a stabilizing role supporting trust development).

Similar to financial complexity, legal experts mainly play a role in the start up phase of a contract: explicating and mapping consequences of clauses that give rise to unclear responsibilities and roles. Legal roles and responsibilities, however, soon become embedded in routine operations and interactions return to relation management.

At the start of the M&O, meetings between client and contractor are with the contract on the table. Later as the relationship develops the legal experts move to the background, sometime however it remains part of routines to involve legal experts at management level. In all cases discussed, only one issue caused legal disagreement between client and contractor. According to clients, once the tender is completed, legal specialists no longer are involved. Only in case the contract needs to be reviewed experts step in again.

<table>
<thead>
<tr>
<th>Legal Issues</th>
<th>Cooperation</th>
<th>Coordination</th>
<th>Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 client</td>
<td>3 x 1</td>
<td>1 x 1*</td>
<td></td>
</tr>
<tr>
<td>2 contractor</td>
<td>7 x 1</td>
<td>1 x 1**</td>
<td>1 x 1**</td>
</tr>
</tbody>
</table>

* Internal and shareholder pressure to perform well.
** Based on experience with establishing governing jurisdiction in international partnership with foreign client.

Table 6-8 Overview of Governance mix for Legal Issues.

Proposition 10: “Cooperation is the dominant governance structure for Legal”, therefore is confirmed by the interviews.

Table 6-9 Overview of Organizational Issues and governance-mix

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Legal roles and responsibilities and the role of legal experts are expected to be of minor importance, (rather the legal framework has a stabilizing role supporting trust development)</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cooperation is the dominant governance structure for Legal.</td>
<td>True</td>
<td></td>
</tr>
</tbody>
</table>

6.3 The Client-Contractor and the Building-Infrastructure perspectives.

In the previous chapter a distinction was anticipated in the perspectives of client-contractor and of Building-Infrastructure. In the understanding that no statistically grounded statements can be made possible differences could produce interesting material for analysis.

6.3.1 Client-Contractor perspective

In all four complexity groups client and contractor have a remarkably united standpoint. The outcomes show in all cases a very similar governance preference between the two groups, either a very clear stance (Organizational; Financial and Legal) or a similar mixed stance (Technical). It can be prudently concluded that the governance mix from the perspective of both groups in the M&O leads to a similar choice of governance.

6.3.2 Building-Infrastructure perspective

It was anticipated that the building and infrastructural contexts would lead to a different outcome for complexity factors or choice of governance. For instance operational availability (see §6.4.2.) or the
pressure to increase availability as the intensity of use increases. Nevertheless in the category “technical” (see table 6.3 and 6.6) this did not result in a clear distinction between client and contractor as can be seen in table 6.10.

<table>
<thead>
<tr>
<th>Technical Complexity</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 client 1-1</td>
<td>Cooperation 1</td>
</tr>
<tr>
<td>2 client 2-1</td>
<td>Coordination 2</td>
</tr>
<tr>
<td>4 client 4-1</td>
<td>Competition 3</td>
</tr>
<tr>
<td>9 contractor 5-1</td>
<td>Cooperation 1</td>
</tr>
<tr>
<td>11 contractor 7-1</td>
<td>Coordination 2</td>
</tr>
</tbody>
</table>

Table 6-10 Summary of Infrastructural perspectives on Governance for Technical Issues.

Another point that induces to be prudent with conclusions follows from Contractor 1,2 and 3. These are all from the same contractor working on the same M&O contract, with different roles, but nevertheless in two out of the four categories they are not unanimous in their choice of governance mix.

It can be concluded therefore that the subdivision of the group in client-contractors or buildings-infrastructure does at this stage not provide additional information in relation to the research questions.

6.4 Additional Issues

A number of additional issues emerged during the interviews. In some cases interviewees labelled these as extra categories viz.: the context, the operational availability and innovation.

6.4.1 Project context

In all cases projects have many interfaces with other systems, and many public officials and stakeholders who want to influence the project. This is partly due to the change from point infrastructure (a single construction) to line infrastructure (a series of connected constructions) in integrated contracts. Managing these stakeholders and their issues during the planning and design phase is a major task for the client and the contractor.

The context is understood to include all affairs in relation to the environment of the construction area and its stakeholders. This complexity is reported by parties involved in infrastructural and area planning who are confronted with a whole network of stakeholders to be managed. They report to experience it as a major issue and would not include it as a sub item as Lenferink (2013) suggests, but as a separate fifth category of complexity. At the moment of interviewing however, these parties were deeply involved in the dialogue and contracting phase of new contracts as well as involved in the operational phase of other projects. The issues raised relate to permissions, reaching agreements with local or regional government and stakeholders and seem to occur mainly in the planning and start up phase and issues seemed to calm down once the operational stages of the contract are reached. The issues reported as pertaining to the project’s context seem to be out of scope for the M&O.

6.4.2 Operational Availability

Another suggested addition is operational availability. Planned maintenance is connected to an object (airstrip, road, railway line) that requires permanent availability and has operators (airlines or train operators) that demand maximum availability. Cases discussed show an increase in the traffic (number of planes, trains and cars) whereas capacity remains the same, demanding an increase in operational availability, combined with an increase in safety regulations. This results in limited access to the object for inspection or maintenance, whereas at the same time the risk of malfunctioning has bigger impact and therefore needs to be minimized. The consequential impact of disruption on planned or corrective maintenance and on the planning of services, transport (cars, trains and planes) and the personnel planning, is big.
In addition contractors complain about employing people that are productive for 1-2 hours a night only. For both rail and airports the number of operators and their power increases complicating an integral planning. Sometimes these operators have the power to overrule planned maintenance. The operational availability can be considered to be an item within organizational issues as it deals with performance and power in relations. At the bottom line however issues around operational availability are determined by technical issues, viz technical condition and performance and risk and in the present categories of complexities, should therefore be discussed under technical.

6.4.3 Innovation
A last addendum is innovation. With contracts in place for a very long period, contractors, according to some clients, are inclined to maintain assets but not to improve or innovate them. In some cases clients complains over the lack of eagerness for innovation. Innovations are stimulated in different ways, sometimes all benefits arising from the innovation are for the contractor, sometimes however the contract stipulates that operational costs will have to be reduced periodically with a certain percentage or in lump sums. Contractors usually accept technological advances as part of the risks and opportunities of enterprising: “If you would have contracted this 20 years ago, you would have contracted old telephones, now they are all mobile phones, it offers opportunities”. In some cases innovations brought forward by contractors are not implemented. In the rail for instance, the country is divided in 15-18 regions and innovations are to be tested extensively for compliance with existing systems, but may not be implemented nationwide, due to non compliance with the existing systems or because it would involve implementation in all regions and “one golden shackle in a chain does not improve the chain”. Innovations therefore are most often accomplished in improvements in tooling, ways of operating, procedures, etc.

During the build phases sometimes opportunities arise with clear future financial benefits not accounted for in the Design phase. In many cases the build company however does not agree to bear extra costs, as the build manager is held accountable for staying within budget, resulting in sub-optimization. Obvious chances for life cycle optimization are thus missed as in the case where treatment of icy surface of a pedestrian bridge to a building costs €20k annually, whereas the one-time investment for inclusion of heating tubes in the concrete would have been €100.000, but due to the tight building budget, this was turned down by the build-manager. Other examples put forward include design decisions like centralised waste collection, that did not take off, resulting in investments in decentralised waste systems at every desk and the consequential rise in cleaning costs. These changes are then renegotiated with the client and meticulously documented and archived. These and other examples touch on technical, financial and organizational issues, but generally seem covered within the technical category (see also §3.3.3).

6.4.4 Other
Some other new categories mentioned are ‘safety’ and ‘soft skills’, but these are covered by technical and organizational respectively.

6.5 Additional Restrictions and Limitations
Some number of interviews need to be brought forward concerning the results presented in this chapter.

The number of interviews is relatively small and most interviews were time-pressed. Respondents were quite hesitant to agree to an interview, as one person said: “I could fill my days giving interviews”. The ones agreeing to an interview did so on basis of existing personal contacts. Especially difficult to find were representatives of clients in the group building. In DBFMO building-contracts outnumber infrastructure projects, but despite trying official venues and networking, only limited participation could be achieved in the building category. Interviews were sometimes time-pressed and lasted from 30-90 minutes. For discussing all topics 60 minutes appeared a suitable timeframe. Despite the quite unanimous results
concerning complexity and governance for the group as a whole, from a point of validity the results should be treated as a first exploratory result, providing insight into the phenomenon, but with limited validity for the subgroup populations.

The topics (f.i. cooperation or technical complexity) are so broad in scope that interviewees found it hard to focus on the DBFMO-contract and often mixed it with experiences from other contracts. This was more apparent from clients than from contractors, a big majority of contracts is subcontracted traditionally with client in charge of M&O. A related issue is the role-perspective from which the interviewee responded. This could for contractors switch from being a representative of the SPV, to a professional perspective (f.i. general manager; maintenance engineer; etc) to the role of an employee in a contractor organization. All these roles have an impact on the perception of the situation, and are likely to influence the definition of complexity and governance towards a politically correct phrasing. Especially so as the same contractors collaborate in one contract and compete with each other in another contract. In addition they struggle with the new cooperative role while the organization they represent often still is involved in traditionally structured contracts (see §2.2 and 2.4) and many professionals started their career in these “old school” contracts. It would seem that the complexity of the situation with different roles in different contracts shape the reality of the interviewee and this influences perception and reaction of the respondent. Results therefore might have a bias towards overall developments, rather than a particular DBFMO.

The research included a broad variety of cases to test whether the model would be robust enough to help understand integrated contracts and possibly find a complexity-governance relation. But the group using DBFMO is possibly too varied. In rail for instance 4-5 big companies share the market, but are dependant on each other as they each operate a part of the same network, sharing knowledge and resources. In the airport and rail industry the bankruptcy of Imtech was received as a blow as it reduces the number of all-round engineering companies to 3-4. In rail and air only three DBFM contracts have been issued so far, due to the dynamics of the operation, and due to very strict safety regulations, which as yet requires central coordination. In the built environment there are many competitors and many DBFM(O) contracts in a relatively stable and predictable M&O setting. The infrastructure market has a growing number of DBFMO, but the road contracts and the “wet” contracts have distinctly different issues. In short the context of these industries is quite different. This at one hand, strengthens the case for applying the 3-C model, at the other hand no in depth study of causes and effects is possible and due to the diversity of cases, therefore no conclusions as to subgroups can be drawn or as to causality of relations between complexity and governance. Causality of the relations needs to be further researched.

Reflecting the sector as a whole, the need for change is pressing (the sector needs to catch up with modern context) and the pace of change tremendous, (integral responsibility; cooperative strategies; contract evolution; bankruptcy of companies, role switch, growing importance of social skills, etc.). The research results therefore should be regarded as a snapshot, rather than a long-lasting portrait of the Integrated Contracts in Dutch situation.

6.6 Summary & Conclusions
The empirical study confirms that the four categories of organizational, financial, technical and legal complexities as proposed by Lenferink et al (2013) adequately cover the factors in the M&O phase. By far the most dominant is organizational issues and relational aspects in particular, whereas the financial and legal categories hardly play a role once routines are set. Cooperation, seems to be dominant not just in the organizational categories, but in all four categories. The results are summarized in enclosure 6.

Results need to be dealt with prudently: the sample group is small and not always complete in responding; bias from other contracts seeped into the reactions; the contexts of the contracts and the nature of the complexity-governance-relation varies significantly and gives a snapshot only of a quickly changing industry and contract-type.
7 Discussion, conclusions and recommendations

Can the research question be answered and what conclusions can be drawn from the confrontation of the model and the situation of the DBF-M&O phase?

7.1 What is governance with the CCC-model in the (DBF-)M&O phase?

In order to answer the main research question a number of sub-questions was articulated that have been answered in previous chapters. DBFM(0) is a PPP-type, integrated contract that relatively quickly developed in the Netherlands and that acquired some typical Dutch characteristics, viz private funding combined with public ownership and a high level of professionalism and learning. The first integrated DBFM(O) contracts are halfway the contractual period. Theory and research on M&O are therefore scarce. The M&O phase can be adequately described by the four complexity factors of Organizational, Technical, Financial and Legal. Based on a literature review the underlying factors in the DBF or start-up phase and M&O however are not the same (see table 3.3. for a summary of the differences). The Lenferink 3-C model is a dynamic model based on systems thinking, TCE-theory and learning and links complexity factors to a governance-mix. Based on a literature review cooperation is expected to the dominant governance type in the Dutch (DBF-)M&O situation.

The main research question reads: What is the CCC-governance model in the (DBF-)M&O phase?

Overarching complexity factors of M&O are found to be the same as in the design phase. The four main categories of Organizational, Technical, Financial and Legal cover the M&O aspects well. Some additional categories suggested by the interviewed appeared to be covered by these four main categories already. As to the sub categories two corrections came forward. In M&O there are hardly technical issues to be discussed between client and contractor and financial experts have no role in operational M&O affairs.

Table 7-1 Overview of Complexity factors after Empirical research

<table>
<thead>
<tr>
<th>Influence</th>
<th>Definition</th>
<th>Investigated factors in M&amp;O defined ex ante</th>
<th>Factors in M&amp;O Phase corrected by results empirical research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational</td>
<td>Issues in the organizational setting and set-up of the CD (Maintain) procedure.</td>
<td>Relation management, performance management, information management</td>
<td>Relation management, performance management, information management</td>
</tr>
<tr>
<td>Issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical complexity</td>
<td>Complexity caused by technical, physical project characteristics.</td>
<td>Technical performance issues and risk management, role of technical experts during M&amp;O including technical solutions discussed.</td>
<td>Technical performance issues and risk management, <strong>There is no role for technical experts discussing technical solutions.</strong></td>
</tr>
<tr>
<td>Financial complexity</td>
<td>Complexity caused by financial project and contract characteristics.</td>
<td>Rewards and compensation in M&amp;O, role of financial experts in M&amp;O phase.</td>
<td>Rewards and compensation in M&amp;O, <strong>There is no role for financial experts in operational M&amp;O phase</strong></td>
</tr>
<tr>
<td>Legal complexity</td>
<td>Complexity caused by procurement procedure and contract characteristics.</td>
<td>Role of legal framework in trust development.</td>
<td>Role of legal framework in trust development.</td>
</tr>
</tbody>
</table>

Concerning governance, cooperation is by far the preferred strategy; competition is absent in public-private interactions but plays a part in private-private relations. Coordination is part of the mix, but purely instrumental for organizing the most effective and efficient way for M&O because it is based on a joint (cooperation) definition of the situation. Table 7.2 presents a view of the preferred / dominant governance strategies.
Table 7-2 Overview of preferred and dominant governance strategies after empirical research

<table>
<thead>
<tr>
<th>Organizational Issues</th>
<th>public</th>
<th>private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
<tr>
<td>Technical complexity</td>
<td>coordination</td>
<td>coordination</td>
</tr>
<tr>
<td>Financial complexity</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
<tr>
<td>Legal complexity</td>
<td>cooperation</td>
<td>cooperation</td>
</tr>
</tbody>
</table>

The preferred / dominant combination of complexity and governance after empirical study appears identical for both public and private.

The CCC governance model in the M&O therefore can be said, bearing in mind the restrictions, to consist of the four complexity categories (with factors as described in the last column of table 7.1) combined with cooperation, except for technical operational matters, where coordination is the preferred strategy.

What further conclusions can be drawn from the confrontation of the model with the material collected empirically of the (DBF-)M&O-phase?

7.2 Discussion

7.2.1 One model for all DBFMO-phases?
The question whether the flexibility of the CCC-model would make it suitable for the M&O as well as the CD phase, led to this research. It appears that the 3-C governance model covers the issues and governance modes of the M&O phase quite well. All issues from all cases seem to be incorporated in the model. At the same time however, only one governance instrument and one influence appear to dominate public-private interactions, whereas the influences were much more balanced in the CD phase. The 3-C model describes and explains mechanisms for both phases, but at the same time is too broad in scope for using in the M&O only.

7.2.2 Learning

Learning was incorrectly omitted from the research. Although mentioned in Lenferink’s research and included in previous paragraphs (§2.3; §3.1; §6.3) as characteristic and a necessity for the Dutch situation, it was not ex ante included as a research topic in the case studies. Learning however appears crucial for governance on many levels and in many forms.

Lenferink refers to “the learning effect as a result of interaction” and of “gained experience” (in the Competitive Dialogue) resulting in an increased capacity of the government to handle variety and a “streamlining” of the CD process. In the M&O phase the cases researched show a similar “learning” pattern of interaction that evolves from caution and a strictly formal attitude at the start towards an open interaction when the contracts arrive in the maintain phase. As players are often engaged in multiple contracts a routine based on experience gained across contracts develops.

In his conclusion Lenferink refers to learning in relation to the CD phase as well, and recommends “to gain insight into public–private interaction beyond procurement” in order to “arrive at a contract in which the stage is set for post-contracting public–private interaction in construction and maintenance.

Organizing international documentation is an example of learning at the overall level. Lenferink (2013) mentioned under Information Management the struggle to translate documentation for the sake of foreign bidders and contractors. In 2015 RWS, based on previous experience, provides documents in Dutch only and demands at least one Dutch partner in a consortium to avoid cultural and language gaps. Another example is that DBFM(O) type contracts are extended towards more complex line infrastructure, from buildings to roads to “wet” infrastructure.
Per contract many examples of learning have been found. In the first place all cases have a similar pattern where the public-private interaction within a contract developed from adversarial to cooperative. Remarkably contractors stress the necessity to learn soft skills at all organizational levels and they describe the accompanying learning curve for all levels to evolve from “competition to coordination to cooperation” as a condition for M&O success.

Sometimes on basis of experience where parties accepted responsibility they cannot handle, knowledge is transferred between parties. For instance where, the contractor is invited by the client to join as an observer in the procedures for obtaining permissions, a second time they do it together, the third time the client is stand by only. As well as that many other knowledge-sharing initiatives between public-private and private-private can be observed. The ‘kennisfabels’ is one example but there are more like ‘kennisplatform CROW’ or international schemes as the Europe PPP Alliance.

Some learning examples relate to management of the phases of design, finance, built, maintain. Each phase used to have a different manager, causing fragmentation and sub optimization. As a result from this observation measures were taken like: overlapping (Build manager is part of design process) or making managers responsible for several phases. Some examples relate to (sub-) contractors having a too narrow focus (task oriented or representing interest of contracting party), resulted in the practice of making a special company for Maintain or Operate (a Vof). On a horizontal level between traditional and DBFM(O) contracts best practices are exchanged like clauses relating to innovation.

The observations from Lenferink that both experience and interaction lead to learning are present in the cases researched in the M&O phase as well.

### 7.3 Conclusions

The 3-C model is a versatile model that can serve as a model for describing the issues of both the CD and the M&O phase. The ensuing governance strategies in both contract phases are a mix of competition, coordination and cooperation. Contractors and clients sometimes have different perceptions regarding complexity and governance mix and the model can accommodate these differences. The model can be applied across a variety of related industries and can therefore be seen as quite robust.

For describing the single phase of M&O the model gives a lopsided view in that it strongly emphasizes cooperation and relation management in the perspective of both clients and contractors. The other influences and governance strategies hardly play a role anymore in public private interactions. In private-private interactions, originally not included in the model, these are more varied.

### 7.4 Recommendations

In all discussions all participants instantly recognise the model-terminology and its relevance. The model and its terminology therefore could help to establish a joint language for mastering complexity.

For studying the M&O phase only, the added value of the 3-C model is limited and models focusing on cooperation only are expected to lead to better understanding of the underlying mechanisms. Possibly the DBFMO as an alliance, a trend set by Australia, one of the front runners in integrated contracts, might provide opportunities for extending current knowledge on cooperation in M&O.

In the present study combinations of complexity-governance have been researched, future studies might want to look deeper into the relation between these two, possibly with a view to detail the mechanisms of causality between complexity and governance.

Finally the importance of learning in this type of contract in this phase of its evolution might make researching the processes of learning and the impact it has on the performance in the contract a worthwhile cause.
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## Enclosures

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<td>6</td>
<td>Overview of Response to Propositions</td>
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</table>
1 DBFMO processes

In the DBFMO process from initiation up to and including the contract close, there is a strictly regulated and transparent program in accordance with Dutch and European legislation (Directive 2004/18/EC). The European council has ruled that contracts with a value in excess of €5,186,000 should be tendered in Europe (Directive 2004/18/EC)\(^3\). In the Netherlands there is a minimum amount for a DBMFO-tender of €25 million for the Rijksgebouwendienst and €60 million for Rijkswaterstaat (Stuivelink, 2013). All Dutch DBFMO contracts therefore are put up for European tendering.

DBFMO from Initiation till contract ends

For a brief discussion of the DBFMO phases we will use the numbering (0-7) from figure x.

0) Initiation and preparation

After a business case has established that the planned construction qualifies for a DFMO-tender by exceeding the minimum investment, a first step, is applying the Public-Private Comparator (PPC), an instrument that measures the Value for Money (VfM) of a DBFMO-contract compared to a more traditional contract (MoF 2013a). VfM is defined as 'the optimum combination of whole life cost and quality (or fitness for purpose) to meet the user’s requirement' (Grimsley, 2005). The VfM is calculated using a Public-Private Comparator, an instrument that calculates the added value of an integrated contract compared to traditional contracts by adjusting the cost-estimate with a surcharge for hypothetical risks, as the procurer retains significant risk exposure (Loosemore, 2007). If an integrated contract offers VfM than a DBFMO tendering process will be started, alternatively a normal contract procedure is initiated. Out of the 49 PPC's in 2010 and 2012 43 were actually tendered as DBFMO (MoF 2010; MoF 2012). The VfM or life cycle optimisation calculations are however not undisputed; transaction costs, extra work and knowledge transfer are some of the issues raised against the optimism of the benefits.

\(^3\) zie: http://www.euwiki.org/2004/18/EC
Noteworthy is the absence of external stakeholders when formulating functional requirements and output criteria. De Schepper (2014) suggests to apply more effective governance structures, taking into account the potential drawbacks of increased (transaction) costs as well as potential conflict of interests that may arise due to involvement of previously neglected stakeholders at later stages.

1) Public Announcement
This phase includes a first announcement of the construction project, the invitation to tender and a first selection of the candidates. Parties can use the information to determine whether they want to apply for the tender and if so to look for partners to form a consortium. In terms of the contractual arrangements, the government will usually sign a contract with private parties in a consortium or a so-called Special Purpose Company (SPC) (Pijnappel 2014) Special Purpose Entity (Chowdhury, 2011) or, most frequently, ‘Special Purpose Vehicle’ (SPV) (de Jong 2010; de Schepper 2014; van den Hurk 2015). An SPV is a ‘project company’ composed of several private parties with differing backgrounds, cultures, tasks and responsibilities (Verhees, 2013). The SPV would typically include companies with the skills required to design, build, finance maintain and service. Shareholders would usually be big construction companies or specialists in big PPP-projects, providing the SPV with equity. Finance companies will provide capital usually at a lower rate (depending on risk profile) than the equity. The ratio equity—loans can be 1:9. Insurers could be involved for limiting liabilities. Agreement between an investor and the SPV is on a “non-recourse“ basis.

The actual work of designing, building, financing, maintaining and servicing is subcontracted by the SPV to companies, usually the SPV shareholders (Demirag et al, 2011; Verhees, 2013; Klijn, 2010; Heiligers, 2012).
In the first DBFMO selection round, bids by SPVs are checked for completeness and validity against a checklist and exit talks may be held with candidates that get turned down, the others receive an invitation for the competitive dialogue (Nagelkerke, 2009). After the prequalification, the project specifications may be adjusted and a first benchmark may be drawn up (Handleiding PSC, 2002; Wijsman et al 2011).

2) The Competitive Dialogue
Under the Competitive Dialogue procedure, authorities invite short listed candidates to participate in a dialogue process during which any aspects of the project may be discussed and solutions are developed. The dialogue is between the government project team and the individual consortium and is competitive because the participants will have to come up with the best proposition without knowledge of each other’s solutions. Depending on the project a shortlist may be drawn up of between 3-5 candidates, if five consortia are invited to the procedure only three will be allowed to go to the second round of dialogues. The client can continue the dialogue until it identifies one or more solutions that are capable of satisfying
its requirements, this process may last between 9-24 months (Nagelkerke, 2009). It then closes the dialogue and invites final tenders from the remaining consortia.

3) The Tender phase
The competitive dialogue results in a realistic and detailed design of the construction, producing input for the Public Sector Comparator (PSC). The PSC calculates the total life cycle costs and is used as a benchmark for the tender bids. The PSC contains a risk analysis, a cost and benefit calculation and ends with the PSC-benchmark that provides the basis for assessing the bids. Similar to the problems encountered in the previous phase confidentiality is a difficult issue again; on the one hand maximum transparency is adamant on the other hand the proposals and discussions will have to remain confidential, adding to the complexity of creating a benchmark (Stuivelng, 2013).

The PSC reflects the DBFMO benefits from innovation, efficiency and risk transfer as compared to a traditional project. On basis of 28 PPP projects in Canada and the USA VfM is calculated to be 11% over 28 projects with a total value of 5.5 billion (Siemiatycki, 2012). The Dutch Ministry of Finance arrives at a saving of between 10-15% amounting to approximately 1.3 billion (MoF, 2014). Crucial in the individual PSC calculation is once again the interest rate, establishing the right interest rate that reflects the risks involved for the particular project, including provisions for the ups and downs of the economic climate and taking account of the full contract duration is vital for all parties involved. The process of drawing up the PSC may take between 17-30 weeks (Handleiding PSC, 2002).

Savings however are based on the design and as suggested by Flyvberg et al (2003) projects often are overrun on costs due to lack of realism in initial cost estimates, motivated by vested interests. Stuivelng (2013) reports that after the contract close in 5 DBFMO projects amendments were made in the initial contracts, amounting to a total of €63 million.

4) Designating the preferred bidder
The remaining parties are invited to put forward their bids, negotiations may follow which could lead to adjustment of the PSC-benchmark after which a Best and Final Offer (BAFO) may be invited from a first and second best bidder (Wijsman, 2011). The BAFO is based on quality and price. For both a number of credit points will be awarded. Quality items usually are project specific themes like functionality, architecture or sustainability. The financial qualification is based on the net present value (npv), the bidder with the lowest npv-score will receive the highest financial score and the party with the highest overall EMVI-score (EMVI = Economically most beneficial offer) will be awarded the contract.

5) Financial and contract close
During the tendering phase the tenderers have to maintain the validity of the Final Submission for up to a year. Contract close follows at the moment that the government and the consortium sign the final contract. Although it would seem logical to complete the Contract Close and Financial Close at the same time, in practice financiers wish to receive a copy of the signed DBFM(O) agreement before they are prepared to make a definitive decision to provide the financing. Financial close therefore occurs usually up to a couple of months after the contract close. (Stuivelng, 2013) (Wijsman, 2011).

6) The build phase
Contract and financial close are a marking point in the DBFMO-process as it separates the tendering from the realization phase and involves a major shift in roles. From this moment on activities will be aimed at meeting the overall project ambitions and requires an
accompanying governance system in order to control project delivery, deal with variations and monitor the service delivery. For the government there is a shift from a client’s role formulating functional requirements, evaluating and discussing design issues and arranging negotiations to checking and controlling whether the performance criteria are met and controlling these through financial incentives and fines. For the consortium it entails that after the competitive design phase with many legal issues, the focus shifts towards accomplishing the construction and different teams will have to be formed around different skills with different tasks and goals. See also § 2.1.1.

7) Maintenance in DBFMO
No DBFMO-contract has served its full contractual period yet, the first contracts to expire are listed below (table x) and only few have entered the maintenance phase yet, literature on the subject is scarce. It should be noted that currently new projects typically have a contractual period of between 20-30 years.

<table>
<thead>
<tr>
<th></th>
<th>contract</th>
<th>ends</th>
<th>contract in million €</th>
</tr>
</thead>
<tbody>
<tr>
<td>A59 Den Bosch - Oss</td>
<td>15 years</td>
<td>2020</td>
<td>279</td>
</tr>
<tr>
<td>Tax office Doetinchem</td>
<td>15 years</td>
<td>2025</td>
<td>47</td>
</tr>
</tbody>
</table>

Maintenance in infrastructure may start before the build phase already. The A-15 is an example of a situation where the SPV acquired the rights and obligations for maintaining the roads from signing of the DBFMO contract on, before any build activity was started. As from the start 20 fte were available to secure that traffic flows and road conditions were in accordance with the agreed performance levels (A-lanes, 20xx). At the end of the contractual period transfer to the client will take place or a new contractual phase will start.

The scope of the activities will be determined on basis of the public goals (f.i. safe and good flow of traffic), the desired output (f.i. safe, sustainable and comfortable roads with minimal hindrance for stakeholders) and the activities necessary to attain the required output (f.i. newtop layer, extra lane, new traffic management systems) (MoF – handleiding PPC). The length of the concession period during which maintain and Operate activities will be performed depends on the lifecycle of the object, similar past projects, predictability of the demand during the period and a reasonable pay-back period for investments by the SPV.

Maintenance is usually performed on basis of international standards like PAS 55, RAMS or NEN-ISO 55000. Maintenance confusingly is referred to as Asset Management in professional circles of maintenance engineers. A definition for Asset Management from the PAS 55 standard is: “Systematic and coordinated activities and practices through which an organization optimally manages its assets and their associated performance, risks and
expenditures over their lifecycle for the purpose of delivering the organization’s business objectives.”

Maintenance can be triggered on basis of periodic condition checks, the intensity of use or damage to the object, giving rise to an average expected life cycle with an uncertainty bandwidth. At the end of the life cycle the object can be replaced by an entirely new object or refurbished to make it fit for use again (Narayan, 2003).
2 A-15 Case

***INTERMEZZO***

In the A-15 case, the biggest Dutch Infrastructure project to date, the A-line consortium offered the Most Economically Attractive Tender (MEAT) and won the contract. In the first round the A-lines consortium scored only 4 out of 5 points on the qualitative scale and decided in the second round to give a very low quotation, some €250 million below the maximum as indicated by Rijkswaterstaat. On top of that the consortium accepted all risks involved. Good practice however, is that the party that can influence the risks best controls them. All risks like: condition of the soil, increase in traffic, permissions, legal controversies however, are transferred to the consortium. Two risks are especially dangerous. The project requires a thousand official permissions, from local governments, ProRail, Harbour authorities, provinces and others. Under the ground the traffic is even more intense than over the road, bridge or river, a very complex network of pipelines transports crude oil, nafta, argon, liquid hydrogen and kerosene, some 100 million tonnes per year. Will cable and pipeline companies cooperate in relocating these? Even the CEO of Rijkswaterstaat visits the consortium to discuss whether taking on all risks is a realistic option. But in the end parties sign the contract.

Delays in the project as a result from complexities and uncertainty in technical, legal and inter organisational relations force the consortium to overspend on the initially planned investments at the expense of the consortium, to go beyond the agreed deadlines, to hire more staff to meet new deadlines and to expensively refinance the project, whereas payments are delayed and fines are imposed due to exceeding the contractually agreed deadlines, bringing the companies involved to the verge of bankruptcy.
3 Interviewed

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Role</th>
<th>Object</th>
<th>Client / contractor</th>
<th>Buildings / infra</th>
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</thead>
<tbody>
<tr>
<td>Paul Zeeuw</td>
<td>Schiphol</td>
<td>Directeur Assets</td>
<td>Schiphol</td>
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<td>infra &amp; buildings</td>
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<tr>
<td>Rens van Twisk</td>
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<td>Project Manager</td>
<td>Sluizen / Snelwegen</td>
<td>client 2</td>
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<td>Jan Stoker</td>
<td>RGD</td>
<td>Researcher</td>
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<td>Onno Hazelaar</td>
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<td>Michel Bikkel</td>
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<td>Provinciehuis Noord-Holland</td>
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<td>infra</td>
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<td>Sander Lenferink</td>
<td>Radbout University</td>
<td>scientist</td>
<td></td>
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<td>Frits Verhees</td>
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<td></td>
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<td>Coordination</td>
<td>Competition</td>
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<td>10 contractor 6-B</td>
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<td>11 contractor 7-I</td>
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<td>2</td>
<td></td>
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</table>

* "Only if you get stuck"

<table>
<thead>
<tr>
<th>Technical Complexity</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooperation</td>
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<tr>
<td>1 client 1-I</td>
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<td>7 contractor 3-B</td>
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<td>10 contractor 6-B</td>
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<tr>
<td>11 contractor 7-I</td>
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</tbody>
</table>

* At the time a competitor (Imtech, about to collapse) was in the partnership.
<table>
<thead>
<tr>
<th>Financial complexity</th>
<th>Governance Strategies</th>
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<tbody>
<tr>
<td></td>
<td>Cooperation</td>
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<tr>
<td>1</td>
<td>client 1-I</td>
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<td>2</td>
<td>client 2-I</td>
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<tr>
<td>3</td>
<td>client 3-B</td>
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<td>4</td>
<td>client 4-I</td>
</tr>
<tr>
<td>5</td>
<td>contractor 1-B</td>
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<td>6</td>
<td>contractor 2-B</td>
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<td>7</td>
<td>contractor 3-B</td>
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<td>8</td>
<td>contractor 4-B</td>
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<td>9</td>
<td>contractor 5-I</td>
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<td>10</td>
<td>contractor 6-B</td>
</tr>
<tr>
<td>11</td>
<td>contractor 7-I</td>
</tr>
</tbody>
</table>

* Within client organization.
** Client asked to include “quite straightforward; contractually arranged, is not too complicated”
*** With partners in other contracts
**** Operations manager deemed himself unsuitable for making statements on financial issues

<table>
<thead>
<tr>
<th>Legal Issues</th>
<th>Governance Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooperation</td>
</tr>
<tr>
<td>1</td>
<td>client 1-I</td>
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<tr>
<td>2</td>
<td>client 2-I</td>
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<tr>
<td>3</td>
<td>client 3-B</td>
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<td>client 4-I</td>
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<td>5</td>
<td>contractor 1-B</td>
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<td>contractor 3-B</td>
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<td>contractor 4-B</td>
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<td>contractor 5-I</td>
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<td>10</td>
<td>contractor 6-B</td>
</tr>
<tr>
<td>11</td>
<td>contractor 7-I</td>
</tr>
</tbody>
</table>

* Internal and shareholder pressure to perform well.
**Based on experience with establishing governing jurisdiction in international partnership with foreign client.**
4 Toelichting & Introductie op Interview

Introductie interview governance van onderhoud in geïntegreerde contracten

Het onderzoek gaat over governance (inrichting beheer en bestuur) in de Maintain & Operate fase (De operationele fase) van geïntegreerde contracten. De governance wordt daarbij beschouwd als een mix van drie governance vormen, te weten: Coördinatie; Coöperatie; Concurrentie.

Het doel is verwerven van nieuwe theoretische inzichten over beheer en onderhoud in complexe samenwerkingen en een bijdrage leveren aan het verbeteren van management van onderhoud in DBFM(O).

Het onderzoek richt zich op 4 gebieden en hun invloed op de mix van governance-structuren in publiek-private interactie.

<table>
<thead>
<tr>
<th>Invloed</th>
<th>Te bespreken factoren</th>
<th>Welke governance-mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisatie complexiteit</td>
<td>- Relatie beheer,</td>
<td>- Coördinatie; Coöperatie; Concurrentie.</td>
</tr>
<tr>
<td></td>
<td>- Performance management,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Informatie management</td>
<td></td>
</tr>
<tr>
<td>Financiële complexiteit</td>
<td>- Vergoedingenstructuur in onderhoud,</td>
<td>- Coördinatie; Coöperatie; Concurrentie.</td>
</tr>
<tr>
<td></td>
<td>- Rol van financiële experts in Onderhoudsfase.</td>
<td></td>
</tr>
<tr>
<td>Technische complexiteit</td>
<td>- Technische performance en risk management,</td>
<td>- Coördinatie; Coöperatie; Concurrentie.</td>
</tr>
<tr>
<td></td>
<td>- Bespreken technische oplossingen,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Rol van technische experts tijdens onderhoud</td>
<td></td>
</tr>
<tr>
<td>Juridische complexiteit</td>
<td>- Juridische rollen en verantwoordelijkheden</td>
<td>- Coördinatie; Coöperatie; Concurrentie.</td>
</tr>
<tr>
<td></td>
<td>- Rol van juridische experts in Maintain &amp; Operate fase.</td>
<td></td>
</tr>
</tbody>
</table>
5 Research & Analysis

Below follows a summary of the interviews giving the reader insight into the issues discussed in addition to the conclusions drawn in chapter 6.

The four Complexity Factors

According to the interviewed the four complexity categories of Organization, Financial, Technical and Legal issues cover the DBFM(O) maintenance phase well, all confirm the relevance of the four factors. A number of additional issues emerged however, and in some cases interviewees labelled these as extra categories viz.: the surrounding, the operational availability and innovation.

Surrounding is understood to include all affairs in relation to the environment of the construction area and its stakeholders. This complexity is reported by parties involved in infrastructural and area planning who are confronted with a whole network of stakeholders to be managed. They report to experience it as a major issue and would not include it as a sub item as Lenferink (2013) suggests, but as a separate fifth category of complexity. At the moment of interviewing however, these parties were deeply involved in the dialogue and contracting phase of new contracts as well as involved in the operational phase of other projects. The issues raised relate to permissions, reaching agreements with local or regional government and stakeholders and seem to occur mainly in the planning and start up phase. For the moment therefore “surrounding” will be further discussed in the category “Organizational”.

Another addition is the operational availability. Planned maintenance is connected to an object (airstrip, railway line) that requires permanent availability and has operators (airlines or train operators) that demand maximum availability and have sometimes the power to overrule planned maintenance. The operational availability can be considered to be an item within organizational issues as it deals with planning and power in relations, but at the bottom line is determined by technical condition and performance and risk will therefore be discussed under technical.

A last addendum is innovation. With contracts in place for a very long period, contractors, according to some clients, are inclined to maintain assets but not to improve or innovate them. Innovation will be considered within the technical category (see also §3.3.3).

Some other new categories mentioned are ‘safety’ and ‘soft skills’, but these are covered by technical and organizational respectively.

The original four complexities are put in sequence according to the number of issues raised by interviewees. Organizational issues appear to be by far the most in number and in impact in the maintain-phase, whereas interviewees report hardly any complications pertaining to the financial and legal parts of the contract once routines are set.

i. Organizational issues

Issues expected to be prominent are relation management, performance management and information management.

Relations management

All interviewed are unanimous that management of relations is the main feature in the interactions between private and public parties and that cooperation is by far the preferred governance strategy. There is a strong belief in cooperation as the most beneficial interaction strategy between client and contractor in a 25 year contract. In the private-private interaction however, interactions are not always harmonious.
**Public-Private**

The overall responsibility for maintaining a service over an extended period of time requires that the contractor is tuned towards the needs of the user: “Getting married is easy, staying together for 30 years is difficult”. Most contractors have a traditional hands-on “contract-management” attitude and have to learn to understand the context and the way of thinking of the client and master the corresponding interaction patterns, for instance that issues have not just a financial side, but that the owner’s conduct has to transparently comply with official rules and regulations. Users often are least experienced in DBFMO and for instance want to modify their office impacting energy consumption, cleaning or climate control and are therefore out of scope of the contract. In all complexities however, all parties strongly favour open interaction and invest time and attention in solving issues with a view to strengthening reciprocal trust.

Being able to upscale from 10 people in the contract close to approximately 100 in the Build to a few thousand in the Operate is challenging. Consortia are sometimes requested to prove this in a basic management plan giving insight in management structure and project management skills. It is the experience that at the start of M&O, when thousands of users from one day to the next start using the asset many issues emerge and every detail is spelled out with financial consequences rising up to €200,000. Gradually trust grows, performance criteria are met and random checks by client confirm the quality of the service and as the relation improves “you become more open towards each other’s challenges”. Trust is the basis for managing these relations and includes: keeping promises, strive for quality, have open communication, focus on problem solving and a reciprocal acknowledgement of each other’s commitment. In addition a sense of ownership of the construction by the M&O party is mentioned as well as to take pride in the asset (building, airport, etc).

Relation management involves all organizational layers, but is reached most easily at the top and at operational level. According to some others, strategic alignment grows from operational to tactical to strategic level. Common practice has become to schedule sessions between management of client and contractor organizations to focus on shared long term values and goals. Especially client organizations stress the importance of these sessions. In a mature relation the phrase: “How can I help you to reach your goals” was heard from senior managers from both client and contractor organizations. Both stress the importance of informal meetings and management style is to be “hard on the soft issues” and “dare to forget the contract and look together what the situation needs”.

Like in the original study by Lenferink, HRM issues are mentioned frequently. Especially the phase between contract close and start of build (a period of 6-7 months) results in managers being moved to other projects causing discontinuity in the project. Clients and contractors report that a tender director may be replaced with a building director who in turn is replaced by a maintenance manager. As they are individually financially responsible for the success of their phase, cases of sub-optimisation are reported. Contractors learn to manage this but with a variety of solutions. One common solution is that the director remains in place during the different phases and is per phase supported by a specialised team. Some companies choose to appoint three different specialised roles in which case the build and maintain director attend the design and negotiations sessions together with the tender director. This allows directors to identify with characteristics of their role in DB (more push) or M&O (more cooperative). Continuity is not yet reported to be an issue during the M&O phase.
Private-Private

Noteworthy is that relations between partners within the consortium can be quite adversarial. Difficulties occur within the SPC as different partners perform the separate DBFMO stages, disputes are reported on settling extra costs or profit (Kromhout; RIVM). Another issue may arise when tasks within the SPC are split, and subcontractors (often subsidiaries of SPC partners) operate task oriented, pursuing their own interest, and the integrated philosophy vanishes. To counter this SPCs have started to operate from a vof\(^{33}\), hiring personnel from the contracting companies, thus ensuring that the overall interests are safeguarded. Companies can be partner in a SPC but competitor in another project, no relational issues are reported on this situation however.

It is not just the private-private relation that can be problematic; some clients report that it is often easier to reach understanding and agreement with contractors than within their own organization where they have to prove themselves continually.

Apart from these issues cooperation between private companies thrives. Knowledge sharing initiatives are in place for all branches and project types.

Performance management

Complexities in performance management appear to be relatively limited. No major disputes are reported over differences between Output Specifications and performance. “Performance management is a way of checking right understanding” and performance management and information management are the means to establish a good relation. Performance management embedded in cooperation of aligned companies provides instruments for performance improvement, “relations based on punishing performance only leads to dissatisfaction and argumentative relations”. In tendering, to secure the contract, often promises are made that exceed the output specifications of the client, but once contracted they are complied with as the other specifications.

All parties agree that just after the construction becomes operational, performance issues peak, but decrease gradually and managing them is reduced from a full time occupation to a few minutes per week. “There is trust, we inform each other, and we know the issues involved”. Performance management systems typically are systems maintained by the contractor and after testing, connected to systems of the owner. Frequency of meetings between client and contractor vary between weekly, monthly or quarterly. Once relations are established the client typically randomly checks the performance reports and settles the periodical payments. For “Operate” activities sometimes external-auditors are hired for performance audits.

The operate includes activities often beyond the normal expertise of the operator and ranges for instance for a museum from providing indoor telephone networks, to operating of ticket boxes, catering, souvenir shop, cleaning displayed objects, or purchasing and operating a flight simulator. Issues reported relate to these beyond-normal expertise issues. In some cases, for instance with airstrips, difficulties in measuring and controlling the object are used as motive to not yet using integrated contracts.

Information management

In information management no structural organizational complications have emerged in the cases studied.

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\(^{33}\) Vennootschap onder firma, legal structure for partnership.
In some cases an existing construction is transferred as part of a contract including information on the asset like drawings, technical details, history of adaptations. In most cases however there is a blank sheet at the start. Maintenance, modifications, changes and technical and contractual alterations are all fully documented and archived for future reference of generations of subsequent employees. Information then is strictly archived, some contracts for instance stipulate that upon the 25 year period, trees chopped down for the build need to have grown back in the condition as at the start of the contract.

Currently a diversity of computer systems are in use. For new projects BIM34-systems is the norm, although the BIM framework is still being developed.

Sometimes in Operate information management is crucial, for lightrail for instance Information Management includes all up-to-date operational information for passengers.

Surrounding
In all cases projects have many interfaces with other systems, and many public officials and stakeholders who want to influence the project. This increase is partly due to the change from point infrastructure (a single construction) to line infrastructure (a series of connected constructions) in integrated contracts. Managing these stakeholders and their issues during the planning and design phase is a major task for the client and the contractor. During M&O the stakeholders, operators and users may want to influence the operational availability. Managing the diversity in stakeholders and users requires flexibility and complicates operational management and maintenance of the services.

ii. Technical Issues
During the M&O phase the overarching technical issues are expected to be: technical performance issues and risk management, technical solutions discussed and role of technical experts.

Performance issues and risk management
For the contractor, risk is accepting that objects will not perform according to specifications or have a shorter lifecycle than expected. All cases have a strict maintenance regime laid down in a maintenance plan per object. The objective is keeping assets available within control limits. Prevention, including theft and accidents, is generally more expensive then correction. Risk is reduced by prevention, but too much prevention is costly, creating a financial dilemma that impacts contractual performance. Postponing to replace an object leads to profits compared to the initial calculations. Sometimes a business case is made to find out whether it is beneficial to replace an asset before its lifecycle is completed as was frequently reported in the case of replacing old lamps for led lighting. Generally M&O staff operates prudently aiming at controlling costs while guaranteeing availability of the asset.

One issue separating buildings from infrastructural DBFMO’s, is safety and operational availability. Cases show an increase in number of planes, trains and cars, demanding maximal operational availability, combined with an increase in safety regulations. This results in limited access to the object for inspection or maintenance, whereas at the same time the risk of malfunctioning needs to be minimized. The consequential impact of disruption on planned or corrective maintenance and on the planning of services, transport (cars, trains and planes) and the personnel planning, is big. In addition contractors complain

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34 Building Information Management, a standard for software systems in built environment.
about employing people that are productive for 1-2 hours a night only. For both rail and airports the number of operators and their power increases complicating an integral planning.

**Technical solutions discussed including Innovation**

In general all parties acknowledge a loss in technical know how by the owner, who manages the contracts through output specifications. One of the ways to create dialogue about technical issues therefore is implementing so called “kennistafels”\(^{35}\) and other opportunities for knowledge sharing between experts.

Problems encountered at operational level are solved in dialogue between technical staff and representatives of the owner or user. In some contracts however technical complexity extends beyond the know-how of the contractor, specialised equipment or service, in which case knowledge is bought or hired.

In some cases clients complain over the lack of eagerness for innovation. Innovations are stimulated in different ways, sometimes all benefits arising from the innovation are for the contractor, sometimes however the contract stipulates that operational costs will have to be reduced periodically with a certain percentage or in lump sums. Contractors usually accept technological advances as part of the risks and opportunities of enterprising: “If you would have contracted this 20 years ago, you would have contracted old telephones, now they are all mobile phones, it offers opportunities”. In some cases innovations brought forward by contractors are not implemented. In the rail for instance, the country is divided in 15-18 regions and innovations are to be tested extensively for compliance with existing systems, but may not be implemented nationwide, due to non compliance with the existing systems or because it would involve implementation in all regions and “one golden shackle in a chain does not improve the chain”. Innovations therefore are most often accomplished in improvements in tooling, ways of operating, procedures, etc.

During the build phases sometimes opportunities arise with clear future financial benefits not accounted for in the Design phase, in many cases the build company however does not agree to bear extra costs, resulting in overall sub-optimization. Examples are put forward as well of design decisions like some cases of centralised waste collection, that did not take off, resulting in investments in decentralised waste baskets at every desk and the consequential rise in cleaning costs. These changes are then renegotiated with the client and meticulously documented and archived.

**Role of technical experts**

Contractors and clients report that during M&O the contractor has all the expertise necessary in the operational staff. Technical experts are called in only for support at the end of the life cycle of installations or when new investments need to be made.

**iii. Financial Issues**

For finances, the rewards and compensation and the role of financial experts are expected to be the two major influences. The general opinion on these two influences is that they are not complex: “I am not inclined to call this complex, it is more a matter of balancing, how to spend the available resources”

**Rewards and compensation in M&O**

---

\(^{35}\) Kennistafels is a platform for the four big rail contractors in the Netherlands, but similar initiatives
Total costs involved in M&O exceeds the costs of D&B, but decisions are still mainly based on design issues. Clients, to the frustration of many M&O managers, typically base decisions on architectural considerations. Once the contract is closed the rewards and compensations are no longer a source of complexity in interaction, instead attention is focussed on clear communication, transparent information and good management. Meetings between client and contractor are typically scheduled weekly, financial settlements are typically monthly or per quarter.

In discussions with DBFM(O)-participants examples are reported of investments in excess of the output specifications, with the aim to reduce maintenance costs (high tech control in a building) or optimize availability (using superior materials and components at a road-bridge interface in order to reduce maintenance and thereby optimize availability and availability fees). Others however report the opposite, obvious chances for life cycle optimization are missed as in the case where treatment of icy surface of a pedestrian bridge to a building costs €20k annually, whereas the one-time investment for inclusion of heating tubes in the concrete would have been €100.000, but due to the tight building budget, this was turned down. A contract may be based on a certain number of users and compensation may fluctuate based on the number of users.

Some report a shift from an all inclusive financing to a situation where the client starts to make a reservation for refurbishment during MO phase avoiding a surcharge for interest and risk of typically 10% on top of the life cycle cost: “the state buys quality and contractor guarantees the quality’.

Role of financial experts
Top management routinely discusses standard operations with financial experts. Financial experts have a role in monitoring the total cost of ownership in relation to maintenance. It is advantageous for a contractor to extend the life cycle of an asset (escalator; heating; etc), whereas risk of malfunctioning rises and thus the risk of contractual penalties. As long as operations remain within the predetermined contractual standards, expert involvement is scarce. Only when the contract is changed experts are called in.

iv. Legal Issues
The two legal influences are: legal roles and responsibilities and the role of legal experts in the M&O period.

Legal roles and responsibilities
Similar to financial complexity, legal experts mainly play a role in the start up phase: explicating and mapping consequences of clauses that give rise to unclear responsibilities and roles. Legal roles and responsibilities, however, soon become embedded in routine operations and interactions return to relation management.

Role of legal experts in the M&O period
At the start of the M&O, meetings between client and contractor are with the contract on the table. Later as the relationship develops the legal experts move to the background, sometime however it remains part of routines to involve legal experts at management level. In all cases discussed, only one issue caused legal disagreement between client and contractor. According to clients, once the tender is completed, legal specialists no longer are involved (RWS). Only in case the contract needs to be reviewed experts step in again.
Legal issues seem to play mainly within the consortium. Complexity arises for instance when parties only are operational during a part of the DBFMO and later costs or benefits arise that can be related to their involvement. Consequences and liabilities of these earlier decisions can become subject of legal disputes. The same applies to benefits when something was budgeted for 100 and appears to be operational for 80, disagreement may arise over who is to benefit.

In some international consortia as in the Fast Consortium building light rail in Riyadh, a Dutch participant (Strukton) has eight partners from seven different countries, grossly complicating legal issues.
### 6 Overview of Response to Propositions

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Relating to</th>
<th>True / False</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The four categories of complexity adequately cover the M&amp;O phase as well as the CD phase</td>
<td>True</td>
<td>na</td>
</tr>
<tr>
<td>2</td>
<td>Influences are DBFMO-phase dependent and will differ between CD and M&amp;O-phase</td>
<td>True</td>
<td>Degree of relevance differs</td>
</tr>
<tr>
<td>3</td>
<td>Organizational issues in M&amp;O are: Relation management, Performance management and information management.</td>
<td>True</td>
<td>na</td>
</tr>
<tr>
<td>4</td>
<td>Technical issues during M&amp;O are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) performance issues and risk management,</td>
<td>a) True</td>
<td>na</td>
</tr>
<tr>
<td></td>
<td>b) technical issues discussed by technical experts.</td>
<td>b) False</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>For finances the two major influences are expected to be:</td>
<td>a) True</td>
<td>Financial experts have no role in operational M&amp;O affairs.</td>
</tr>
<tr>
<td></td>
<td>a) the rewards and compensation and</td>
<td>b) False</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) the role of financial experts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Legal roles and responsibilities and the role of legal experts are expected to be of minor importance, (rather the legal framework has a stabilizing role supporting trust development)</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>a) Governance on technical issues is dominated by cooperation from both parties.</td>
<td>a) False</td>
<td>In 3 out of 11 only cooperation is dominant</td>
</tr>
<tr>
<td></td>
<td>b) In private-private interactions, next to cooperation,</td>
<td>b) True</td>
<td></td>
</tr>
<tr>
<td></td>
<td>both coordination (risk based maintenance) and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>competition (innovations and technological developments) are present.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>In financial matters the DBFMO is expected to have cooperation as the dominant governance model, mixed with coordination for maintaining a transparent structure</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cooperation is the dominant governance structure for Legal</td>
<td>True</td>
<td>Cooperation is deemed dominant in all aspects.</td>
</tr>
</tbody>
</table>