

Contract management competencies

A research on critical competencies for contract managers from a public client in the infrastructural sector using the Integrated Project Management model and a Design and Construct contract.



Lisette de Jonge - van Wijngaarden
March 2017

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Date March 2017

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Inkoop- en Contract Management

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Preface

This research report is written as part of my graduation research for the master Construction Management and Engineering at the Delft University of Technology. This master program is the finalization of my university education, which I enjoyed very much.

Determining the topic of the graduation project was quite difficult. It had to be an interesting topic for me since conducting the research would take up quite some time. The result of this thesis is something I am very proud of.

I would like to thank everyone who has contributed to this research. First of all I would like to thank the graduation committee, Prof. dr. ir. Marleen Hermans, dr. ir. Ruben Vrijhoef and drs. Martijn Leijten for their contribution and feedback during the entire project. I would like to thank ir. Marjolijn Lubbert for her enthusiasm and support. This has helped me to take the next steps within the research.

Without the help of Tufail Ghauharali, Louis Mauricio, Leon Hombergen and Astrid Boogers I would not have been able to do this research at Rijkswaterstaat. Thank you for providing me with the opportunity to do my internship at Rijkswaterstaat. I would like to thank Hans van Haren, Leo van Es and Huub de Lange for providing me with the large number of respondents for the survey. I would like to thank all participants of the survey and the interviewees for their time and contribution to this research and to everyone who has taken an interest into my research.

I would like to thank my fellow students for collaborating in the research. A special thanks to my friends, especially Ashley, Joost and Cynthia for helping me in the right direction. Last but certainly not least a special thanks to my parents, who have giving me the opportunity to complete this study and who have always believed in me and to my husband Pepijn, for his continuous support, patience and help wherever this was possible.

Lisette de Jonge-van Wijngaarden

Nieuw-Vennep

March 24, 2017

Executive summary

The successful realization of large infrastructure projects is a challenge for both the client and contractor. The mutual obligations between the client and contractor are stated within the contract and are managed by the contract manager. Some contracts run remarkably smoothly, while other contracts are fought over, with all consequences. Different competencies, tasks and requirements are needed to perform successful contract management. Unfortunately, there is a lack of knowledge on the competencies of the contract manager, which are important for successful execution, while practical interest is certainly shown into this topic. The project manager and contract manager are placed into the same function group of the “Functiehuis Rijk”, which is used by the Dutch government and there is no separation made into the competencies of the different roles. In order to adequately assess whether the contract manager can be successful in the future, the objective of this research is to find the critical competencies for a contract manager and to determine if and where the tasks, responsibilities and corresponding competencies of the contract manager and project manager overlap and differ from each other. In this research critical competencies are viewed as the most important and necessary competencies for the contract manager in order to perform contract management tasks and responsibilities.

To achieve this objective, the following main research question is placed central into this research:

What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase in the Netherlands?

In order to provide an answer to the main research question, the research design consists of three steps. First of all a desk research into the topics of contract management, the IPM model (Integrated Project Management model), contract and project management competencies and Design and Construct contracts is carried out. The IPM model is a collaboration model, implemented by Rijkswaterstaat for the management of projects, in which in the decision-making a continuous trade-off is made between the interests of technique, contract and stakeholders in relation to project control in order to achieve a successful project outcome. Within the IPM model there are thus five roles identified: project manager, manager project control, technical manager, stakeholder manager and contract manager. Contract management within the IPM model is defined as the responsibility for a process based control of the determination of the procurement needs, the drafting of the procurement plan, the contract preparation, tendering and contract monitoring within the boundaries of time, money, quality and risks. The desk research has resulted in the first conceptual model on necessary competencies for the contract manager.

The second step is a qualitative analysis of practical data, determined by a comparative case study in which four cases are selected. For a good comparison these are all projects from the GPO department of Rijkswaterstaat with a Design and Construct contract in the realization phase. The results are compared to find differences and overlaps between the cases and are compared to the results of the desk research, concluding with the final conceptual model of competencies for the contract manager and six criteria for successful contract management by the contract manager. The six criteria for successful contract management are: process of amendments, legality of payments, satisfied client, satisfied contractor, prevention of problems and solving problems. In the conceptual model, 43 possibly relevant competencies for the contract manager are found.

The last step entails the quantitative analysis of a survey on the topics on contract management as discussed previously. The survey was sent to project managers and contract managers of two departments within Rijkswaterstaat (GPO and PPO) and to different Dutch water boards in order to form conclusions for the infrastructural client working with the IPM model. The survey is sent online to a sample of 242 contract and project managers from the aforementioned organizations. After a selection of useful responses of project managers and contract managers working within the IPM model and with experience with projects in the realization phase with D&C contracts, the responses of 119 respondents were analyzed with the use of the t-test within the statistical software SPSS.

With 95% confidence it can be stated that the competencies, stated in the table below, are critical to the contract manager in order to perform the tasks and responsibilities, as well for the project manager.

Contract manager			Project manager		
Rank	Competency	Mean	Rank	Competency	Mean
1	Collaboration	4.52	1	Collaboration	4.48
2	Integrity	4.46	2	Binding	4.31
3	Decisiveness	4.40	3	Decisiveness	4.31
4	Risk awareness	4.37	4	Integrity	4.29
5	Communication	4.24	5	Anticipation	4.26
			6	Communication	4.26
			7	Helicopter view	4.24

The contract manager and project manager share competencies, which can be explained by the shared management aspect in their roles. The shared competencies are: collaboration, integrity, decisiveness and communication. The role specific competency for the contract manager is risk awareness. For the project manager it is binding, anticipation and helicopter view. These role specific competencies can be explained by the tasks and responsibilities of each role. As the contract manager has to make sure that the contract is lived up to and the contractor performs according to contract, the contract manager needs to monitor this and notice deviations and the possible effects in time. The project manager is the overarching role that has to bind the IPM team and to monitor the coherence of different aspects within the team. Even though the contract manager and project manager share some critical competencies, both roles are viewed as different aspects within the IPM model.

Remarkably, a further analysis into the competencies of the different backgrounds of the respondents shows that the contract managers of PPO and water boards score considerably higher on soft skills such as binding and empathy than the contract managers from GPO. This might be related to the size of the projects or the history of the departments, but further analysis on this topic is necessary.

The case study has defined six criteria for successful contract management. The corresponding critical competencies for each criterion of successful contract management by the contract manager have been determined and are stated in the figure below.

Process of amendments	Legality of payments	Satisfied client	Satisfied contractor	Prevention of problems	Solving problems
<ul style="list-style-type: none"> • Negotiation • Collaboration • Decisiveness • Cost awareness • Integrity • Making judgements • Risk awareness • Persuasiveness 	<ul style="list-style-type: none"> • Integrity • Meticulousness • Risk awareness 	<ul style="list-style-type: none"> • Integrity • Governance sensitivity • Collaboration • Communication • Approachability 	<ul style="list-style-type: none"> • Collaboration • Approachability • Empathy • Communication • Market focus • Integrity • Flexible behavior • Decisiveness • Openness • Binding 	<ul style="list-style-type: none"> • Collaboration • Anticipation • Empathy • Problem analysis • Communication • Helicopter view • Risk awareness • Openness • Analytical thinking • Integrity • Decisiveness 	<ul style="list-style-type: none"> • Collaboration • Communication • Integrity • Problem analysis • Negotiation • Decisiveness • Empathy • Approachability • Risk awareness • Analytical thinking • Flexible behavior • Creativity

The determination of the critical competencies and criteria for successful contract management has resulted in answering the main research question. Besides this, the recommendation is provided to Rijkswaterstaat to implement the critical competencies in the “meetlat” of contract management and project management in order to select employees with the right competency set for projects with a D&C contract in the realization phase. Besides this, Rijkswaterstaat can now determine the level of interchangeability of the project management and contract management roles that is desirable within the organization, because of the identified differences in competencies. The aforementioned criteria for successful contract management can be used to measure and improve the performance of contract management within the project.

Finally, the report mentions some suggestions for further research. This can be aimed at researching the contractor’s perspective on the contract manager’s competencies, research the possible differences between the project manager and contract manager based on behavioral aspects of the competencies, differences in critical competencies based on function scales, differences due to another type of contract and the possible effects of the differences between the contract manager and project manager within the IPM model.

Samenvatting

De succesvolle realisatie van grote infrastructurele projecten is een uitdaging voor zowel de opdrachtgever als opdrachtnemer. De wederzijdse verplichtingen tussen de opdrachtgever en opdrachtnemer staan beschreven in een contract en worden beheerd door de contractmanager. Sommige contracten verlopen opmerkelijk soepel, terwijl anderen uitlopen op vechtcontracten, met alle gevolgen van dien. Verschillende competenties, taken en vereisten zijn nodig om contractmanagement succesvol uit te voeren. Er is echter een gebrek aan kennis over de competenties van de contractmanager, die van belang zijn bij het succesvol uitvoeren, terwijl er vanuit de praktijk zeker interesse is in dit onderwerp. In het door de overheid gebruikte Functiehuis Rijk worden de projectmanager en contractmanager ingedeeld in dezelfde functiegroep en wordt er geen onderscheid gemaakt in de bij deze verschillende rollen horende competenties. Om in de toekomst op adequate wijze te kunnen inschatten of een contractmanager succesvol kan zijn, is het doel van dit onderzoek het achterhalen van de kritieke competenties voor de contractmanager en om te bepalen of en waar de taken, verantwoordelijkheden en bijbehorende competenties van de contractmanager en projectmanager overlappen en van elkaar verschillen. In dit onderzoek worden kritieke competenties beschouwd als de meest belangrijke en noodzakelijke competenties voor de contractmanager om de taken en verantwoordelijkheden van contractmanagement uit te kunnen voeren.

Om dit te bereiken is de volgende hoofdonderzoeksvraag centraal geplaatst in dit onderzoek:

Wat zijn de kritieke competenties voor een contractmanager in infrastructurele bouwprojecten met een Design and Construct contract binnen het IPM model in de realisatiefase in Nederland?

Om de hoofdonderzoeksvraag te kunnen beantwoorden, bestaat het onderzoeksontwerp uit drie stappen. Allereerst is literatuuronderzoek gedaan naar de onderwerpen contractmanagement, het IPM model (Integraal Projectmanagement model), contract- en projectmanagement competenties en Design and Construct contracten. Het IPM model is een samenwerkingsmodel, geïmplementeerd door Rijkswaterstaat voor de aansturing van projecten, waarbij in de besluitvorming steeds een afweging wordt gemaakt tussen de belangen van techniek, contract en omgeving in relatie tot projectbeheersing om tot een succesvol projectresultaat te komen. Binnen het IPM model zijn derhalve vijf rollen geïdentificeerd: projectmanager, manager projectbeheersing, technisch manager, omgevingsmanager en contractmanager. Contractmanagement binnen het IPM model is gedefinieerd als de verantwoordelijkheid voor de procesmatige beheersing van het vaststellen van de inkoopbehoefte, het opstellen van het inkoopplan, de contractvoorbereiding, aanbesteding en contractbeheersing (contractbewaking) binnen de randvoorwaarden van tijd, geld, kwaliteit en risico. Het literatuuronderzoek heeft geresulteerd in de eerste versie van het conceptueel model met de benodigde competenties voor de contractmanager.

De tweede stap is een kwalitatieve analyse van data uit de praktijk, bepaald door een vergelijkende case studie waarin vier cases zijn geselecteerd. Voor een goede vergelijking zijn alle projecten van de afdeling GPO van Rijkswaterstaat met een Design and Construct contract in de realisatiefase. De resultaten zijn vergeleken om verschillen en overlappingsen tussen de cases te vinden en zijn vergeleken met de resultaten van het literatuuronderzoek, resulterend in de definitieve versie van het conceptueel model van competenties voor de contractmanager en zes criteria voor succesvol contractmanagement door de contractmanager. De zes criteria voor succesvol contractmanagement zijn: proces van wijzigingen, rechtmatigheid van betalingen, tevreden opdrachtgever, tevreden

opdrachtnemer, voorkomen van problemen en oplossen van problemen. In het conceptueel model zijn 43 mogelijk relevante competenties voor de contractmanager gevonden.

De laatste stap bevat de kwantitatieve analyse van een enquête over de onderwerpen van contractmanagement die zojuist besproken zijn. De enquête is gestuurd naar project- en contractmanagers van twee directies binnen Rijkswaterstaat (GPO en PPO) en naar verschillende Nederlandse waterschappen, zodat conclusies getrokken kunnen worden voor de infrastructurele opdrachtgevers die met het IPM model werken. De enquête is online verstuurd naar een groep van 242 contract- en projectmanagers van de bovengenoemde organisaties. Na een selectie van de bruikbare antwoorden van de project- en contractmanagers die binnen het IPM model werkzaam zijn en met ervaring met projecten in de realisatiefase met een D&C contract, zijn de antwoorden van 119 respondenten geanalyseerd met behulp van de t-test binnen de statistische software SPSS.

Met 95% zekerheid kan gesteld worden dat de in onderstaande tabel opgenomen competenties kritiek zijn voor de contractmanager om de taken en verantwoordelijkheden te kunnen uitvoeren, zo ook voor de projectmanager.

Contractmanager			Projectmanager		
Rank	Competentie	Gemiddelde	Rank	Competentie	Gemiddelde
1	Samenwerking	4.52	1	Samenwerking	4.48
2	Integriteit	4.46	2	Verbindend zijn	4.31
3	Besluitvaardigheid	4.40	3	Besluitvaardigheid	4.31
4	Risicobewustzijn	4.37	4	Integriteit	4.29
5	Communicatie	4.24	5	Anticiperen	4.26
			6	Communicatie	4.26
			7	Helikopterview	4.24

De contractmanager en projectmanager delen een aantal competenties wat te maken kan hebben met het gezamenlijke management aspect in beide rollen. De gedeelde competenties zijn: samenwerken, integriteit, besluitvaardigheid en communicatie. De rolspecifieke competentie voor de contractmanager is risicobewustzijn. Voor de projectmanager is dit verbindend zijn, anticiperen en helikopter view. Deze rol specifieke competenties kunnen worden verklaard door de taken en verantwoordelijkheden van elke rol. Aangezien de contractmanager moet zorgen dat het contract wordt nageleefd en de aannemer presteert volgens het contract, dient de contractmanager dit te bewaken en mogelijke afwijkingen en de gevolgen daarvan vroegtijdig op te merken. De projectmanager is de overkoepelende rol die het IPM team moet verbinden en de samenhang van de verschillende aspecten binnen het team moet bewaken. Ondanks dat de contractmanager en projectmanager een aantal kritieke competenties delen, worden de rollen beschouwd als verschillende aspecten binnen het IPM model.

Opmerkelijk is dat bij een nadere analyse van de competenties naar de verschillende achtergronden van de respondenten opvalt dat bij de contractmanagers van PPO en de waterschappen soft skills, zoals verbindend zijn en empathie, aanzienlijk hoger scoren dan bij GPO. Dit kan een relatie hebben met de omvang van de projecten of de achtergrond van de directies, maar nader onderzoek zal dit moeten uitwijzen.

De case studie heeft zes criteria voor succesvol contractmanagement opgeleverd. De bijbehorende kritieke competenties voor elk criterium van succesvol contractmanagement door de contractmanager zijn bepaald en zijn te vinden in de figuur hieronder.

Proces van wijzigingen	Rechtmatigheid van betalingen	Tevreden opdrachtgever	Tevreden opdrachtnemer	Voorkomen van problemen	Problemen oplossen
<ul style="list-style-type: none"> •Onderhandelen •Samenwerken •Besluitvaardigheid •Kostenbewustzijn •Integriteit •Oordeelsvorming •Risicobewustzijn •Overtuigingskracht 	<ul style="list-style-type: none"> • Integriteit •Nauwgezetheid •Risicobewustzijn 	<ul style="list-style-type: none"> • Integriteit •Bestuurs-sensitiviteit •Samenwerken •Communicatie •Benaderbaarheid 	<ul style="list-style-type: none"> • Samenwerken •Benaderbaarheid •Empathie •Communicatie •Marktgerichtheid •Integriteit •Flexibiliteit •Besluitvaardigheid •Openheid •Verbindend zijn 	<ul style="list-style-type: none"> • Samenwerken •Anticiperen •Empatie •Probleem analyse •Communicatie •Helikopterview •Risicobewustzijn •Openheid •Analytisch vermogen •Integriteit •Besluitvaardigheid 	<ul style="list-style-type: none"> • Samenwerken •Communicatie •Integriteit •Probleem analyse •Onderhandelen •Besluitvaardigheid •Empathie •Benaderbaarheid •Risicobewustzijn •Analytisch vermogen •Flexibiliteit •Creativiteit

Het vaststellen van de kritieke competenties en criteria voor succesvol contractmanagement heeft geleid tot de beantwoording van de hoofdonderzoeksvraag. Tevens is de aanbeveling gedaan aan Rijkswaterstaat om de kritieke competenties te implementeren in de meetlat van contract- en projectmanagement, zodat medewerkers met de juiste competentieset geselecteerd kunnen worden voor projecten met een D&C contract in de realisatiefase. Daarnaast kan Rijkswaterstaat nu bepalen welke mate van uitwisselbaarheid van de projectmanagement- en contractmanagementrollen wenselijk is binnen de organisatie gezien het geconstateerde verschil in competenties. De benoemde criteria voor succesvol contractmanagement kunnen gebruikt worden om de performance van het contractmanagement binnen het project te meten en te verbeteren.

Tot slot worden in het rapport enkele suggesties gedaan voor vervolgonderzoek. Vervolgonderzoek zou zich kunnen richten op het onderzoeken van het perspectief van de opdrachtnemer op de competenties van de contractmanager, het onderzoeken van de mogelijke verschillen tussen de project- en contractmanager gebaseerd op gedragsindicatoren van de competenties, verschillen in kritieke competenties op basis van functieschalen of verschillen als gevolg van een andere contractvorm, evenals de mogelijke gevolgen van de verschillen tussen de contractmanager en projectmanager binnen het IPM model.

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List of abbreviations

CM	Contract manager
GPO	Grote Projecten en Onderhoud (Dutch for Large Projects and Maintenance, department at Rijkswaterstaat)
EMAT	Economically Most Advantageous Tender
HID	Head-engineering Director
IPM	Integrated Project Management model
PM	Project manager
PPO	Programma's, Projecten en Onderhoud (Dutch for Programs, Projects and Maintenance, department at Rijkswaterstaat)
TM	Technical manager
RWS	Rijkswaterstaat
SCB	Systeemgerichte contractbeheersing (Dutch for system-based contracting)
UAV-GC	Uniforme Algemene Voorwaarden – Geïntegreerde Contracten

1. Introduction

The realization of large infrastructure projects, such as the construction of roads, bridges and water ways has a growing impact on society. The projects become a part of area development, on which everyone can exert influence. As this involves many stakeholders and there is an increasing complexity in design, it is a challenge for both the client and the contractor to deliver these projects successfully (Hotterbeekx, 2013; Wermer, 2016a). According to Hoezen, Voordijk, and Dewulf (2011), the combination of increased project complexity, the changed role of the government and the sector's poor professional functioning forms the context in which several changes in the construction industry are embedded. "The changes are twofold: on the one hand they are aimed at new structures (formal processes and contracts) and on the other hand at new working relationships (informal processes and understandings). The formal tasks and roles of the government and market have changed. The public clients confine themselves on monitoring as they have less influence on the works. On the other side do the contractors have more substantive tasks" (Hoezen et al., 2011, p. 1). The projects are outsourced by the clients to contractors to manage costs, to transfer risks and to access capabilities that are not available in-house (NEN-ISO 37500:2014 (en), 2014). This makes construction projects and contracts inseparable, because nothing is built without some type of contract. Construction contracts are fundamentally different from major service contracts. There are many types of construction contracts, that vary in the remuneration scheme, risk transfer, responsibility of performance, cost certainty and complexity. The choice of contracts depend on the remuneration scheme and contracting strategy that best fit the project objectives (Office of Governance Commerce, 2002). The client needs confidence in the knowledge that the project is performing in a way to achieve a successful outcome for them, while they are depending on their contractors and therefore the contract. Many contract relations start promising, but end in a deception (Van den Hoven, 2015). This makes the management of the contract a critical element. Contract management is not a new topic as there have always been contracts. However there was no uniformity in the decision making as well as the contract control. Every contract has a multidisciplinary aspect: juridical, commercial, technical etcetera. Therefore there has to be an intermediary that connects all expertise and monitors the affairs. This is basis of contract management according to Knoester (2013).

There might be a systematic approach to contract management in organizations, but even the most carefully designed contracting process will not succeed without capable contract management professionals. Organizations need to invest in developing the functional and interpersonal skills of their staff (Arraiza-Montoux & Henschel, 2013). According to Collin (1997) in Dainty, Cheng, and Moore (2004), establishing the competence or competency of an individual or occupational role has been seen as an increasingly versatile and powerful tool in contemporary human resource management. Such assessments can help to define job-role characteristics and desired levels of performance and can therefore provide a basis for many aspects of the HRM function. Rijkswaterstaat is the largest infrastructural client of the Netherlands and has applied contract management in different ways inside and outside the organization. Some contracts run remarkable smoothly, while other contracts are fought over, with all consequences. Within the organization there is a question what makes a good contract manager (Rijkswaterstaat, 2015a). Different competencies, tasks and requirements are needed to perform proper contract management. Unfortunately, there is a lack of knowledge on the competencies of the contract manager.

1.1 Problem definition

The previous paragraph introduced the context of the topic of this thesis: contract management competencies. Contract management is applied to facilitate the full use of contracts and is a powerful steering mechanism to hold the interests of the public and private parties in balance and to ensure the added value of the integrated contracts when changes are made during the contract period. Contract management is a unique discipline, therefore it can be assumed that unique competences are necessary in order to be an efficient contract manager. However, there is a gap of knowledge on the competencies of a contract manager, while a lot of research has been done on the competencies of project managers and research shows that the competencies of the project team are related to the project performance and organizational performance. Besides this, in practice there is a tension between the responsibilities of the project manager and the contract manager. The distinction in tasks, responsibilities and challenges have become unclear and blurred. Which discipline-specific (hard) skills and interpersonal (soft) skills are necessary for a contract manager? Different vacancies ask for different competencies, but there is no consensus or research done on the necessary competencies for a contract manager.

1.2 Research objective

The problem definition has shown that contract management is a unique discipline, in which there is a gap of knowledge on the competencies of the contract manager. Therefore the following main research objective has been formulated:

“The research objective is to find the critical competencies for a contract manager within the IPM model in a Design and Construct contract in the realization phase in order to get a better overview on the necessary competencies of the contract manager and to determine where the tasks, responsibilities and corresponding competencies of the contract manager and project manager overlap and differ from each other.”

The problem definition shows that there is limited research available on contract management in large client organizations and the competencies of the contract manager, while contract management can lead to contract success and to be able to achieve this, relevant competencies are necessary. This shows there is a gap in the scientific knowledge on this topic. Answering the research question mentioned above will have as scientific purpose to add knowledge to the existing literature. In practice, Rijkswaterstaat is interested in the critical competencies of their contract managers. This research tries to fill in the scientific gap of knowledge and fulfill the practical interest in this topic by researching the critical competencies of the contract manager. In this research critical competencies are viewed as the most important and necessary competencies for the contract manager in order to perform contract management tasks and responsibilities.

1.3 Research question

To achieve the objective of this research, the following main research question has been formulated:

“What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase in the Netherlands?”

This main research question will be divided into sub questions to keep the research structured. The following sub questions have been formulated:

1. How is contract management in construction projects defined, based on the IPM model?

To be able to answer the question which competencies are necessary to a contract manager, insight in the concept of contract management is necessary first.

- 2. What is the role of the contract manager in construction projects within the IPM model?**
The previous question focused on contract management within the IPM model, but in order to research the competencies of a contract manager, it is necessary to understand how the role of the contract manager is implemented within contract management at Rijkswaterstaat through the IPM model, by looking at the IPM model, the tasks and responsibilities of the contract manager.
- 3. Which competencies are being asked from a contract manager within the IPM model?**
This question will look into the currently asked competencies at Rijkswaterstaat within the IPM model. This will serve as a baseline to determine the competencies necessary in the realization phase.
- 4. What are the challenges for a contract manager that come with a Design and Construct contract in the realization phase within the IPM model at Rijkswaterstaat?**
To find elements for which competencies are necessary, it will be researched which challenges a contract manager has in the realization phase.
- 5. In what way do the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?**
As a starting point for an overview of competencies, research into the competencies of the project manager will be used. This question will provide understanding of which competencies of the project manager overlap those of the contract manager and where the differences lie.
- 6. Which criteria can be distinguished to determine whether contract management will be successfully conducted by the contract manager?**
Contract management competencies are necessary in order to conduct contract management in a proper manner. However, it needs to be researched which criteria determine whether contract management is conducted successfully by the contract manager. The focus here will be on the contract manager, as contract management is conducted by the contract manager and his team.
- 7. What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?**
For this question, a survey will be held, in order to find which of the determined competencies of the contract manager are critical. The survey will be held amongst multiple organizations and departments to test for differences and to be able to make statements about contract management within the IPM model in general.

1.4 Report outline

Chapter 2 will describe the methodology and approach of this research. Chapter 3 will describe the existing literature on the topics of contract management, the IPM model, contract and project management competencies and Design and Construct contracts in order to present the first conceptual model. Chapter 4 presents a case study with a description of the design, the results and a cross-case analysis. Chapter 5 will discuss a survey with its methodology and results. Chapter 6 will conclude on the research questions, recommendations will be made to Rijkswaterstaat and the limitations of this research will be indicated as well as suggestions for further research.

2. Methodology

In the previous chapter an introduction is given on the topic of contract management, as well as the problem definition and research objective and question. This chapter will discuss the methodology in order to provide an answer to the sub questions and main research question. First, the methodology will be explained, as well as the research framework and the scope, limitations and relevance of the research.

2.1 Explanation of methodology

According to Verschuren and Doorewaard (2010, p. 155) the decision what kind of approach will be taken – i.e. which kind of strategy to follow – is the most important one when constructing a technical research design. Research strategy is defined as “the coherent body of decisions concerning the way in which the researcher is going to carry out the research.” Multiple research methods can be used to do this research. This paragraph will discuss the chosen research method.

Large construction projects are unique cases. These cases entail behavioral events, which is supported by the topic of competencies. For this type of research, desk research, a case study, or survey are possible options. Experiments are left out as there will not be different groups in which one group will get a special treatment and the other group will remain a control group in order to test changes. Grounded theory and cases studies have some overlaps, as they both can be used for theory developing, both use a sampling procedure for cases and are both approaches to analyze data in a qualitative way. However, with a (comparative) case study it is possible to systematically vary some factors while keeping others as similar as possible, reducing the complexity and enabling the assessment of causality (Researchgate.net, 2015). Also, a case study research will build on existing theory frameworks, to test whether the phenomenon under study applies to this theory (Allan, 2003). As the existing literature and current competencies in practice will be used to form a conceptual model, the case study is a suitable research method and it is chosen to leave the grounded theory approach out as suitable approach for this research.

2.1.1 Desk research

A desk research is a research strategy “in which the researcher does not gather empirical data herself or himself, but uses material produced by others” (Verschuren & Doorewaard, 2010, p. 194). The data for desk research can be literature, secondary data and official statistical material and is a good option as a literature review has to be performed to get a more in-depth view on the research available on contract management and competencies.

An in-depth study through desk research will be done to get insight in the role of the contract manager; to understand the implementation of the IPM model at Rijkswaterstaat and its influence on the tasks and responsibilities of the contract manager and to get in-depth information on project management and the competencies of the project manager. The competencies of both the project manager and contract manager are used, as Rijkswaterstaat has put these two different functions in one family function group, suggesting that the competencies of the project manager and contract manager are related to each other. Besides this, research shows that the performance of the project team is related to project success. Because of this relation between the project team performance and project success, the competencies of the project manager are also relevant for the contract manager. The data needed for this component will mainly be found in reports and documents. This research methodology will be the input for answering sub question 1, 2 and 3 and will result in a conceptual model of possible competencies of the contract manager that will be tested in the case studies. During the case studies also some desk research will be needed to form a general picture of the cases.

2.1.2 Case studies

A case study is “a research strategy in which the researcher tries to gain a profound and full insight into one or several objects or processes that are confined in time and space” (Verschuren & Doorewaard, 2010, p. 178) and is a good option to gain insight in contract management in large infrastructure projects, as those are unique cases. With the use of interviews in the case studies, the opinions of employees of large construction projects on contract management and required competencies will be collected in order to find the competencies of a contract manager compared to those of a project manager in the conceptual model. A few cases of large infrastructural construction projects will be selected. This will all be cases in which both a project manager and contract manager are part of the project team, because the IPM model is used. By doing these interviews with both contract managers and project managers, interfaces between contract management and project management within the IPM model will come to light, as well as the differences, leading to the determination which project management competencies are relevant for contract management and which are not. The selected cases will be in the Netherlands and will involve projects using a Design & Construct contract and will all be in the realization phase. These boundaries are chosen, to make a comparison possible: what differences in competencies can be found between cases and are these differences explained by the cases or do all cases have the same fundamental characteristics and necessary competencies? Parameters such as contract type, contract phase and the structure of the project team won't influence the selection of competencies this way. The choice for Design and Construct contract has been made in order to get a larger target pool. To get more profound information, interviews will be held with a target group of employees of the projects and will involve both viewpoints: those of the contract manager and project manager. Before conducting the interviews, it is important to have determined the key evaluation questions: what needs to be investigated. This should include at least the function of the interviewee, questions on relevant competencies and criteria for good contract management. Chapter 4 will give a more detailed explanation of the case protocol, selection, data gathering and analysis. This research method will result in an answer on sub question 4, 5 and 6.

2.1.3 Survey

A survey is “a type of research in the course of which the researcher tries to gain an overall picture of a comprehensive phenomenon spread out over a stretch of time and/or space” (Verschuren & Doorewaard, 2010, p. 161). An advantage of a survey is its scope. A wide overview will be obtained, general valid statements will be formed and the large number of research units will make it possible to determine statistical relationships. A survey is only possible when there is access to a large number of respondents. The case studies will result in the completion of the conceptual model of necessary competencies. This conceptual model will consist of many competencies of which it will not be possible to get a clear distinction between critical and non-critical competencies due to the relatively small number of cases and corresponding interviewees. With the use of a survey, the findings of the case studies will be quantitatively validated by a larger pool of respondents in order to determine the critical competencies for a contract manager.

The survey will be sent to a large group of contract managers and project managers involved in large infrastructural construction projects with a Design and Construct contract and using the IPM model for the selection of the project team. This will include the contract managers from the GPO department and PPO department at Rijkswaterstaat, but also the different water boards, as they are organizations that also use the IPM model as clients. The department PPO of Rijkswaterstaat and the water boards will serve as a control group in order to test differences amongst the departments and organizations. This survey will generate the critical components from the list of competencies found in the cross case analysis. By including different organizations using the IPM model, the findings of the case studies

within Rijkswaterstaat will be examined to get a complete picture. The results will be used to form an overview of critical competencies, to which the ideal contract manager should comply. The data should exist of a large group of respondents and should be as clear and precise as possible. Chapter 5 will give a more detailed explanation of the survey protocol, data gathering and analysis. The results of this research method will provide an answer to sub question 7, resulting in answering the main research question.

2.2 Research framework

In order to get an overview of the steps to be taken in the research, a research framework has been drawn up. “A research framework is a schematic representation of the research objective and includes the appropriate steps that needs to be taken in order to achieve it” (Verschuren & Doorewaard, 2010, p. 65). The framework shows how the different phases of the research are interconnected and how the one step implies the other. The framework in figure 1 shows the objects for a literature review on the far left. The literature review will be done on the topics of contract management, the IPM model and the role of the contract manager and project manager within this model and the competencies of the contract and project manager. This will give the input for the first version of the conceptual model, which will be confronted with a number of cases in the case study in order to complete the conceptual model. These confrontations will be analyzed and provide input for the survey, which will test the conceptual model to a larger public and will identify the critical competencies out of the conceptual model for the contract manager to contribute to the knowledge on contract management.

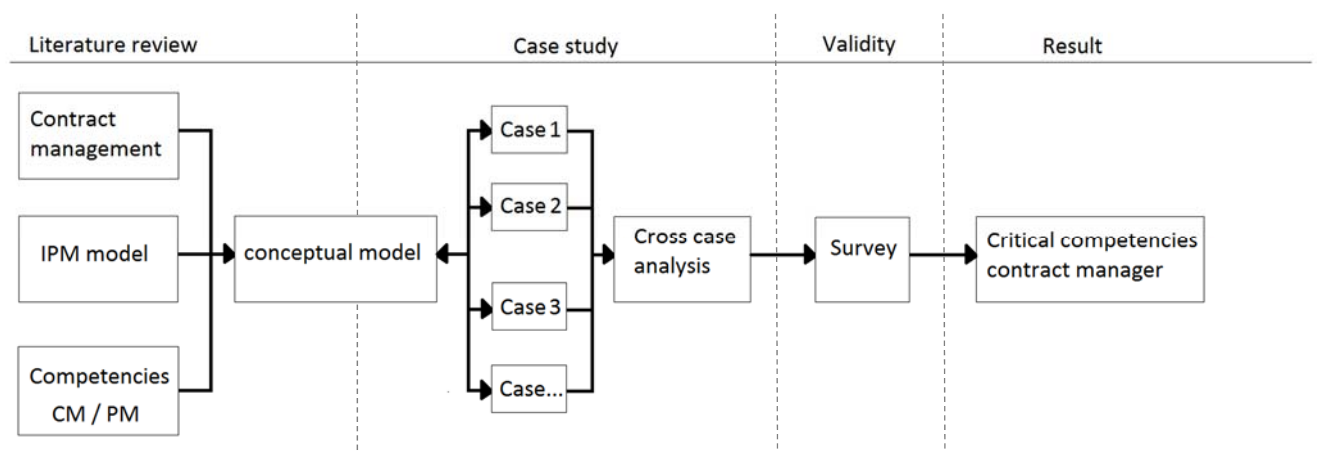


Figure 1: Research framework

2.3 Scope, limitations and relevance of the research

This section describes the scope, limitations and the relevance of the research: what will be included in this thesis, what will be left out due to the limited time available and what will be the theoretical and practical relevance.

2.3.1 Scope and limitations

This thesis will include the following elements:

- A description of contracts and contract management. This will include the benefits of contract management, the key elements and its phases.
- A section on Design and Construct contracts and its influence on the relation between the client and contractor and the corresponding roles, responsibilities and tasks.
- An overview of the Integrated Project Management (IPM) model, a discussion of the different roles within this model and a task and responsibilities description of the contract and project

manager. The IPM model is chosen because it is the most applied model within the largest infrastructural client organization of the Netherlands.

- A discussion of the competencies for contract and project management and a determination of critical competencies of the contract manager with a Design and Construct contract.
- The major infrastructural client organization within the Netherlands is Rijkswaterstaat. The competencies of the contract manager will be based on the contract manager from Rijkswaterstaat from the department of large projects and maintenance (GPO).
- A comparison of tasks and responsibilities between the contract manager and project manager of Rijkswaterstaat.

This thesis will be limited to the scope mentioned above. This means that the following elements will not be included in this thesis:

- The geographical scope is the Netherlands. This means that only projects within the Netherlands will be selected for case studies. No conclusions will be drawn on the potential applicability of the critical competencies from contract managers outside the Netherlands.
- This thesis only includes projects with a Design and Construct contract, not a project with an RAW or DBFM contract. This is chosen because of the number of projects within the Netherlands with that type of contract and larger potential impact with a D&C contract, also outside Rijkswaterstaat.
- Contract management (competencies) from the contractor's perspective. The tasks and responsibilities from a contract manager from the contractor's side will most likely differ from those of the client's side. This thesis will only focus on the client's perspective.
- Projects within the realization phase are the only projects selected. The project and contract lifecycle have different phases from which only the realization phase will be taken into account. Competencies for the preparation, tendering, awarding and hand-over phase will be left out of the scope. This is chosen, as it turns out that in practice, the realization phase is the phase in which projects will experience problems in terms of time, budget and quality at Rijkswaterstaat (Rijkswaterstaat, 2015a). However it can be expected that the research into the realization phase will be related to decisions made in the previous phases. In such situations, this research will refer to the other phases mentioned before.
- Even though the IPM model is a collaboration model in which all roles have overlapping elements, in this research only the tasks, responsibilities and competencies of the contract manager will be taken into account, in comparison to the tasks and responsibilities of the project manager. The competencies and corresponding tasks and responsibilities of other IPM roles are left out of the scope.

2.3.2 Theoretical relevance of the research

Literature provides a lot of guidelines for and research on project management. However, as stated before, there is limited research available on contract management in large client organizations and the competencies of the contract manager. As contract management can lead to contract success, relevant competencies are necessary to be able to achieve this. This shows there is a gap in the scientific knowledge on this topic. Answering the research question, formulated in the previous chapter, will have as scientific purpose to add knowledge to the existing literature on contract management and contract management competencies. Differences between project managers and contract managers will be addressed and criteria for properly conducted contract management will be

researched. Elements for further research will be addressed, leading to even more scientific research. Besides this, research has shown that the project team performance can lead to project success. Project team performance is influenced by the competencies of the team members. As the contract manager is an essential team member within the IPM model of Rijkswaterstaat, research into the competencies of the contract manager is an added value to the knowledge.

2.3.3 Practical relevance of the research

As the major infrastructural client of the Netherlands, Rijkswaterstaat has many large infrastructural projects. For this research, cases are selected that represent the projects of Rijkswaterstaat with a Design and Construct contract that are in the realization phase. There hasn't been any research on the necessary competencies of the contract manager. With a specific competency profile of the contract manager, Rijkswaterstaat can select the right contract manager for their many projects in order to achieve more contract success. Right now, Rijkswaterstaat uses the same function and competency profile for both the project manager as well as the contract manager, which are stated in the Functiehuis Rijk. A networking event for contract managers and project managers of the department GPO from Rijkswaterstaat has shown the necessity of this research, as voices rose during that meeting whether the contract manager or project manager are interchangeable or that the role of the contract manager should be heavier, making the role of the project manager redundant. The differences between the contract manager and project manager have become unclear. This points towards overlap between the roles of the project manager and contract manager, making a research into the competencies of the contract manager necessary. This research will include a validation aspect, in which it will be determined whether the findings can be generalized for other projects with the same criteria in different organizations. If this is the case, the results will be relevant for other projects and organizations as well.

3. Literature review

This chapter presents the outcome of the literature study in which the first version of the conceptual model will be presented. This is based on the existing literature about contracts and contract management, Rijkswaterstaat and the IPM model, competencies of a contract and project manager and the Design and Construct contract. The literature study was conducted to explore the existing scientific and organizational research and information on the topics of contract management and competencies in order to build a theoretical framework. This chapter will be the scientific foundation for the case study and survey. This chapter will provide an answer to sub question 1: *“How is contract management in construction projects defined, based on the IPM model?”*, to sub question 2: *“What is the role of the contract manager in construction projects within the IPM model?”* and to sub question 3: *“Which competencies are being asked from a contract manager within the IPM model?”* in order to formulate the first version of the conceptual model on necessary competencies for the contract manager. First an introduction of contracts and contract management will be given and research on good contract management will be discussed. After that the organizational structure of Rijkswaterstaat and the IPM model will be presented. Then the topic of competencies will be discussed. The last part of the literature study will be the Design and Construct contract. This chapter includes an analysis of interviews with contract managers in the field, in order to test the literature to practice and will conclude with the outcomes of the literature study and interviews.

3.1 Contracts and contract management

A contract is a promise or set of promises between parties, which the law will enforce (Müller & Turner, 2005). It states the mutual obligations between two parties (Knoester, 2013). There are various types of construction contracts. The choice of contracts depends on the basis of pricing and the contract strategy that best meets the project objectives. The various types offer different ways of handling its remuneration, division of risks, responsibility for performance, cost certainty and complexity (Office of Governance Commerce, 2002; Vulink, 2015). The type of construction organization describes the way in which the responsibilities are divided among the participants of the construction process. However, in practice the name of the contract type corresponds to that of the construction organization (PIANOo, 2016).

One of the main contract types is the RAW. In this type of contract, there is a strict separation between the design and execution. This has certain advantages as limited transaction costs and a high degree of certainty that quality is realized, but also disadvantages as the knowledge and experience of the market is left out and the relations between client and contractor are confronting and not dynamic. This type of contract is used in the Netherlands for over 30 years (PIANOo, 2012).

In integrated contract types the contractor is responsible for a larger section of the project than with an RAW contract, depending on the elements that are contracted. An example of such a contract is Design & Construct or Design & Build. In this type of contract, the contractor has the responsibility to determine which activities have to be carried out to execute the project. In this situation, the contractor has the freedom to optimize and innovate in the design and construction of the project (De Ridder, 2001). The downside is that it the procurement phase becomes more difficult due to the differences in the offers (PIANOo, 2016).

Another integrated contract type is DBFM(O). A DBFM(O) contract is a relative new type of contract with a public-private collaboration. In this type of contract, different phases of a project are outsourced to one consortium of private parties in an integrated contract. These contracts have a long duration between 15 and 30 years, which is necessary to recover the investment costs incurred in the design and construction phase at the start of the project. Such an integrated contract stimulates private

parties to take into account the technical feasibility and consequences of maintenance and operation during the design phase. By doing this, the costs of the different lifecycle phases of the project can be adapted. However, the transaction costs are high and these projects require a long preparation period (Bos, 2014; PIANOo, 2016).

3.1.1 Contract management

A lot of energy is invested in the procurement and the establishment of a contract (Bos, 2014). However, only half of the contracts are managed after implementation and only half of those contracts do not go any further than measuring performances. Three quarter of all contracts aren't properly managed (Van den Hoven, 2015, p. 1), while the primary goal of a contract is the management and adjustment of the agreed performance (Bos, 2014). The importance of contract management can be found in all sectors, from public to private, as organisations in both sectors are facing increasing pressure to reduce costs and improve financial and operational performance (Elsey, 2007). According to Bos (2014): "Managing a contract is required, as a contract is realized through some form of negotiation. There is always tension between the requirements of the client and performance the contractor is willing to deliver, given the price offered by the client. Such a compromise is fragile and one must assure that the agreements in the contract are complied with. Furthermore, the environment does not remain the same during the contract period. Ideally a contract is an evolving document which should be adjusted to changing circumstances."

There are different definitions of contract management. Bos (2014) gives the following definition: "Contract management is the process in which full compliance of the obligations of all parties in an agreement is ensured, in order to meet the operational objectives of the contract." According to Van den Hoven (2015), contract management is the "prevention of 'leakage of value' from the contract." Elsey (2007, p. 3) and Carter, Kirby, and Oxenbury (2012, p. 3) describe contract management as a lifecycle management that is "the process of systematically and efficiently managing contract creation, execution and analysis for maximizing operational and financial performance and minimizing risk." According to Carter et al. (2012), contract management is the process that ensures that both parties to a contract fully understand their respective obligations and that these are fulfilled as efficiently and effectively as possible to provide the best value for money. Besides this, contract management is also the active management of the relationship between the client and the contractor over the term of the contract for the provision of goods and services to the agreed standards. Contract management is a multidisciplinary function in which the contract manager has an intermediate function between organization and suppliers and a network inside and outside the organization has to be build (Knoester, 2013).

There are many benefits from contract management. Among those are better insight in the performance of a supplier and added value; more favorable contract outcomes; better internal and external communication; more insight in risks; cost reductions by working more efficiently, insight in possibly extra work and contract savings; early identification and resolution of poor performance; better collaboration, harmony and satisfaction between client and contractor as both parties are familiar with the unified approach, content and results (Bos, 2014; Carter et al., 2012).

The Algemene Rekenkamer (2013) states that a powerful contract management is important as steering – or control – mechanism to hold the interests of the public and private parties in balance and to ensure the added value of the integrated contracts when changes are made during the contract period. This steering mechanism consists of the relation between performance and payments. When the contractor does not provide the required performance, the client does not make payments. This is an important financial incentive to the contractor or consortium to deliver the agreed performance and will balance the interests of the public and private parties. To make sure the steering mechanism

works long-term, it is important to ensure the financial incentive will remain in effect for the duration of the contract. For the steering mechanism to work, the (minimal) output specifications have to be defined in the contract, a system has to monitor the performance of the delivery of output specifications and a payment mechanism connects the financial incentive to the delivery of the agreed performance.

The basis for contract management is laid in the stages before the contract award, including the procurement process. The contract should include pricing mechanisms, provide incentives, escalation procedures, change control procedures and other mechanisms in order to let the contract function. If the contract was poorly constructed, it will be much more difficult to make the relationship a success (Office of Governance Commerce, 2002). This is called the contract management lifecycle and is defined as “the process of systematically and efficiently managing contract creation, execution and analysis for maximizing operational and financial performance and minimizing risk” (Carter et al., 2012, p. 3; Elsey, 2007, p. 3). Generally, the contract management lifecycle consists of three major phases: contract set-up, contract management and contract close-out. Queensland Government (2014) describes these phases as follows: the contract set-up defines the plan, roles and responsibilities for managing a contract. This step allows the contract manager to agree upfront to the key roles and management activities of the contract during its lifecycle. The second phase, contract management, is the key step to manage the contract in order to successfully deliver the goods and services at the agreed level and costs, within the agreed timeframe, with minimal risks. The contract close-out phase is the step for closing-out contract obligations and liabilities with suppliers. It may also include transitioning to another supplier for the goods and services.

The contract management lifecycle is part of the larger procurement cycle, that consists of the six steps depicted in figure 2 below. The first step is defining specification, in which the requirements to which the product or service should comply to in order to meet the users’ goal is defined. The second step is the selection of the supplier, but most of the time this overlaps with the previous phase. At least it includes a market research, drafting a list of potential suppliers, requesting tenders and comparing them. In the third step, a contract agreement will be negotiated. Ordering goods or services is part of step 4. However, this might also be a part of a framework contract and done by another party. The fifth step is the management of the contract, whether the agreed products or services are delivered or not. In the last step, the procurement and delivery of the product is evaluated (NEVI, 2009).

	Define specification	Select supplier	Contract agreement	Ordering	Expediting	Evaluation
P&S Role	<ul style="list-style-type: none"> • Get specification 	<ul style="list-style-type: none"> • Assure adequate supplier selection 	<ul style="list-style-type: none"> • Prepare contract 	<ul style="list-style-type: none"> • Establish order routine 	<ul style="list-style-type: none"> • Establish expediting routine 	<ul style="list-style-type: none"> • Assess supplier
Elements	<ul style="list-style-type: none"> • Functional specification • Technical changes • Bring supplier-knowledge to engineering 	<ul style="list-style-type: none"> • Prequalification of suppliers • Request for quotation 	<ul style="list-style-type: none"> • Contracting expertise • Negotiating expertise 	<ul style="list-style-type: none"> • Develop order routines • Order handling 	<ul style="list-style-type: none"> • Expediting • ‘Trouble-shooting’ 	<ul style="list-style-type: none"> • Supplier evaluation • Supplier rating
Documents	<ul style="list-style-type: none"> • Functional specification • Norm/spec control 	<ul style="list-style-type: none"> • Supplier selection proposal 	<ul style="list-style-type: none"> • Contract 	<ul style="list-style-type: none"> • Order 	<ul style="list-style-type: none"> • Exception report • Due date listings • Invoices 	<ul style="list-style-type: none"> • Preferred supplier list • Supplier ranking scheme

Figure 2: the procurement process. Source: van Weele (2009).

3.1.2 Successful contract management

Activities performed prior to contract award have a strong impact on the contract management process. A few key requirements need to be fulfilled before the contract starts, as they are fundamental for properly conducted and successful contract management. These requirements are the contract terms and conditions that have to be developed and agreed on by all parties, performance management activities and reporting need to be agreed upon, the contract owner needs to be appointed and the contract management plan has to be implemented (Queensland Government, 2014). The arrangement should be flexible enough to accommodate change and requires a mutual commitment to meeting evolving business requirements. However, according to Office of Governance Commerce (2002) successful contract management goes much further than ensuring that the agreed terms of the contract are being met. It is a vital step, but just the first of many. There will always be some tensions between the perspectives of the client and provider, independent from the scope of the contract. It is about resolving or easing such tensions to build a relationship, based on mutual understanding, trust and open communications.

The following list provides factors that are essential for successful contract management, with an explanation of the contribution of each factor, according to the Office of Governance Commerce (2002):

- Good preparation. An accurate assessment of needs helps create a clear output-based specification. Effective evaluation procedures and selection will ensure that the contract is awarded to the right provider.
- The right contract. The contract is the foundation for the relationship. It should include aspects such as allocation of risk, the quality of service required, and value for money mechanisms, as well as procedures for communication and dispute resolution.
- Single business focus. Each party needs to understand the objectives and business of the other. The client must have clear objectives, coupled with a clear understanding of what the contract will contribute to them; the provider must also be able to achieve their objectives, including making a reasonable margin.
- Service delivery management and contract administration. Effective governance will ensure that the client gets what is agreed, to the level of quality required. The performance under the contract must be monitored to ensure that the client continues to get value for money.
- Relationship management. Mutual trust and understanding, openness and excellent communications are as important to the success of arrangement as the fulfilment of the formal contract terms and conditions.
- Continuous improvement. Improvements in price, quality or service should be sought and, where possible, built into contract terms.
- People, skills and continuity. There must be people with the right interpersonal and management skills to manage these relationships on a peer-to-peer basis and at multiple levels in the organization. Clear roles and responsibilities should be defined, and continuity of key staff should be ensured as far as possible. A contract manager (or team) should be designated early on in the procurement process.
- Knowledge. Those involved in managing the contract must understand the business fully and know the contract documentation inside out. This is essential if they are to understand the implications of problems or opportunities over the life of the contract.

- Flexibility. Management of contracts usually requires some flexibility on both sides and a willingness to adapt the terms of the contract to reflect a rapidly changing world. Problems are bound to arise that could not be foreseen when the contract was awarded.
- Change management. Contracts should be capable of change (to terms, requirements and perhaps scope) and the relationship should be strong and flexible enough to facilitate it.
- Proactivity. Successful contract management is not reactive, but aims to anticipate and respond to business needs to the future.

According to Elsey (2007, p. 3), contract management is successful if:

- The arrangements for service delivery continue to be satisfactory to both parties, and the expected business benefits and value for money are being realized.
- The expected business benefits and value for money are being achieved.
- The supplier is co-operative and responsive.
- The organization understands its obligations under the contract.
- There are no disputes.
- There are no surprises.
- A professional and objective debate over changes and issues arising can be had.
- Efficiencies are being realized.

Contract management is an organizational activity. It is not only about the contract manager, but also about the role contract management has within the organization. Van den Hoven (2015) identified five key elements of successful contract management:

1. Organization of contract management
2. Contract administration
3. Performance management
4. Supply management
5. Stakeholder management

The contract is the most important information source. The contract administration (2) should provide the internal organization insight in the contracts and agreements on budgets and milestones. Performance management (3) is necessary to be able to use the steering mechanism. Performances are monitored, contract risks are identified and adjustments can be made. Supply management (4) involves all activities in an organization to create and maintain collaborative relationships with suppliers. Stakeholder management (5) is important as a good contract manager should be a good relation manager who has the ability to build relationships with all stakeholders, but internally as well as externally.

What the most important goals of successful contract management are, depends on the type of (public) organization. The three most important goals of successful contract management for a water board are the (1) development, (2) efficacy and (3) legality of the project. For a municipality these goals are (1) efficacy, (2) legality and (3) effectiveness, while for the government, these goals are (1) legality, (2) internal client satisfaction and (3) providing of accountability (Ierland & Nieland, 2016).

3.2 The IPM model and contract management at Rijkswaterstaat

Rijkswaterstaat is the executive division of the Ministry of Infrastructure and Environment of the Netherlands. Rijkswaterstaat manages and develops the national highways, waterways and waters and strives for a sustainable living environment. Rijkswaterstaat has around 8,700 employees and with

more than 200 years of knowledge and experiences, Rijkswaterstaat knows that it is not only about the technical execution of infrastructural projects. It is also about the balance between all interests: economy, environment and living comfort (Rijkswaterstaat, n.d.-a).

3.2.1 The IPM model

The organizational structure of Rijkswaterstaat consists of 6 specialized departments and 7 regional departments. Two of the specialized departments are the departments of Large Projects and Maintenance (in Dutch: Grote Projecten en Onderhoud, abbreviated with GPO) and Programs, Projects and Maintenance (in Dutch: Programma's, Projecten en Onderhoud, abbreviated with PPO). Both departments are responsible for the realization and maintenance projects of national highways, waterways, bridges, weirs and sluices and operating facilities. The PPO department is responsible for projects with a value below 65 million euros, GPO for projects above 65 million.

The board of Rijkswaterstaat wants a professional, efficient and effective execution of the tasks of Rijkswaterstaat. Therefore attention should be paid to the professionalism and knowledge of Rijkswaterstaat employees and the market parties with whom Rijkswaterstaat collaborates (Wermer & Nissink, 2012). In order to do this, the Integrated Project Management model (IPM model) is implemented at Rijkswaterstaat. The ambition that is at the root of this, is to enhance the efficiency of the production process within the construction sector of Rijkswaterstaat through greater uniformity and standardization in the management, organization and staffing of projects. This uniformity and standardization is necessary for:

- An efficient deployment and exchange of employees across departments and services
- A controlled steering of projects
- A uniform and professional attitude towards market parties

Projects ask for collaboration. From different disciplines collaboration is necessary to get (sub)products to fit well together within a project, to eventually form one integral project result. Sharing and coordinating information and knowledge and coproduction are essential in this. The IPM model is a collaboration model, in which it is important to find the balance between process control on the one hand and substantive quality assurance on the other hand (Expertgroep Projectmanagement, 2008).

The IPM model makes a distinction in the project management between technical, contract and stakeholder management and in the project control for the factors planning, scope and costs. The IPM model is a uniform model that is used in every project and constantly weighs the interests of technique, contract and surroundings in relation to project control to get a successful project result (Wermer & Nissink, 2012). The IPM model as collaboration model means that the input from every member within the project organisation is important to be able to reach the end result. The fact remains that specific project roles can be distinguished within the project organisation, each with a specific contribution to achieving the end result. The idea behind the IPM model and with it the five role model is in the fact that project control, stakeholder management, technical management and contract management are specific disciplines, which justifies five separate roles (Expertgroep Projectmanagement, 2008). The specified roles are project manager, manager project control, technical manager, stakeholder manager and contract manager and are depicted in figure 3. Each role is as important as the other, therefore the relation within the team is not hierarchical. The project manager is depicted 'on top' as this role is related to the internal client. The five core roles have a joint responsibility in realising the assignment. All roles are responsible for a good control of the interfaces between the roles. Besides this, all core roles lead a team within the project. All core roles signal and identify and recognize the need/requirement for changes or modifications relating to the project, make proposals for this purpose and take the initiative. All core roles oversee opportunities, risks and consequences medium

to long term. The IPM team has to be able to exercise control on the market on program and multi-project level. This means that one has to look over project boundaries, project phases and Rijkswaterstaat boundaries. The bundling of projects gives an efficiency profit. The downside is that the IPM team needs to have more experience to reach a higher quality. Knowledge, both substantive as well as process-oriented, together with the right skills and competencies determine to a large extent a successful course of the project (Wermer & Nissink, 2012).

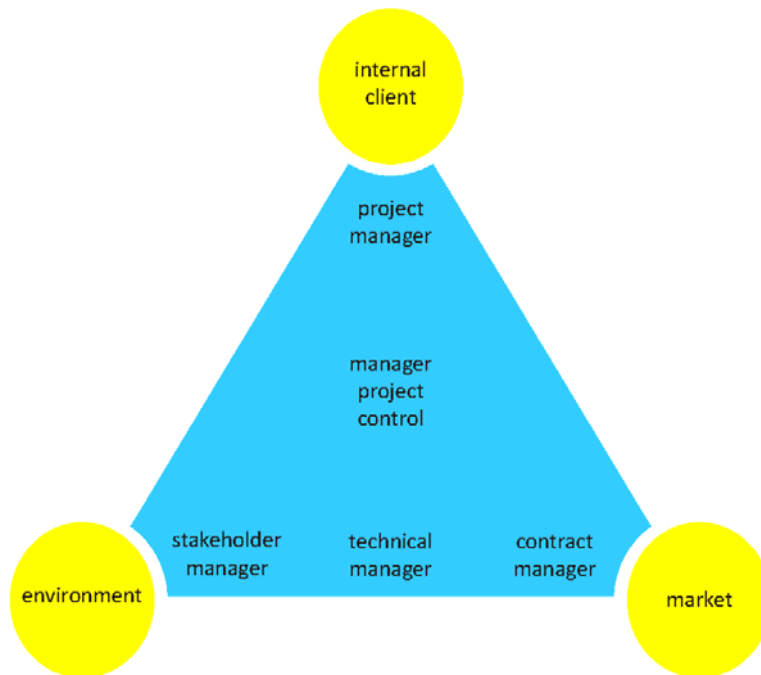


Figure 3: graphical representation of the IPM model. Own depiction, after Rijkswaterstaat (2014b).

3.2.2 The contract manager

The contract manager has a prominent role at Rijkswaterstaat due to the IPM model, as the contract manager is often the contract representative and thus the spindle and figurehead towards the market both during market approach and the implementation phase. According to the Werkwijzer Aanleg from Rijkswaterstaat, contract management is responsible for the process-oriented control of establishment of procurement, the preparation of the procurement plan, the contract preparation, tender in the preparation phase of the project and contract control and monitoring in the realization phase, within the boundaries of time, money, quality and risks. Contract management has interfaces with the other IPM-roles, but also with supply management and risk management (Schat, Maas, Lange, & Meijer, 2016). Within the IPM team, the contract manager is the responsible manager when it comes to the completion of the contractual relation. All aspects of contract management are reviewed daily in an often hectic environment. This requires a flexible attitude of the contract managers in which a steady role and substantive knowledge are important elements (Rijkswaterstaat, n.d.-c).

When a contract is in place, one cannot simply lean back. A working relationship needs to be established between the client and the contractor. Poor communication can result in unacceptable performance, due to misunderstanding and tasks that are poorly done. It can result in conflict between client and contractor. According to Puil and Weele in Hotterbeekx (2013), common problems with the role of contract management within a construction project are: misalignment of objectives between client and contractor; lacking knowledge and expertise at employer; active involvement of engineering and other consultants; inefficient decision making; frequent scope and planning changes;

misunderstanding of what has been agreed; payment problems; and local political pressure. Given the many problems that may interfere in a successful project completion, they recommend that for larger projects, companies must differentiate between project management and contract management. After contract closure the contractor monitors the progress and performance of the contractor based on tests and frequent meetings with the contractor, according to system-based contracting. When the operations of the contractor are not in line with the contract, the contract manager has to intervene. In case of changes to the project or unexpected events, the contract manager should find solutions together with the market parties. In all of the activities, close cooperation with the other project team roles is necessary. Besides this, external relations are also important because of the direct relation between the contract manager and the market (Hotterbeekx, 2013).

The contract manager has the following tasks, according to Expertgroep Projectmanagement (2008, p. 18):

- The contract manager organizes and supervises the procurement – contract (management) team
- The contract manager handles the evaluation and assessment of the contract to the assignment and other agreements
- The contract manager is, on behalf of the client, the contact point for the contractor
- The contract manager performs his tasks within the framework of Rijkswaterstaat's standards, conditions and contracts
- The contract manager decides on documents presented for acceptance
- The contract manager is in the planning phase responsible for mandatory added value tests like the market scan (exploratory phase), planning phase and optionally organises the necessary market consultations
- The contract manager carries out the drafting of the contracts for products in the planning phase and controls large integrated contracts such as the environmental impact assessment
- The contract manager ensures a timely start-up of the market approach for realisation in the planning phase, when an intertwining of the route/EIA and tender phases is chosen.
- The contract manager ensures the preparation of the procurement strategy and procurement plan
- The contract manager will be advised by the procurement consultant regarding all procurement aspects
- The contract manager is responsible for main procurement contracts involving outsourcing costs
- The contract manager takes care of the contract control
- The contract manager establishes a test plan based on the risk dossier
- The contract manager system tests, process tests and product tests carried out
- The contract manager makes sure that risk-based tests are determined, executed and possible be followed-up
- The contract manager weighs the findings of the performed tests and communicates this with testers and contractor
- The contract manager decides on bonus/malus, discounts and penalties
- The contract manager allows himself to be assisted by substantive expertise from other core roles for the review of various contracts under his responsibility

- The contract manager contributes risks within his field, updates and controls them within his field and implements management measures

The responsibilities of the contract manager are:

- The contract manager is responsible for the exploration, preparation, drafting, tendering, awarding and execution of the contract
- The contract manager is responsible for the market orientation, exploration and consultation in accordance to the directives
- The contract manager is responsible for the management of the execution activities based on the agreement within the boundary conditions of time, money, scope, quality and risks.
- The contract manager is responsible for the realization of the contract scope within the boundary conditions of time, money, quality and risks
- The contract manager is responsible for the contract technical related products, as market scan, procurement plan and test plan

Specific role accents of the contract manager are:

- Anticipate
- Resistance to stress
- Judgment ability
- Progress monitoring

3.2.3 The project manager

Another role within the IPM model is the project manager. Rijkswaterstaat defines the project manager as being “the primary responsible one for reaching the project results within the predetermined boundaries for time and budget. He is held liable to this by the internal client of Rijkswaterstaat. The project manager steers the project team, guards the mutual interfaces within the team and binds the individual role keepers as a team and enhances the team spirit. The project manager is the intermediary between the client, line and project” (Wermer, 2016b, p. 7).

The tasks of the project manager are, according to Expertgroep Projectmanagement (2008); Wermer (2016b):

- The project manager organizes and leads the project organization/team
- The project manager is responsible for the creation and execution of the project assignment according to the project plan
- The project manager approves decision documents when it is within his or her authority
- The project manager is responsible for reaching the project results within the requirements of time, budget and quality
- The project manager sees to the appropriate staffing, in consultation with the line
- The project manager has an antenna for changes and is the initiator for decision making on scope changes
- The project manager has a keen eye for binding within the team and enhancing the team spirit
- The project manager maintains contact with the client
- The project manager maintains contact with the Ministry of Infrastructure and Environment, where necessary in consultation and coordination with the client
- The project manager puts risks relating to his field forward and updates this regularly

The corresponding responsibilities are:

- The project manager is responsible for the planning and organization of the project
- The project manager steers and tests the planning and organization of the project management
- The project manager is responsible for initially setting an approved SMART project brief for the project organization
- The project manager is responsible for the realization of the project brief in accordance to SMART agreements, which serve as input for the project plan
- The project manager is responsible for a timely, correct and complete handover and evaluation of the entire project
- The project manager is ultimately responsible for a timely, correct and reliable reporting to the client, amongst others
- The project manager is ultimately responsible for compliance with interested parties/stakeholders (market parties and political/social)
- The project manager is ultimately responsible for the risks within the project
- The project manager is ultimately responsible for the internal quality within the project

The specific role accents of the project manager are:

- Binding leadership
- Targeted control
- Customer focus
- Governance sensitivity

An overview of the tasks and responsibilities of the other roles and the interdependencies between the roles can be found in Appendix A and B.

3.3 Contract and project management competencies

A project is defined as: “a temporary organization to which resources are assigned to undertake a unique, novel and transient endeavor, managing the inherent uncertainty and need for integration in order to deliver beneficial objectives of change” (Turner & Müller, 2003). The construction industry is one of the largest and most established project-based industries. Construction projects are unique and exist within a complex multidisciplinary team-oriented environment (Cheng, Dainty, & Moore, 2005). Groups of individuals from different organizations are brought together to work collaboratively towards project goals. Project management is therefore one of the most demanding roles within the modern construction industry. According to the Project Management Institute (2004, p. 8) project management is “the application of knowledge, skills, tools and techniques to project activities to meet project requirements.” Traditionally, project management is understood as using the right tools and techniques for being successful, regardless of a project manager’s match of personality with the project type (Müller & Turner, 2010). However, according to Mumford et al. (2000), managers are more likely to perform better or to stay longer in their position if their personal characteristics meet the requirements of the position. These characteristics can be identified by profiling the personalities of successful managers. This provides the combination of behavioral, temperamental, emotional and mental attributes. Crawford (2001) linked project management competence, project performance and organizational performance together. Project success is therefore related to the project manager’s competencies.

Competencies can be seen as a specific combination of knowledge, skills and personal characteristics (Müller & Turner, 2010). According to Project Management Institute (2014) competency is defined as “a cluster of related knowledge, attitudes, skills and other personal characteristics that affect a major part of one’s job correlates with performance on the job, can be measured against well-accepted standards and can be improved by means of training and development.” A competent portfolio, program or project manager is qualified with high standards of responsibility and integrity. Therefore, a competent person is considered a capable person. Competencies have different dimensions and can, at any level, be divided into ones that involve performance – the hard, or technical competencies – and others that are personal, or how one interacts most effectively with others – the soft competencies or skills. Competencies apply, regardless of the function of the individual. However, every situation is unique and requires different combinations of abilities and competencies. There is no one-size-fits-all approach (Project Management Institute, 2014).

The requested profile varies by sector (NEVI, 2015). Projects become more complex, more integral, riskier, more output controlled and aimed at a longer life span, leading to a drastic change in the roles of different parties. This already means a different coordinating role for Rijkswaterstaat. Contract types change with it to more PPP-like models and more integration within the chain. This has implications for the competencies and attitudes of parties and means that a more proactive approach is necessary as well as thinking in terms of benefits and revenues instead of costs and having an eye for the context, environment and customers (Wermer & Nissink, 2012).

The function family Project- and Program management of the Dutch government function system, to which contract management in the Netherlands is subject to, has the following description: “To give direction to a temporary cooperation of various disciplines and responsibility to the realization of a project / program assignment within a predetermined timeframe, in accordance with predefined quality requirements and using resources provided.” This involves functions that structural and substantial manage (parts of) projects and programs and are also ultimately responsible for it (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012). According to Hotterbeekx (2013, p. 20), previously the composition of the IPM team was merely based on the availability of employees who represented the different IPM roles. Nowadays a composition mechanism is used to find matching IPM roles within a project team. This helps in composing a constructive IPM team. It is important to take the specific project environment in mind when selecting a contract manager. Different contract types, and the nature of a project call for other types of contract managers. There are managers that focus strongly on the contract, while others are more focused on the relationship with contractors. However, a good contract can never replace a bad client-contractor relationship according to Puil and Weele (2013) in Hotterbeekx (2013).

The project manager and with them the other IPM-roles want to be able to “listen better, deal with conflicts easier, be more empathic and inspire.” Also competencies like team building and leadership are very much wanted. Apparently the environment asks different personal qualities from the IPM roles (Wermer & Nissink, 2012). The current competencies asked by Rijkswaterstaat from their IPM roles are related to the function profiles Project leader and Project manager from the family Project and Program management, as determined in the Functiegebouw Rijk (Rijkswaterstaat, 2012). Below, table 1 is provided in which is showed which research provide which competencies. These competencies also include the current competencies profiles according to Rijkswaterstaat and researches from NEVI (2011), Brill, Bishop, and Walker (2006), Skulmoski and Hartman (2010), Thomas and Mengel (2008) and Dainty, Cheng, and Moore (2003). Besides this, competencies listed in vacancies for contract managers are used. A description of the competencies can be found in appendix C, together with the behavioral indicators of the competencies.

Table 1: Conceptual model of competencies found in literature review

The blue boxes (CM) and red (PM) are competencies listed by Rijkswaterstaat. The green ones (CM) and orange ones (PM) are found in other literature.

	Meetlat contractmanager Rijksoverheid	Rijkswaterstaat (2012)	Vacancies contract manager Rijkswaterstaat	Wermer & Nissink (2012)	meetlat Project manager Rijksoverheid	NEVI (2011)	Funcatieplattgrond TU/E	Kennisportal Inkoop	Kennisportal Europese aanbesteding	Nationale beroepengids	Buyers United	Geertsema (2006)	Tazelaar (2012)	Vacancies	Thomas & Mengel (2008)	Brill et al. (2006)	Skulmoski & Hartman (2010)	Dainty et al. (2003)	score
Communication								x	x		x	x	x	x	x	x	x	x	10
Planning and organising	x	x	x		x			x	x	x		x							9
Integrity	x	x	x		x			x			x				x				8
Analytical thinking			x				x			x		x		x		x			7
Entrepreneurship	x	x	x		x		x	x				x							7
Leadership								x		x	x				x	x	x	x	7
Result driven	x	x	x		x		x	x		x									7
Customer focus			x					x	x			x	x	x					6
Motivate	x	x			x	x					x			x					6
Negotiation						x		x	x			x		x			x		6
Networking skills	x	x	x		x									x				x	6
Organisation sensitivity	x	x	x		x			x							x				6
Act innovative	x	x			x	x								x					5
Approachable	x	x	x		x													x	5
Personal development								x						x		x	x	x	5
Problem analysis				x				x	x					x		x			5
Binding	x	x	x		x														4
Collaboration								x	x	x		x							4
Cost awareness							x			x		x		x					4
Decisiveness						x		x						x				x	4
Environmental awareness		x						x					x			x			4
Making judgments	x		x		x			x											4
Monitoring progress	x	x			x			x											4
Persuasiveness								x	x		x			x					4
servicing	x	x	x		x														4
Flexible behaviour				x				x						x					3
Sociability								x							x		x		3
Creativity								x			x								2
Helicopter view				x		x													2
Independence				x				x											2
Market focus								x			x								2
Open				x										x					2
Project administration / management competencies																x	x		2
Sensitivity								x	x										2
Stress resistance								x						x					2
Vision								x							x				2
Work interdisciplinary						x							x						2
Accurate														x					1
Adaptability								x											1
Ambition								x											1
Anticipate		x																	1
Coaching								x											1
Commitment								x											1
Connecting				x															1
Curious				x															1
Deal with resistance						x													1
Delegating								x											1
Discipline								x											1
Handling details										x									1
Impact								x											1
Initiative								x											1
Inspiring						x													1
Integral thinking									x										1
Juridical insight									x										1
Learning ability								x											1
Listening								x											1
Objective						x													1
Organisational loyalty								x											1
People expertise																x			1
Professionalism																	x		1
Team building																		x	1
Tenacity								x											1
Thinking in facts						x													1
Tools expertise																x			1

The table will be placed central in this research and shows a total of 64 competencies. The competencies that are listed most are communication, planning and organizing, entrepreneurship, integrity, result driven, analytical thinking, customer focus and leadership, while according to Rijkswaterstaat, the competencies are planning and organizing, result driven, integrity and entrepreneurship. This shows a discrepancy in competencies, because the competency mentioned most, communication, and other competencies often mentioned in research like negotiation and collaboration, are not mentioned at all by Rijkswaterstaat. This discrepancy will be investigated in the next chapter.

3.4 Design and Construct contracts

Design & Construct (also known as Design and Build) is a contract type, in which the design and the construction of a building is executed by one contractor. Since the UAV-GC 2000, there is a growing interest in the integration of design and construction in the Netherlands, not only for large public construction projects but also for smaller civil initiatives (Vasters, Prins, & Koppels, 2010). Design and Construct (D&C) is a well-accepted delivery option for major construction projects. The contractual merger of design and construction activities, particularly in complex projects, has improved project time and cost delivery (Australian Constructors Association, 2005). A client who sets out a building project in detail (including plans and working drawings) leaves the contractor no scope for improvisation. The gap between design and execution is too wide to bridge easily. Price competition invites (illegal) deals between building firms (cartel forming). The client's task in the new setting is to precisely define the functional program, the performance criteria for the project and the regulations on spatial planning, the environment, safety, health, maximum annual allowable disruption to infrastructural capacity, etc. Cross-border competition can be more effectively mobilized if the invitation to tender is performance-based. Construction firms will then compete on quality as well as price. Extra quality can be expressed in added value. Construction firms in competition with one another can devise creative solutions to create this added value (Priemus, 2009).

According to Priemus (2009), the building trade is not exactly renowned as an innovative branch of industry, as Dutch construction firms have invested 0.09% of their turnover in R&D, while the average of other sectors is six times as much (0.59%). This is usually attributed to the relatively small size of the firms and the heterogeneity of the product. Besides this, traditionally constructors have not been able to exert any real influence on the design. Priemus (2009) states that the Dutch building sector in general is characterized by difficult client-contractor relationships, low innovative capacity and unfavorable price-quality ratios. Recently, integrated contracts have been put out to tender in which the dividing line between design and construction is fuzzy or even non-existent. In these cases, the contractor also provides the design, which is ideally speaking based on a program of functional requirements submitted by the principal. The hypothesis is that D&C contracts give the contractor plenty of design freedom and that the contractor often gets a chance to apply process and product innovations. The aim of the Design & Construct contract is therefore to achieve better price-quality ratios in projects by closer integration of design and construction expertise. The integration of design, construction and possibly maintenance would redistribute the risks between the principal and the contractor, because the contractor would have a greater responsibility. The principal would concentrate on determining the functional requirements, on the basis of which the contractor would be free to optimize the execution. Design freedom for the contractor would save building costs, shorten building time and stimulate creative competition, innovation and dynamism. It increases the efficiency of the building process in terms of costs and time as it offers certainty on the contract sum as the close integration of design and construction methods give the contractor the relative freedom to use their purchasing power and market knowledge to provide the client with a competitive price (Power, 2016; Priemus, 2009; Vasters et al., 2010).

A few benefits are distinguished by De Ridder (2001, pp. 1-2) for clients dealing with the development of complex system with a D&C contract. “The main advantage is that the time, needed for design and construction, can be shortened when compared with the traditional contracts, as late phases of design can overlap early phases of construction. In consequence, operational benefits can start earlier having a positive influence on the cash flow and hence also on the overall viability of the project. Another advantage is that clients are dealing with one party being responsible and liable for the eventual result. There is also an important disadvantage for clients. The most important disadvantage is that the projects goals expressed in performance, time schedule and budget are fixed at the moment that uncertainties are at “maximum”. This also would be the moment that not all possibilities would have been investigated, which means that clients are not able to define exactly what they want. The main consequence is that clients will eventually get a building or a structure which does not fulfil the a priori expectations.” For the contractor, mostly disadvantages can be found. This is caused by the early fixation of project goals, while at the start the project is underestimated due to perception problems. This perception makes the clients’ and contractors’ image subjective, partial and relative, while it should be objective, global and absolute in order to justify the fixation of the project parameters at the start of the project, according to De Ridder (2001). This places much more liability on the contractor due to the variables that have to be managed (Power, 2016).

D&C is a project delivery method whereby the contractor takes responsibility for both the design and construction of the project based on requirements specified by the client. The D&C process starts when the client causes a project brief to be developed. This will determine the client’s project requirements and will typically include the functional, performance, quality and design life requirements. The project requirements will also include any constraints on the design, such as land acquisition, environmental approvals and the like. The client will call for tenders and enter into a contract with the accepted tenderer on a fixed price basis, where the contractor carries out the design using its own designer. There are a number of reasons why the clients choose a D&C contract according to Australian Constructors Association (2005) and include the shortened program duration, fix costs, innovation, value improvement, an established program and reduced change of claims (compared to separate design and construct responsibilities).

Vasters et al. (2010) have determined a few contract characteristics of a D&C contract, which can be found in table 2. The characteristics include the transfer point, competition, design responsibility and exploitation responsibility.

Table 2: characteristics of a D&C contract. Source: Vasters et al. (2010, p. 85).

Characteristics	D&C
Transfer point	After the program phase and before the development phase, on the basis of a specification possibly including drawings.
Affiliation designers	At the contractor
Competition	All alternatives possible
Reward system	Fixed price
Management structure of construction phase	At the contractor
Management structure of design phase	Go and no go moments
Design responsibility	At the contractor
Financing responsibility	At the client
Exploitation responsibility	At the client

Table 3 provides an overview of the effects of a D&C contract. One of the main downsides is the full liability of the contractor for both the design as well as the construction works, making the risks of the contractor beyond all proportions, according to De Ridder (2001). The risk adopted by the main contractors in relation to D&C projects need to be managed in an effected manner. The risks include design changes, cost issues, time delays, high work pace etcetera (Power, 2016). This can lead to claim situations, if the client measures the actual performance below his expectations or if the contractor claims a financial compensation for extra efforts, which mainly originate from the consequences of unexpected events. Therefore the client is able to make changes (variations) in his request during the design process and the contractor has to be financially compensated for every change in scope.

Table 3: effects of D&C. Source: Vasters et al. (2010, pp. 85-86)

	Positive impact on D&C	Negative impact on D&C
Time	<ul style="list-style-type: none"> • Harmonization of design and construction. • Possibility of fast-tracking. • No full specifications necessary. • The contractor will understand the design better and vice versa. • Risk of time delays are transferred to contractor in an earlier stage. • Innovative solutions can be considered in design and construction. 	<ul style="list-style-type: none"> • The specification is more complex and demands more time.
Costs	<ul style="list-style-type: none"> • Harmonization of design and construction. • Risk of an incomplete design is smaller when the contractor takes full responsibility. • Due to low participation of the client, he has lower costs. • Tenders that are deposited by subcontractors by D&C are realistic and better competitive. • The contractor will understand the design better and vice versa. • Risk of cost overruns are transferred to the contractor in an earlier stage. • Innovative solutions can be considered in design and construction. 	<ul style="list-style-type: none"> • The specification is more complex and demands more costs. • The tender for D&C can result in less potential contractors and therefore in a less competitive price. • Risk purchase of the contractor brings extra costs with it.

This gives some additional requirements to the parties after the contract has been signed, which also should be included in contract documents. Communication is a key issue. The client should make sure that there are no impediments to the successful completion of the project, to take an overview, away from the day-to-day issues. The aforementioned variations will arise if the client changes its

performance scope or technical criteria, or if a regulation changes. The contractor should comply to this (Australian Constructors Association, 2005).

Rijkswaterstaat wants to realize efficient projects with an added value for the users and stakeholders. This requires the optimal use of expertise, innovation and creativity of the market, making the D&C contract one of the major used contract types. The choice of contract type depends, amongst others, on the risk of the project. When the D&C contract type has been chosen, Rijkswaterstaat will provide the contractor a functional program and the requirements to the processes of the contractor. The contractor has to show that they comply to this (Rijkswaterstaat, 2015b).

As every project has other interests, functional requirements and other parties involved, Rijkswaterstaat chooses to work with a clear and structured approach in phases. These phases are (Rijkswaterstaat, 2014):

1. Initiative: the government or politicians take the initiative and decides on whether a infrastructural project should be executed. Rijkswaterstaat functions as the client towards the market.
2. Exploration: Rijkswaterstaat analyses the problem and formulates solutions. Often, the market is already included in this phase for the knowledge and experience. Rijkswaterstaat stimulates the market to come up with innovative and sustainable solutions.
3. Planning study: the alternatives are being reviewed and submitted to the public for a say. The secretary takes the final decision.
4. Elaboration: when the main features of the final solution are known, a procurement plan with the tender, contract type and project instruments is drafted. The contract type that is selected mostly, is the Design and Construct contract as discussed above. Only in very complex projects, a DBFM contract is selected. When the procurement plan is ready, the project assignment is formulated. Market parties have the possibility to make improvements to the design and execution on top of the minimal requirements.
5. Review: the tenders will be reviewed, where it will always first be reviewed on quality and then on price.
6. Execution: In the realization phase, Rijkswaterstaat used the IPM model. The contract clearly states the division of responsibilities between Rijkswaterstaat and the contractor.
7. Hand-over: when the construction is complete, it is audited by Rijkswaterstaat in order to see whether the contractor delivered what he promised.
8. Management and maintenance: the maintenance projects mostly have a performance contract. Only in DBFM contracts this is an integral part of the assignment.

The market is involved in every phase. However, the largest involvement is in the realization phase and management- and maintenance phase (Rijkswaterstaat, n.d.-b). Within this research, the focus will be on the execution or realization phase for determining the competencies for the contract manager.

3.5 Results from general interviews

Together with other graduate students from the TU Delft on the topic of contract management, general interviews have been held with contract management experts. The interviewees came from different sections of the infrastructural sector and included contract managers and a contract management department head from Rijkswaterstaat, contract managers from Rijksvastgoedbedrijf, contract managers at the clients' side from consultancies, contract managers from the water authorities and contract managers from the contractors side from two major contractors. In total

fourteen interviews have been held. In this section elements from the interviews will be presented and compared to the literature discussed in the previous paragraphs. The topics will consist of contract management (responsibilities and difficulties), competencies, differences between contract management and project management and the influence of the contract lifecycle on contract management in the realization phase. The complete interview protocol can be found in appendix D. Besides this, the comments from project managers and contract managers from a networking event from Rijkswaterstaat are included in this paragraph also. This networking event had as general topic the relation between project manager and contract manager. The complete analysis on the general interviews and networking event can be found in appendix E.

3.5.1 Contract management, responsibilities and difficulties

During the interview one of the questions asked, was “What is contract management to you?” and “What do you see as the main purpose of contract management?”. Open questions were used in order to determine what the definition of contract management is according to the interviewees and to test the responses with the literature. The general answer from all interviewees was, that contract management is to make sure that you will get what was promised in the contract. This was the response from contract managers from the client side, as well as from the contractor’s side. One of the main objectives of contract management was seen as aligning the objectives of both parties and safeguarding the interest. This corresponds with the literature, as a definition of contract management was being the process to ensure that both parties to a contract fully understand their respective obligations and that these are fulfilled as efficiently and effectively as possible to provide the best value for money. However, as literature showed a contract management lifecycle, that included the contract set-up or contract creation, execution and contract close-out, not all contract manager experts agreed on where contract management will start. One said:

“Contract management starts after the tender is done and the contract is signed. It is about managing the contractual relationship between the parties involved, about making sure everyone fulfills their part of the contract, to make the process go smoothly and to make sure the contract is working.”

However, another contract management expert said that it starts earlier and also involves the planning phase, as contract management is also about what and how it will be in the contract. The main responsibilities are coherent to the purpose of contract management as it entails the interaction between the client and contractor to realize the work, to make the different parties work together in collaboration and to understand the mechanisms involved and to make them work smoothly. It also includes the justification of the payments, process of amendments and dealing with subcontractors. A difficult element of contract management is the high administrative level in the last phase, as that is something that doesn’t have the focus of the contract manager. Other difficulties mentioned, are the risks involved, poorly written contracts, the tension with the market and when to intervene. At the networking event of Rijkswaterstaat, the general opinion was that the D&C philosophy was 6-7 years ago to leave everything to the contractor and to ‘sit on one’s hands’. This opinion has changed, as you should be more involved now.

“On the one hand you have to maintain the contractual line, on the other hand you have to make sure you deal with it in a good way and to maintain the right atmosphere. It is difficult to determine when to intervene.”

This last citation shows the tension that will always be there between the client and the provider, but that the relationship between the client and contractor is something that always should be worked on.

3.5.2 Contract management competencies

The literature study discussed the need for selecting the right person for the job, as competencies can influence project performance, but also team performance. One consultant literally agreed to this by saying that:

“Competencies are important, as the contract manager should be fit for the job.”

The other interviewees did not go into the necessity of competencies, but discussed the necessary competencies for a contract manager. Everyone agreed to the necessity of soft skills. Competencies were mentioned such as helicopter view or thinking about the bigger picture, analytical thinking, political sensitivity, networking skills, planning and organizing, result oriented, communication, being open to people, negotiation and collaboration. However, a discrepancy in answers came on whether the contract manager should have a good technical knowledge or not. The supporters advocate that you cannot decide on a solution if you don't understand it, while this can be contradicted by the opinion that it is more important to have a helicopter view.

3.5.3 Differences contract management and project management

In the IPM model, a separation has been made in tasks and responsibilities of the contract manager and project manager, while there is no difference in competencies according to the Functiegebouw Rijk and Meetlat from Rijkswaterstaat. In the interview, a question was asked about the differences between contract management and project management. The answers from the interviewees could be placed into two different opinions: those who think there is an actual difference and those who think this is very minute. For example:

“I would say contract management is a part of the project management. In each project it is different. Sometimes the project manager and the contract manager are basically the same person. It depends on the situation – what is the project, how is the organization of the project structured or not. Not all organizations use the IPM model.”

This is of course something that has to be taken into account. Not all organizations use this separation between the project manager and the contract manager as the IPM model does.

However, other voices support the differences between the contract manager and project manager as there are differences in the integral responsibilities. On the question whether the contract manager could become a project manager or the other way around, someone said:

“Once you are a good project manager you can become a contract manager. It is difficult the other way around or even impossible. You have to oversee all the possibilities, escapes, etcetera to become a contract manager. Now a project manager has a more internal role, getting the budget fixed, keeping the organization represented. The contract manager is dealing more with the product and the executing party.”

At the networking event of Rijkswaterstaat a theorem was whether contract managers and project managers are exchangeable. This led to a discussion with different opinions as mentioned above. Some said that different competencies are necessary, while others agreed with the last citation, that the contract manager needs more knowledge and that you can grow towards becoming a contract manager, but not replace him.

3.5.4 Influence of other phases

According to the literature, the activities prior to contract award have a strong impact on the contract management process. Not all interviewees agree to this. Some say that there is no relation as you don't know with whom you are going to deal later on, or that it can even be an advantage if you're not

involved in the previous phases, because you will then have a clear view. However, others agree that it has a strong influence.

3.6 Conclusion

This paragraph will conclude the literature research on the topic of contract management, Rijkswaterstaat and the IPM model, competencies and D&C contracts as depicted in the previous paragraphs and the views of contract management experts, found in interviews on this topics. The answers to sub questions 1, 2 and 3 will be provided here.

Contracts are defined as a promise or set of promises between parties, which the law will enforce. There are various types of construction contracts. The choice depends on the basis of pricing and the contract that best meets the project objectives. The type of contract describes the way in which the responsibilities are divided. Contract management is a very important mechanism, as the primary goal of a contract is the management and adjustment of the agreed performance. There are many definitions on contract management, but all entail the element of meeting the agreed objectives. The definition that will be used in this thesis is the following: “the process of systematically and efficiently managing contract creation, execution and analysis for maximizing operational and financial performance and minimizing risk.” Besides this, contract management is also the active management of the relationship between the client and contractor over the term of the contract for the provision of goods and services to the agreed standards. It gives the contract manager an intermediate function between the organization and suppliers and a network inside and outside the organization. Contract management experts agree to this, by all describing the same definition of contract management and important elements from contract management. The benefits from contract management range from insight in the performance of the supplier and risks to better collaboration, harmony and satisfaction between client and contractor. For public clients, contract management is important as a steering or control mechanism to hold the interest of the public and private parties in balance. This steering mechanism consists of the relation between performance and payments. At Rijkswaterstaat, the largest infrastructural client of the Netherlands, this steering mechanism is called system-based contracting. This includes system, process and product tests in order to monitor the performance of delivery of the output specifications. Contract management consists of three major phases, the contract set-up, contract management and contract close-out. These three steps are part of the larger procurement cycle, that consists of the specification step, selection of supplier, negotiation of contract agreement, ordering goods or services, contract management and evaluation of the procurement and delivery of the product. The contract management experts discussed that the phases before the contract management phase might be very important to contract management, as the choices made in drafting the contract, will influence the realization phase. The replacement of central members might lead to a deviation from the initial course. However, according to others, there is no relation as you don't know with whom you are going to deal later on and having a clear view might help. In order to perform contract management in the right way, a few essential factors have been listed. Among others, these are a good preparation, the right contract, relationship management, knowledge, change management and people skills, continuity, no disputes and a cooperative and responsive supplier.

At Rijkswaterstaat, the executive division of the Ministry of Infrastructure and Environment of the Netherlands, the contract manager is one of five roles of the Integrated Project Management model, which is used for all executed projects for uniformity. The contract manager has a prominent role, as he is the contract representative towards the market. The contract manager monitors progress and performance and intervenes when operations are not in line with the contract. The roles of the contract manager and project manager are closely connected. There are differences in the integral responsibilities, as the project manager is internally responsible as well for the escalation process,

while the contract manager gets more in the lead when the project becomes closer to the realization phase, but contract management can also be seen as a part of project management.

As stated before, within Rijkswaterstaat contract management is part of the larger Integrated Project Management model. However, the contract management is mentioned as being the process that ensures that both parties to a contract fully understand their respective obligations and that these are fulfilled as efficiently and effectively as possible to provide the best value for money. It is also a steering or control mechanism to hold the interests of the public and private parties in balance and to ensure the added value of the integrated contracts when changes are made, which consists of the relation between performance and payments. This is still the case for contract management at Rijkswaterstaat. Within the IPM model, the contract manager is responsible for the completion of the contractual relation, measures the performance of the contractor and links the performance with payments through discounts and penalties. Within Rijkswaterstaat, the contract manager is also responsible for the larger procurement lifecycle, as he is responsible for the exploration, preparation, drafting, tendering, awarding and execution of the contract and thereby fulfilling the definition of contract management that will be used in this report. Based on this, no differences have been found between the literature on contract management and the implementation of contract management within the IPM model at Rijkswaterstaat.

As projects are unique endeavors with complex multidisciplinary teams, the competencies of individuals are important. Competencies are defined as a cluster of related knowledge, attitudes, skills and other personal characteristics that affect a major part of one's job, correlates with performance on the job, can be measured against well-accepted standards and can be improved by means of training and development. At Rijkswaterstaat, the roles of the contract manager and project manager are part of the same function family Project- and Program management and therefore have the same formulated competencies, such as planning and organizing, integrity, result driven, networking skills, organization sensitivity and being approachable. However, research on contract management and project management competencies showed communication, analytical thinking, leadership, negotiation, problem analysis, collaboration, cost awareness and decisiveness as the most important ones. This shows a discrepancy between the competencies according to Rijkswaterstaat and to the literature. Experts on contract management mention both sets of competencies. According to them, the development of soft skills is an important improvement to contract management, as well as a more balanced risk division and to build trust from the beginning of the project.

The risk division is determined through the contract. A D&C contract is often chosen by Rijkswaterstaat and with this contract, the contractor is responsible for both the design as well as the execution of the project. This type of contract mostly provides benefits for the client, as time can be shortened because the latest phases of design can overlap early phases of construction and can give value improvement, innovation and fixed costs. The downside is that the functional program has to be determined earlier in the project, while they might change later. For the contractor is this also a downside as well as the large liability due to the variables that have to be managed.

Within this literature review, the sub questions 1: *"How is contract management in construction projects defined, based on the IPM model?"*, sub question 2: *"What is the role of the contract manager in construction projects within the IPM model?"* and sub question 3: *"Which competencies are being asked from a contract manager within the IPM model?"* answered. Contract management is defined as the process of systematically and efficiently managing contract creation, execution and analysis for maximizing operational and financial performance and minimizing risk. Within the IPM model, contract management is the responsibility for a process based control of the determination of the procurement needs, the drafting of the procurement plan, the contract preparation, tendering and contract

management (contract monitoring) within the boundaries of time, money, quality and risks. The role of the contract manager in this, is to monitor the progress and performance and to intervene when operations are not in line with the contract. The contract manager is the contract representative towards the market. In case of changes to the project or unexpected events, the contract manager should find solutions together with the market parties. In all of the activities, close cooperation with the other project team roles is necessary. Besides this, external relations are also important because of the direct relation between the contract manager and the market. The answer to the third sub question is given by the analysis of different researches into the competencies for the contract manager and the project manager and the competencies that are currently asked by Rijkswaterstaat for both roles. Figure 4 gives an overview of the competencies listed in these researches and the number of times these competencies are mentioned. This is the first version of the conceptual model.

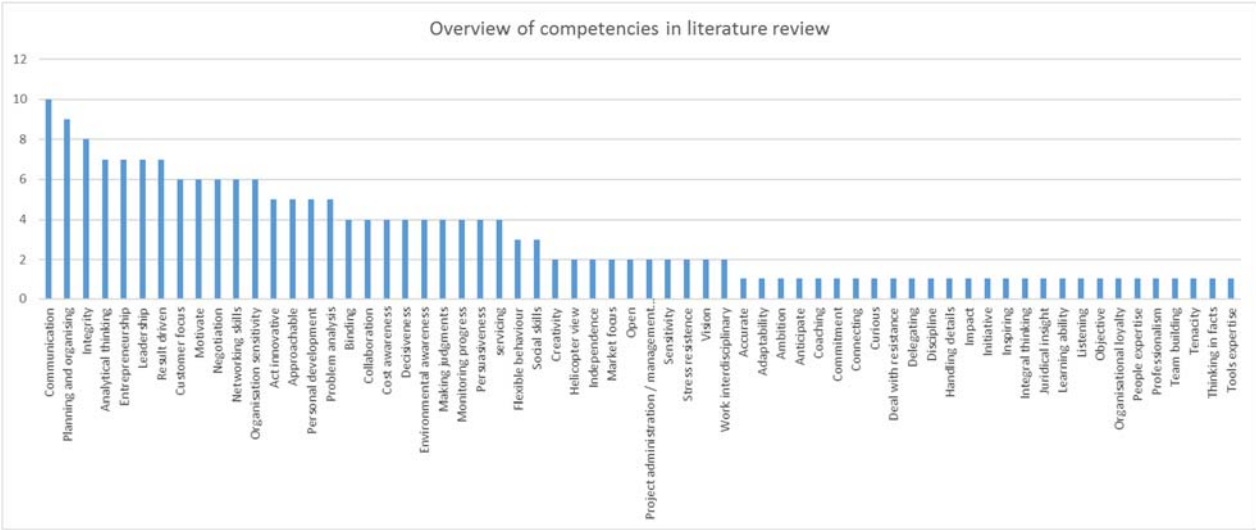


Figure 4: Conceptual model of necessary competencies according to literature

The literature review provided the theoretical framework (conceptual model) of necessary competencies for the contract manager and project manager. The conceptual model covers a large number of competencies. This conceptual model will be completed with perspectives from practice with the use of a case study in the next chapter.

4. Case study

The previous chapter gives a good overview of the existing literature and provides the first version of the conceptual model. This chapter will complete the conceptual model by gathering practical data. The case study focuses on the sub questions 4: *“What are the challenges for a contract manager that come with a Design and Construct contract in the realization phase within the IPM model at Rijkswaterstaat?”*, sub question 5: *“In what way do the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?”*, and sub question 6: *“Which criteria can be distinguished to determine whether contract management is properly conducted?”* Besides this, the answers to sub question 2: *“What is the role of the contract manager in construction projects within the IPM model?”* and sub question 3: *“Which competencies are being asked from a contract manager within the IPM model?”* from the literature review are verified with the perspectives from practice. First, a clarification will be given on the research methodology, case study protocol, data gathering and data analysis in section 4.1. Then the selection of cases will be discussed. After that, section 4.3 will consist of the case study comparison results. The chapter will conclude with section 4.4 in which answer will be provided to the sub questions.

4.1 Methodology

In section 2.1.2 the following definition for a case study was given: *“a case study is a research strategy in which the researcher tries to gain a profound and full insight into one or several objects or processes that are confined in time and space”* (Verschuren & Doorewaard, 2010, p. 178). In a case study a relative small number of research units, or cases, are selected. This means that a quantitative analysis of the data is not possible, but a qualitative method should be used and therefore the emphasis will lay on the comparison and interpretation of results. As a case study opts for depth instead of breadth, intensive methods for generating data are used, such as an interview. Several variants of the case study can be distinguished, from which the comparative case study will be used in this research. The comparative case study entails several interrelated cases that will be compared. The hierarchic method determines that in the initial stage separate cases will be examined independently as if they were a series of single case studies. In order to be able to make a comparison in the second stage, it is necessary to proceed in each case according to an established pattern. In the second stage, a comparison is made by trying to find explanations for the similarities and differences between the cases (Verschuren & Doorewaard, 2010).

4.1.1 Case study protocol and data gathering

Following a specified case protocol increase the reliability of the case study research. It ensures an established pattern that will be followed in each separate case. An important element of the case study protocol is the unit of analysis. The determined unit of analysis in this research is a project. This sets the focus of the research and determines what subjects and elements are important. A distinction can be made between a single and multiple case study design. In the previous paragraph the comparative case study was mentioned, making a single case study impossible. This was chosen as an infrastructural construction project is unique and a single case study would not provide enough reliable data. By comparing multiple cases, similarities and differences can be found. The choice was made to select the project manager and contract manager of each project in the case study analysis, to research their opinions on the competencies of the contract manager and the overlap and differences between the contract manager and project manager. The complete case study protocol can be found in appendix F. Semi-structured interviews were chosen as the method of data gathering, as these interviews make it possible to ask specific questions and to immediately ask follow-up and clarification questions. A number of questions were structured in the form of an interview protocol, starting with introductory questions on the background of the interviewee and specific problems of the project. After that,

questions would be asked on the daily tasks of the interviewees and corresponding competencies in relation to the current project. The third set of questions consisted of the relation between the contract manager and the project manager. The last element was the testing of the found competencies in literature, the conceptual model, and finalizing questions in which each interviewee would have the possibility to add to the topics discussed. This list of competencies consisted of the competencies mentioned at least twice by different sources and all competencies listed by Rijkswaterstaat. For each interview, the consent of the interviewee was asked to record the interview, in order to transcribe it more literally and confidentiality was guaranteed. At the end the interviewee was asked to participate in a follow-up survey. The complete interview protocol can be found in appendix G. Prior to the interview a short description of the project was made in order to be well-prepared for the interview. To guarantee the confidentiality and anonymity of the interviewees, the projects are made anonymous and the description of the project won't be included in this report. Not all questions were asked in each interview, because some questions were already answered during a different question or due to time limitations. In order to make sure that the most crucial questions would be answered, the most important questions were determined beforehand. The complete interview would take up to 60-90 minutes on average.

4.2 Selection of cases

The case selection is an important aspect of the case study, as each case should be selected carefully so that it will predict similar results and it should serve a specific purpose. The first criteria to which the case should comply are:

- A project from Rijkswaterstaat
- A project from the department GPO
- A project with a Design and Construct contract
- A project in the realization phase

These selection criteria were chosen in order to leave out elements that can influence the critical competences such as project organization, department, contract type and contract phase. These criteria provided a list of ten possible cases. Due to time limitations a subsequent selection should take place. Another selection criterion becomes the department that hosts the project manager and contract manager of the projects. This is chosen, as a project manager or contract manager from a different department or even a hired one, won't have the same responsibilities and tasks (external managers) or mindset (different department). In order to make the cases even more comparable, the managers that are not from the GPO department are left out of the selection. This gave a selection of five cases. One of the possible cases was deemed unfit, as it was a project consisting of multiple smaller projects of steel construction works. This is different type of project and therefore left out of the case selection, ultimately leading to a selection of four projects. The set-up is to interview both the contract manager and project manager of each case. However, due to a crowded agenda, the project manager from case 3 was unfortunately not able to participate to the interview. Additionally to the four cases, an expert on the IPM model and role of the contract manager and project manager will be interviewed. This is depicted in figure 5.

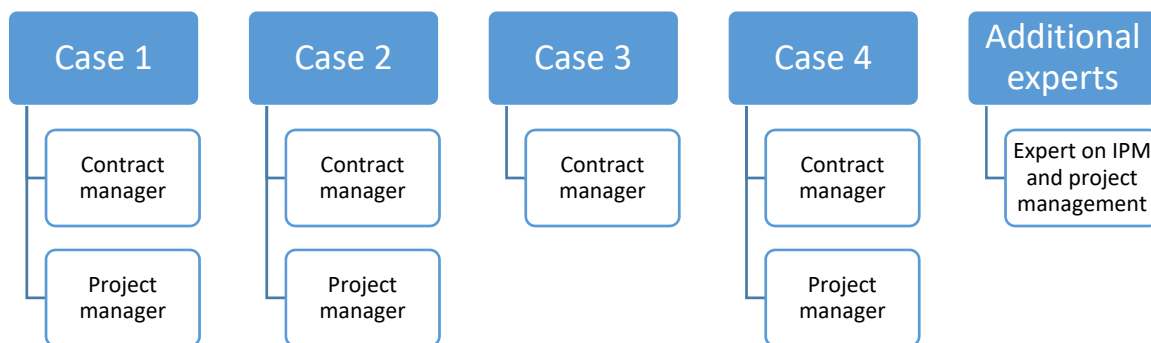


Figure 5: Overview of cases and interviews

4.3 Results case study

The results of the interviews with the project manager and contract manager of each of the four different cases and the additional interview with an IPM expert and project manager are discussed in appendix H. In this section the general results will be provided and differences and commonalities between the cases will be discussed using the same structure as the sections on each case in the appendix: first the problems within the projects will be discussed, followed by the daily tasks and responsibilities and corresponding competencies of the contract manager and project manager. After that, specific competencies for the projects will be discussed as well as the differences and overlaps between the contract manager and project manager, leading to the interchangeability of the contract manager and project manager. A conclusion on the differences between D&C contracts on the one hand and DBFM and RAW contracts on the other hand will be given, as well as common criteria for properly executed contract management by the contract manager. The last element that will be concluded is the conceptual model consisting of the competencies necessary for the contract manager and project manager.

4.3.1 Project description and problems

Within each case study a short description of the project and its problems is provided and can be found in appendix H. The case study consisted of four cases, of which two were “wet” infrastructural projects and two were “dry” infrastructural projects. One of the wet infrastructural projects involves a renovation. All projects have their own characteristics and corresponding problems. The first project, a dry project, was characterized by three problems: a minimal financial proposal by the contractor leading to discussions when changes occurs; a larger area that had to be investigated for a different type of ammunition, due to regulations leading to a conflict on price that lasted for three years; and problems with the issue of licenses by the municipalities, resulting in delays for specific parts of the project.

The second project, a wet renovation project, had difficulties with their contractor, being a party which main operations are not within the infrastructural sector. As they do not have any knowledge on steel or dredging, this causes difficulties in managing the subcontractors. The main contractor is very financially driven and did not mirror the IPM team structure of Rijkswaterstaat, leading to issues in the escalation of problems, since the contract manager’s counterpart is not present at the contractor’s side. The collaboration between the client and contractor also becomes a bit troubled due to the financial motivation of the contractor. Besides these issues, this project has an extra complexity, considering the renovation aspect of the project. A renovation project means that the structure still needs to remain in operation while elements of the structure will be replaced. It was compared to replacing parts in a driving car.

The third project was a dry infrastructural project in a dense urban environment: the temporary construction roads will almost run through the local resident's living rooms, so to speak. This project is in the realization phase for just a few months, but the first issues with the contractor are already there, since there is a disagreement on the contents of the offer and the contract. The IPM team still needs to form a common picture towards the contractor.

The fourth project is a wet project known for its issues with the contractor. These issues have been present since the start of the realization phase and are all related to collaboration and escalating emotions. The tender price was far beneath the estimation of Rijkswaterstaat but was still awarded to the contractor, there were differences in opinion on the translation of the functional requirements to a design and the presence of asbestos in the shores was unforeseen. The project was halted for more than a year and external parties were flown in, in order to take the problems out of the construction trailer to enhance the collaboration. This did not work out as planned as irritations on the settlement were still present and continued until the IPM team members from both sides were replaced, some roles even multiple times. The construction trailer has a common lunch area for the contractor's team and client's team to lunch together. The ties between the two parties were so deteriorated, that this lunch room was not used for two years.

The occurred problems have a few commonalities amongst them. One of these are the low tender price for which the contract is awarded still. Later on in the projects this will lead to problems when changes occur or when the contractor is making a significant loss. This will eventually have its effect on the collaboration between the IPM team of Rijkswaterstaat and the contractor. A second common issue is the composition of the project team at the contractor's side. In the second case, the contractor did not mirror the composition of the team at the RWS side, leading to escalation issues as a layer is missing and the contract manager and project manager from RWS have to talk with the same person at the contractor's side. In the fourth project, the IPM team from both sides needed to be replaced before the emotions were reduced and the environment became workable. For all projects the supposition holds that it is characterized by specific issues and complexity, making it unique projects.

4.3.2 Tasks and responsibilities of the contract manager and corresponding competencies

The contract manager as well as the project manager were asked about the most important daily responsibilities of the contract manager within the realization phase of a construction project with a D&C contract. Table 4 below gives an overview of the different answers given per case. The first thing noticeable from this table is the differences in task descriptions. All interviewees describe it differently and mention different tasks. Figure 6 gives a graphical view of the tasks.

Table 4: Overview responses CM and PM on tasks and responsibilities of the contract manager

	Case 1	Case 2	Case 3	Case 4	IPM expert
Contract manager	<ul style="list-style-type: none"> • Manager of all amendments • Implement changes • Payments • SCB • Prevent and solve hassle 	<ul style="list-style-type: none"> • Managing the project • Knowing agreements between TM and contractor • Making sure risks are managed properly • Testing 	<ul style="list-style-type: none"> • No standard days • Amendment process • Payments • Testing • Being the contractual delegate. 	<ul style="list-style-type: none"> • (Too much) meetings • Amendments • Delegate and preparation for testing and payments • Making decisions • Tackling problems 	No contract management expert
Project manager	<ul style="list-style-type: none"> • Amendment process • Switch between levels of abstraction • Make analyses on these different levels • Knowing to involve IPM roles 	<ul style="list-style-type: none"> • CM is the guy from RWS • Primary contact for contractor • Responsible for execution of contract • Contract controller • Amendment process • Perform tests • Report to PM • Project and contract meetings • Notice deviations in time 	<i>No interview with the project manager of the case</i>	<ul style="list-style-type: none"> • Planning and organizing • SCB process • Legality of payments • Contract meetings • Secondary contracts 	<ul style="list-style-type: none"> • Primary contact • Responsible for contract • Contract control



Figure 6: number of times tasks are mentioned by respondents

The tasks mentioned most are amendment process (1), legality of payments (2), performing tests (2), being the primary contact point towards the contractor (4), meetings (4), project management (4). Legality of payments and performing tests are mentioned separately, while they are part of the process of system-based contracting (SCB). The graph showed that the contract managers clearly see a large set of job responsibilities. This corresponds to the large list of tasks and competencies of section 3.2.2. For some tasks and responsibilities, comments can be made. Meetings was mentioned four times, but this is a very generic task. The interviewee of case 4 commented that meetings is the most important task as they need to have meetings for everything and that it has become an annoyance, as it does not improve the performance or efficacy. Another task that was mentioned is being the contact point towards the contractor. This is a responsibility that belongs to the contract manager, but that some project managers tend to forget. This was mentioned by both the contract managers and project managers. No differences can be found in the responses between the contract manager and the project manager on the most important daily tasks and responsibilities of the contract managers. Recently, a team of contract managers of Rijkswaterstaat were tasked with investigation possibilities for professionalizing the department and did a research, which also included the tasks of the contract manager. Figure 7 shows the result of that investigation (in Dutch), which contains more than 20 different tasks and differences in percentages of the time these tasks take up. This supports the large list of tasks and responsibilities for the contract manager.

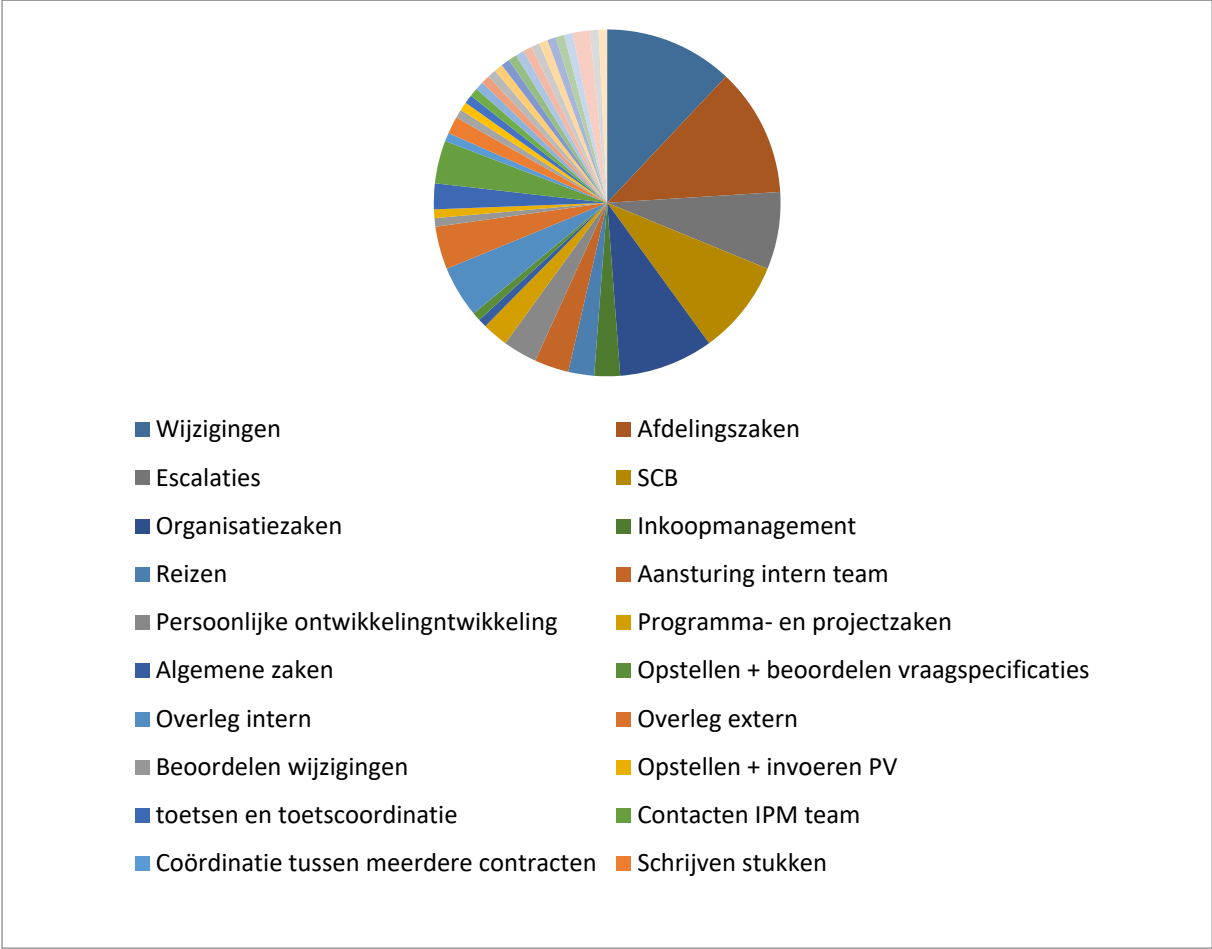


Figure 7: Results on different tasks and responsibilities of the contract manager according to a survey on professionalization (in Dutch)

The competencies that the contract managers mentioned first to being the most important for these tasks and responsibilities can be viewed in figure 8. Besides the different tasks, everyone has also

mentioned different competencies, such as adaptability, decisiveness, empathy, integrity, leadership, meticulousness and process management. The only competency mentioned twice is collaboration. This overview of competencies only show a few competencies. As stated, these were mentioned first of being most important for the mentioned daily tasks and responsibilities. This does not mean that the other competencies were not viewed as being not important. Section 4.3.9 will elaborate on this topic.

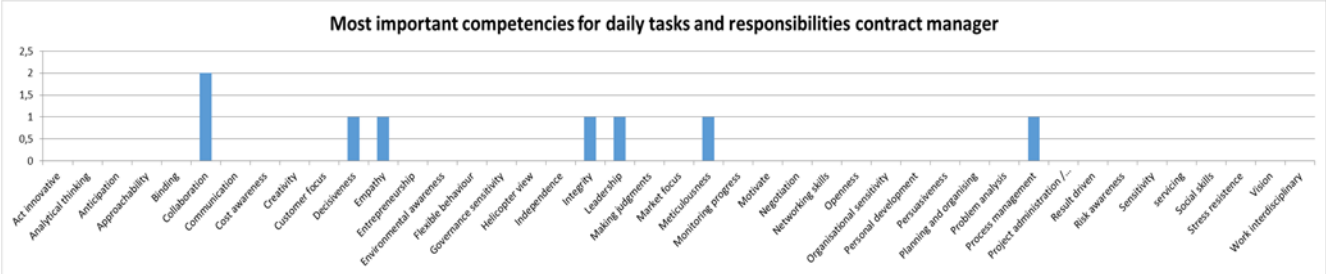


Figure 8: Most important competencies for the tasks and responsibilities of the contract manager

4.3.3 Tasks and responsibilities of the project manager and corresponding competencies

The tasks and responsibilities of the project manager in a construction project in the realization phase with a D&C contract were only pointed out by the project managers themselves. It seems they give more shared answers. The answers per case can be found in table 5 below. Figure 9 gives an overview on the different responsibilities and the amount these responsibilities were mentioned of both the project manager and contract manager.

Table 5: Overview responses on tasks and responsibilities of the project manager

	Case 1	Case 2	Case 4	IPM expert
Project manager	<ul style="list-style-type: none"> • Jack of all trades • Sparring partner • Link between internal client and team • Connect the team • Part of escalation line • Inform client and team • Being aware of major elements 	<ul style="list-style-type: none"> • Leading the IPM team • Team building • Managing large risks • Enhance collaboration • Help CM • Process management • Determine joint course 	<ul style="list-style-type: none"> • Switching, calling, steering and consulting • Team building • Escalation line with contractor • Inform client • Handle mandate • Being aware of issues • Enhance collaboration 	<ul style="list-style-type: none"> • Team building • Jack of all trades • Link with client • Monitoring progress • Result oriented and strive for collaboration • Balance knowledge skills, content and results • Part of escalation line

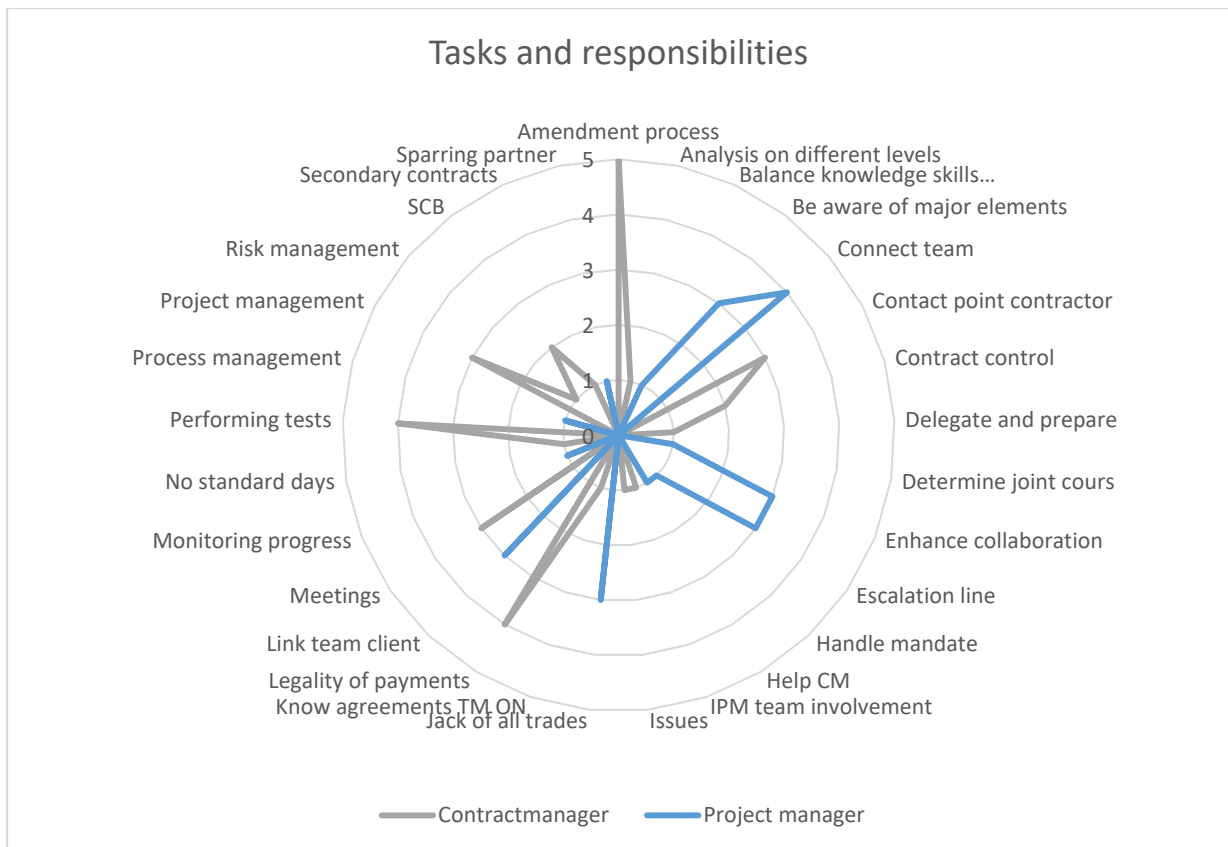


Figure 9: Number of times tasks are mentioned by respondents

The most important responsibility of the project manager is to connect the IPM team and to work on team building. The other tasks mentioned multiple times are being a Jack-of-all-trades, act as a link between the IPM team and the client, being a part of the escalation line, be aware of major elements in the project and to enhance collaboration between the team and contractor. The other tasks and responsibilities were mentioned only once. The figure also presents the tasks and responsibilities of the contract manager, that was already discussed in section 4.3.2. The figure shows that of all the mentioned tasks and responsibilities of both roles, there are no overlaps.

The competencies mentioned by the project managers as being most important for these responsibilities can be found in figure 10. What can be seen from this figure is that the project managers have mentioned more competencies and the competencies have more overlap than in the case of the contract managers. The competencies mentioned the most are anticipate, binding and collaboration, as these three competencies were mentioned by three project manager. Other common competencies are communication, decisiveness, environmental awareness, governance sensitivity, helicopter view, leadership, organizational sensitivity, process management and result driven. All these competencies were mentioned by two of the four project manager and IPM expert. The last competencies were mentioned by a single project manager: act innovative, adaptability, creativity, flexible behavior, independence, motivate, personal development, persuasiveness, team building and vision. As mentioned before for the contract managers, also in this situation the competencies were mentioned as being most important for the daily tasks and responsibilities. The opinion on the other competencies will be elaborated upon in section 4.3.9.

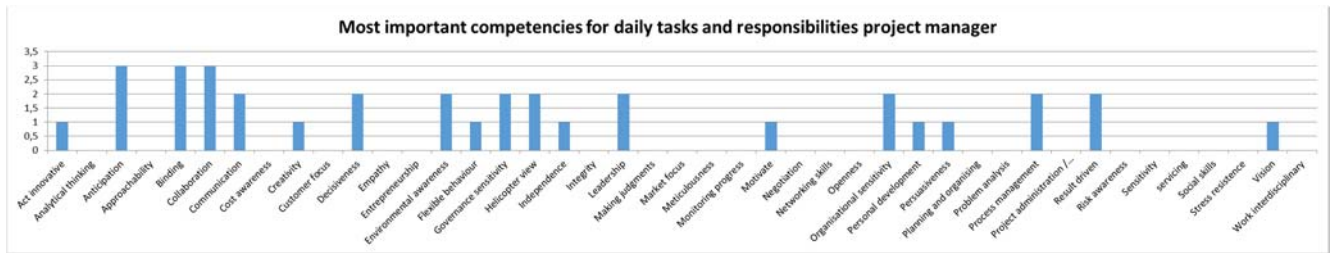


Figure 10: Most important competencies for the tasks and responsibilities of the project manager

4.3.4 Competencies specific for the project

Each project is unique. Therefore it is expected that each project will ask for specific competencies to deal with the problems at hand within the projects. For each case, the competencies mentioned as being most important in relation to the tasks and responsibilities are depicted next to the specific competencies necessary for these cases.

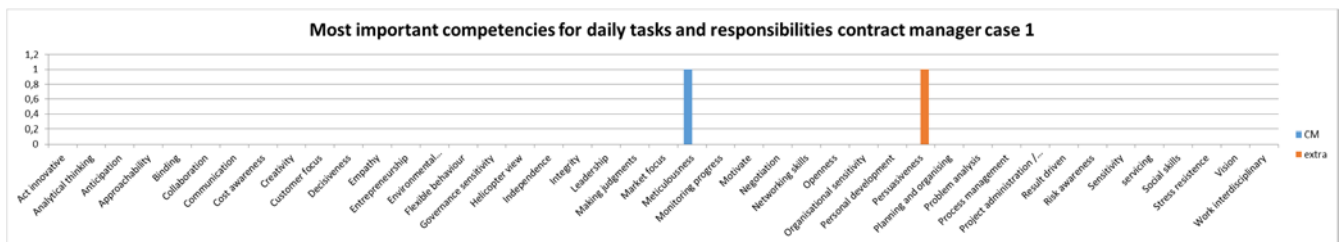


Figure 11: Most important competencies for the tasks and responsibilities of the contract manager of case 1

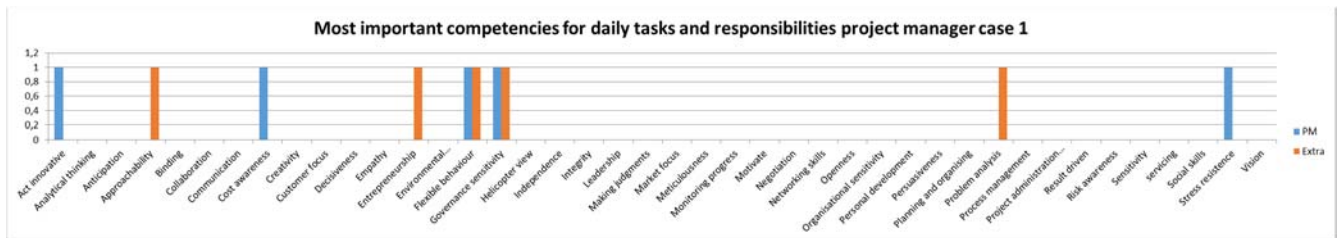


Figure 12: Most important competencies for the tasks and responsibilities of the project manager of case 1

What can be seen from figure 11 and 12, depicting the competencies according to the contract manager and project manager from the first case, the contract manager only mentions one extra competency, persuasiveness, while the project manager mentions six: binding, collaboration, environmental awareness, governance sensitivity, helicopter view and process management. The extra competencies can be linked to the project problems, since this project was characterized by a complex organizational structure of multiple governmental organizations, making governance sensitivity and environmental awareness extra important. The contractor in this project is a bit reserved, making it necessary for the project manager to focus on the collaboration, while the contract manager wants to make progress and therefore needs the competency of persuasiveness.

Case 2 was characterized by a contractor who's main field of operation was not in the steel and dredging sector. The extra competencies of the contract manager are communication, flexible behavior and organizational sensitivity and can be explained by that. The contractor is a different type of organization, making communication and a flexible behavior extra important. By having organizational sensitivity the contract manager can find a way to give incentives to the contractor to act a certain way. For example, the contract manager used the satisfaction reviews to evoke a different behavior from the contractor.

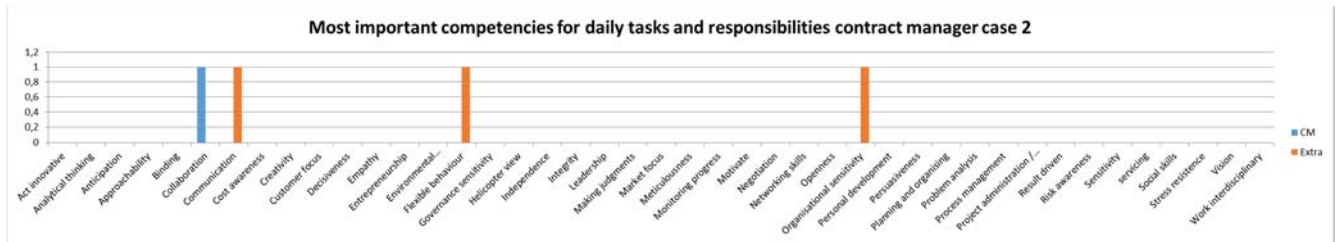


Figure 13: Most important competencies for the tasks and responsibilities of the contract manager of case 2

The project manager of case 2 pointed out that the contractor has a businesslike approach, asking for a professional and businesslike response from the project manager. Because of the missing counterpart at the contractor, it could be expected that competencies such as communication and organizational sensitivity would be extra important in this project. The project manager did not mark them as being extra used as can be seen in figure 14, but did mention them as the most important competencies for his daily tasks and responsibilities.

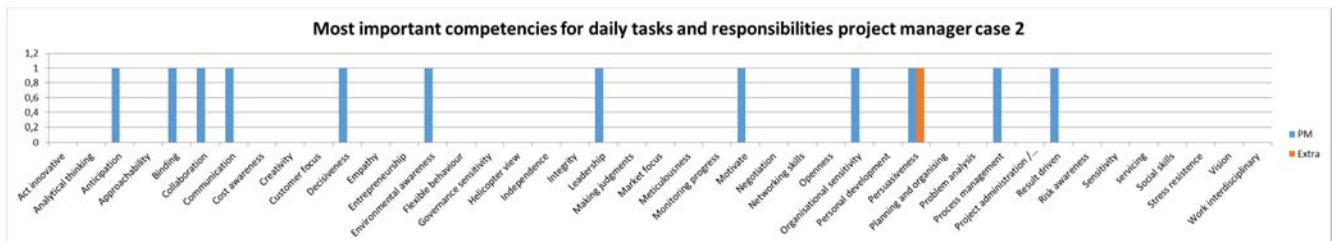


Figure 14: Most important competencies for the tasks and responsibilities of the project manager of case 2

The third case has issues with formulating a common image towards the contractor for a project in a very dense and governance sensitive environment. It is therefore clear that competencies such as governance sensitivity, risk awareness, communication and helicopter view are important in this project, as can be seen in figure 15. Without having clear which potential risks are present and what effect a certain decision has with this environmental complexity, more issues would arise. The competency of persuasiveness can be explained by the lack of progress and the call of the contract manager to start acting and to be courageous.

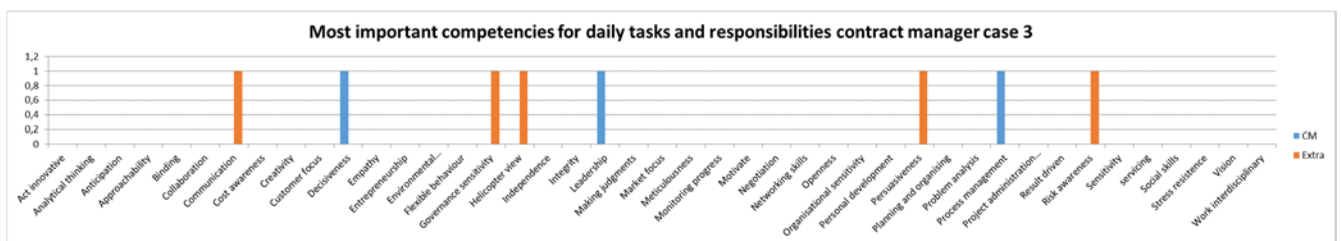


Figure 15: Most important competencies for the tasks and responsibilities of the contract manager of case 3

Case 4 is characterized by the troubled collaboration with the contractor. It holds no surprise that collaboration was mentioned by both the contract manager and project manager as an extra competency for this project, as visualized by figure 16 and 17. Other competencies are communication and empathy, all related to the collaboration with the contract and effects certain actions might have on it.

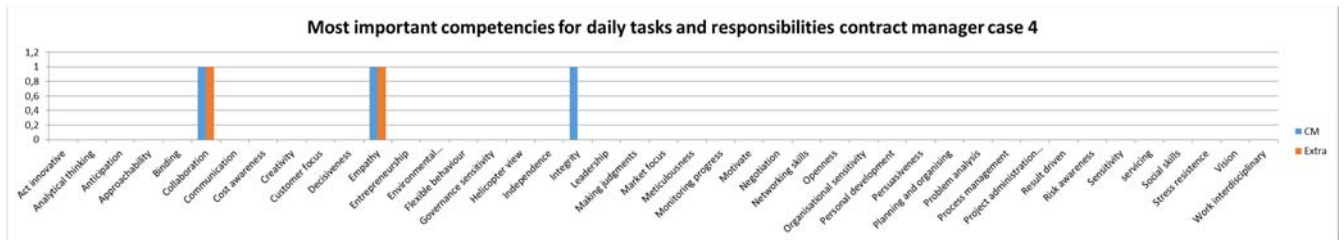


Figure 16: Most important competencies for the tasks and responsibilities of the contract manager of case 4

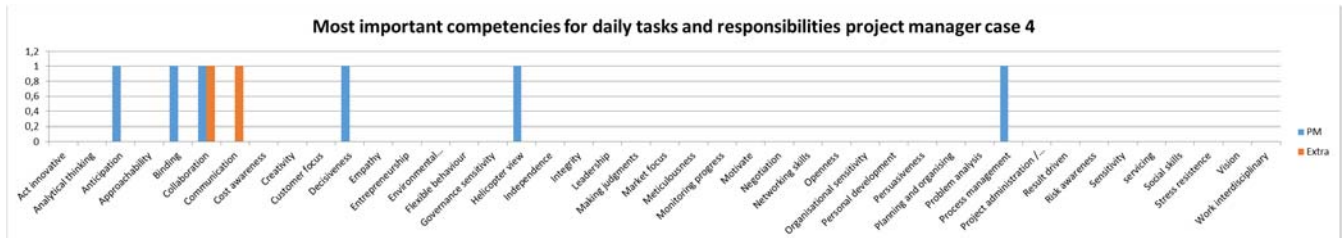


Figure 17: Most important competencies for the tasks and responsibilities of the project manager of case 4

Besides commonalities in competencies amongst the contract manager and project manager within the same case, there might also be commonalities among all the contract managers and the project managers that are interviewed. What can be seen is that communication is mentioned by two contract managers, as communication determines collaboration and has effect on other elements. Persuasiveness is also mentioned twice: in case 1 and case 3. For the project managers the only overlap lays in communication.

4.3.5 Differences and overlaps between the contract manager and project manager

The tasks and competencies of the contract manager and project manager already showed many different responses from the interviewees, but even more different answers on the overlaps and differences between the contract manager and project manager were provided. Overlaps such as every IPM team member needs to be approachable, they both need to have a helicopter view and differences such as the contract manager gives performance statements and looks whether the planning is realistic were given. However these were all single comments. The elements below were mentioned by multiple interviewees.

The overlap between the contract manager and project manager were:

- Every IPM role member has a team and is a manager.
- There is much overlap in the competencies of the contract manager and the project manager, however the details differ.

The overlap that every IPM role member is a manager was mentioned four times, the overlap in competencies was mentioned trice. The number of differences and the number of times it was mentioned is much higher for the differences. The common differences are:

- The contract manager is the primary point of contact towards the contractor (7 times).
- The project manager needs a higher level of helicopter view than the contract manager (6 times).
- The contract manager needs to have blue management drives (6 times).
- The project manager is responsible for the IPM team (5 times).
- The contract manager needs to be meticulous and know the contract in detail (4 times).
- The contract manager is more market oriented than the project manager (4 times).

- Negotiation is more related to the contract manager and the contract manager negotiates with the contractor while the project manager negotiates with the client (3 times).
- The contract manager has more knowledge content wise about the UAV-GC, contract and procurement (3 times).
- The project manager needs to have a higher level of governance sensitivity and organizational sensitivity (3 times).

4.3.6 Interchangeability

On the topic of the interchangeabilities of the roles the opinions differ. As already discussed in the chapter on literature review the networking meeting between the contract managers and project managers at Rijkswaterstaat, there was a division in the opinion whether the roles of the contract manager and project manager have a clear distinction and if this distinction should be more clear or not. Amongst the interviewees of the cases the same division holds. There is even a different opinion amongst the contract managers and project managers. The contract manager of case 1 states that the roles are interchangeable, as the project manager can take over the role of the contract manager. The project manager of case 1 agrees, but not completely, as they both would become unhappy in the other role. The contract manager and project manager of case 2 both fully agree: the roles are complete interchangeable. However, the contract managers of case 3 think that they are not complete interchangeable due to the differences in competencies. Eventually you could overcome the differences within six to twelve months, but it would be easier for the contract manager to take over the role of the project manager than the other way around due to the focus of the contract manager which is lacking by the project manager. The contract manager of case 4 then thinks that the roles are very interchangeable and should be placed even more together, as it cannot be the case that one of them knows something the other does not. The project manager of the case disagrees as the knowledge differs. The IPM expert explains this as they are both managers with closely connected roles, but each with a different playing field.

Whether the roles should become more separated the opinions also differ: one states that it is necessary as the competencies differ, another says that practice will separate them and according to others the separation is already there and it should even be closer together. On these topics there is no clear opinion and no explanation can be found.

4.3.7 Differences in D&C contracts compared to DBFM and RAW

The contract manager as well as the project manager were asked how the D&C contract differs from DBFM contracts and RAW contracts in terms of competencies. According to the contract manager of the first case, a DBFM contract is much more juridical than a D&C contract, while a RAW contract is much more technical. An RAW contract will lead much faster to contract amendments, as each diversion of the stated amount is a change in the contract. According to the project manager, the DBFM contract has a much longer duration, but you don't have to anticipate to it more than in D&C contracts. The contract type will be the foundation, but eventually the individuals and the project team determine how the project and collaboration will work out, as everyone differs in for example the level of organizational sensitivity and contract discussions.

According to the project manager of case 2, a DBFM contract is a difficult concept. Not all contract managers are suitable for this contract type and training is necessary. The competencies do not differ much, only the level of the necessary competencies. In both contract types the contract manager needs to keep his distance, but this is stronger for a DBFM contract, according to the contract manager. An RAW contract has a lower level of abstraction compared to the D&C contract. The project manager agrees to this as well.

The project manager of the fourth case has the opinion that decisiveness is much stronger in D&C contracts than RAW contracts, because of the discussions around the design component. Collaboration is more important in D&C contracts and you cannot make decisions from an ivory tower. The responsibility has shifted towards the contractors in a DBFM contract, but empathy is less needed as the availability is defined much more tightly than in a D&C contract. According to the contract manager each individual determines the necessary competencies, just as project manager of case 1 stated. However, the organization won't switch back to RAW contracts according to the contract manager of case 4 and it is therefore more important to have an efficient collaboration.

The IPM expert also states that the necessary competencies are independent from the contract type. Only differences in experience and knowledge are possible, because of the finance component in DBFM contracts.

Overall, the majority states that the competencies are contract type-independent and that the individuals determine the necessary competencies. There is a longer duration for DBFM contracts, but that does not ask for different competencies. You do however need to do courses to be able to work on DBFM projects, as the finance element in a DBFM contract uses different financial models from financiers. An RAW contract will not be used anymore but would have led to more contract changes and a lower level of abstraction than a D&C contract.

4.3.8 Criteria for successful contract management

All interviewees had difficulties with distinguishing different criteria for successful contract management by the contract manager of project in the realization phase with a D&C contracts. Most interviewees eventually mentioned a few criteria, as can be seen in table 6 below.

Table 6: Criteria for successful contract management mentioned by the interviewees

	Case 1	Case 2	Case 3	Case 4	IPM expert
Contract manager	<ul style="list-style-type: none"> • No unhandled changes • Legal payments/SCB process • No unsolved issues • Project in time 	<ul style="list-style-type: none"> • No surprises for all parties 	<ul style="list-style-type: none"> • Time, quality and budget • Satisfied client • Satisfied contractor • Contractor executes original plan • Paid to comply with contract • Not possible to formulate hard KPI's 	<ul style="list-style-type: none"> • Legality • The least issues as possible • All issues handled well 	No contract management expert
Project manager	<ul style="list-style-type: none"> • No unhandled changes • Legal payments • No unsolved issues • Satisfied client • Satisfied contractor • Balance between legality and efficacy, social purpose and costs 	<ul style="list-style-type: none"> • No surprises • Amendment process • Process of SCB 	<i>No interview with the project manager of the case</i>	<ul style="list-style-type: none"> • Legality • Collaboration • Good escalation 	<ul style="list-style-type: none"> • Satisfied client • Satisfied contractor • SCB • Process went smoothly • Satisfied IPM team • Satisfied Minister: no questions

Some criteria are very distinctive, however others are descriptions of the same criteria. For example satisfied minister and IPM team are part of the client. These will therefore be viewed as satisfied client.



Figure 18: Number of times criteria are mentioned by respondents

All criteria that were mentioned more than once, are counted as criteria for properly conducted contract management, as one answer has no validity. The criteria are:

1. Legality/SCB
2. Satisfied contractor
3. Amendment process
4. No unsolved problems
5. Prevention of problems/no surprises
6. Satisfied client

The legality of payments is a criterion that is done with the help of system-based contracting (SCB) and involves more than simply making a payment on time. With the used of SCB, the client can work risk based because of the insight into the quality management of the contractor. This makes it possible to anticipate and to manage risks timely and better. The SCB process consists of three types of tests: a system test, process test and product test. Based on the results of these tests, the performance of the contractor is supported and the legality of payments can be assured. For each new term of payment, the contractor submits an application for a declaration of performance. Based on the support in the contract administration, the contract manager decides on the issue of a declaration of performance. The amendment process is an important criterion for successful contract management, as a contract will have many amendments. Both the client as well as the contractor can propose changes to the contract. The changes have to be tested to the contract, whether they are already implemented in the contract or not and to make adjustments with the help of the people involved. Problems might occur between the IPM team (client) and contractor. In order to improve the collaboration and to have an efficient process, the possible problems should be mitigated and problems that have arisen, should be solved in a way that is satisfactory to all parties. At the end of the project, no problem should exist anymore. Satisfied contractor and satisfied client are two criteria that involve end states to which the contract manager should strive.

4.3.9 List of competencies for contract manager and project manager



Figure 19: Necessity of competencies for contract managers and project managers based on the case study

At the end of each interview, the interviewee was asked whether certain competencies were necessary for his or her role as contract manager or project manager within the current project, which were selected as cases. The answers could fall into three categories: not necessary, leading to 0 points for the competency; the second category being a little bit important, but far less than others, leading to 0.5 points; the last category was important, leading to a full point for the competency. After asking each competency to all interviewees, the following graph can be drawn up, giving an indication of which competencies are found important by the project managers and contract managers.

Large differences can be found in the competencies of acting innovative, governance sensitivity, monitoring progress, negotiation, planning and organizing, project administration and sensitivity. The contract manager scored much higher on acting innovative, monitoring progress, negotiation, planning and organizing and project administration. Negotiation, monitoring progress and planning and organizing can be explained by the nature of the responsibilities of the contract manager, since the contract manager is responsible for making sure the contract is lived up to by the contractor, whether everything is still going according to plan and the contract has to negotiate with the contractor about amendments. This might lead to a higher level of acting innovative, but this could also be used by the project manager for the execution of certain tasks. The fact that governance sensitivity is more important to the project manager can be explained because the project manager has to maintain a relation with the internal client, where the contract manager is not responsible for this. The competency of project administration is scored higher by the contract manager. However, the contract manager is not responsible for project administration, but as stated by the contract manager of case 1, the contract manager is influenced most by a badly organized project administration. Competencies that scored low where the competencies added by the interviewees themselves. These competencies were not on the list to ask to all interviewees and had to be mentioned extra by the interviewee to get a score. The fact that for example process management scored a 3 while this competency was added, means that this competency was quite important to the interviewees. The same holds for governance sensitivity. Meticulousness was mentioned by both the project manager and contract manager from the same case.

Many competencies have a maximum score for both the contract manager and project manager, indicating that in those areas the role of the contract manager and project manager overlap. This can be explained by the management aspects they both possess, such as anticipation, collaboration, communication, integrity, result driven, stress resistance and work interdisciplinary, as well as the (complex) nature of the projects. Competencies such as cost awareness, environmental awareness and risk awareness can be explained by this. Besides this there are competencies which almost have a maximum score with 3,5, meaning that one interviewee scored the competencies important, but not

as important as the ones mentioned above. Examples of these competencies are approachable, binding, empathy, flexible behavior, motivate, networking skills, persuasiveness and social skills.

4.4 Conclusion case study

This chapter has discussed the case studies and its results. The case study was done according to a case study protocol, in order to increase the reliability of the research by following an established pattern in each case. Four cases were selected with the help of selection criteria. The selection criteria consisted of being a project from Rijkswaterstaat from the GPO department, with a D&C contract in the realization phase. To narrow down the possible cases even further, an extra criterion became having the contract manager and project manager both from the GPO department and not externally hired. This led to the selection of 4 infrastructural cases, of which two were dry projects and two were wet projects. For each case interviews were held with the project manager and contract manager of the case and an extra interview with a IPM expert related to project management. From case 3 the project manager was not able to participate in the interview due to a busy schedule, what has led to a total of nine interviewees.

Each case was analyzed based on the same topics: project description and problems, tasks and responsibilities of the contract manager and corresponding competencies, tasks and responsibilities of the project manager and corresponding competencies, competencies specific for the project, differences and overlaps between the contract manager and project manager, interchangeability of the roles, differences in D&C contracts and the list of competencies for the contract manager and project manager to complete the conceptual model.

This section will conclude on the sub questions 4, 5 and 6 and will compare the results of the case study to the answers on sub questions 2 and 3 according to the literature review.

Sub question 4: What are the challenges for a contract manager that come with a Design and Construct contract in the realization phase within the IPM model at Rijkswaterstaat?

Every project has its own complexity and uniqueness. The problem descriptions of the cases have shown that the contract managers have to deal with different contractors which might lead to certain problems in communication and collaboration or that problems occur in terms of delay or financial disagreements. The challenge of dealing with large infrastructural projects for the contract manager lays in the uniqueness and the approach towards it. The contract manager has to make sure the contract is lived up to and agreements are met. However, if this is not the situation, the contract manager should act a certain way: the contract manager could intervene or lean back and see how the contractor will solve the problem. Therefore it is necessary to understand the risks involved and to know what motivates the contractor. Specific competencies might be used in such situations, such as risk awareness, organizational sensitivity, helicopter view, next to communication, persuasiveness, negotiation and collaboration.

The element of the D&C contract poses for different challenges than other contract types do for the contract manager. With D&C contracts, the collaboration with the contractor becomes even more important than with other contract types. The contract manager needs to anticipate and cannot manage the contract from an ivory tower, but needs to be involved. However, the necessary competencies do not depend on the contract type. The contract type will be the foundation, but eventually the individuals involved in the project will determine how the project will work out and what kind of challenges the contract manager has to deal with.

Sub question 5: In what way do the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?

The case study has researched the differences between the project manager and contract manager. Even though the IPM model is a collaboration model in which the roles are equal to each other, the roles of the contract manager and project manager tend to weigh more in practice than the other roles. There are some overlaps between the roles, such as that every IPM role member has a team and is a manager. This will cause the overlap in competencies between the roles, however some details or the level of competencies will differ.

Besides these overlaps, much more differences can be found between the roles. The most important difference, is that the contract manager is the primary point of contact towards the contractor. Other differences, listed from most mentioned to least, are that the project manager needs a higher level of helicopter view than the contract manager; the contract manager needs to have blue management drives while the project manager does not; the project manager is responsible for the IPM team; the contract manager needs to be meticulous and needs to know the contract in detail; the contract manager is more market oriented than the project manager; negotiation is more related to the contract manager and the contract manager negotiates with the contractor while the project manager negotiates with the client; the contract manager has more knowledge content wise about the UAV-GC; the contract and procurement and the project manager needs to have a high level of governance sensitivity and organizational sensitivity than the contract manager.

Half of the differences found in the case study were also present in the literature review. The descriptions of the tasks and responsibilities of the contract manager and project manager show that the contract manager is indeed the contact point towards the contractor on behalf of the client, the project manager is responsible for the project (IPM) team, the contract manager negotiates with the contractor while the project manager deals with the client, the contract manager has more knowledge on the contract and procurement or is assisted in this and the contract manager is more market oriented as he is responsible for the main procurement. However, the other differences are not found in literature, as the management drives are not mentioned, as well as the higher level of helicopter view or governance sensitivity and organizational sensitivity for the project manager. In literature these were mentioned for the project manager as well as the contract manager.

Challenges for both managers lay in the communication towards the contractor and the internal client, as the contract manager is responsible for the first one and the project manager for the second one. However, this tends to get a bit troubled as sometimes the contract manager already discusses issues with the client without the project manager being present, or that the project manager has meetings with the contractor for which the contract manager is actually responsible. These communication lines can become unclear, leading to more undesired situations.

Sub question 6. Which criteria can be distinguished to determine whether contract management will be successfully conducted by the contract manager?

One of the questions of the interview protocol was about criteria for successful contract management. It was difficult to determine for the interviewees. All the criteria that were mentioned more than once are seen as valid criteria for successful contract management by the contract manager. The criteria can be found in figure 20.

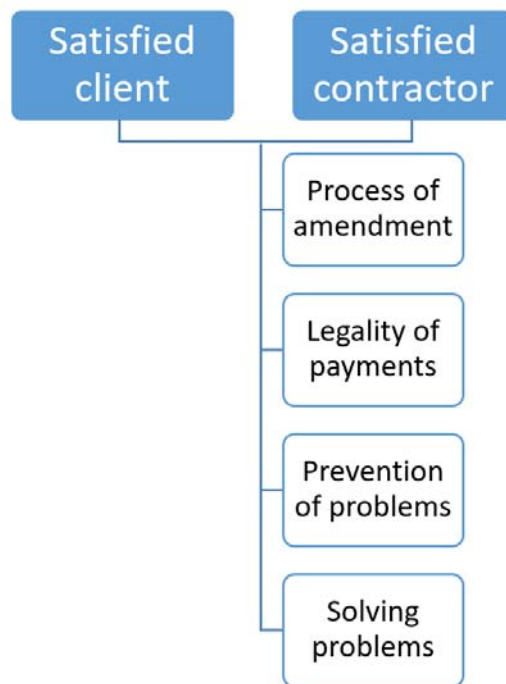


Figure 20: The six criteria for successful contract management by the contract manager

All criteria from the case study are mentioned by at least one of the sources on successful contract management in the literature review. The legality of payments is done at Rijkswaterstaat through system based contracting, a process in which the performance is linked with payments. This is a part of performance measurement. Having a satisfied contractor and a satisfied client are part of relationship management and stakeholder management, mentioned by multiple studies. This is also the case for the process of amendment requests. No unsolved problems, or no disputes, is part of the literature review, as well as the prevention of problems. The criteria that were left out of further analysis as they were mentioned only once, are not mentioned in the literature review.

Sub question 2: What is the role of the contract manager in construction projects within the IPM model?

The comparison of the cases showed that the tasks and responsibilities of the contract manager that are mentioned more than once are the amendment process, legality of payments, performing tests, being the contact point towards the market, contract meetings, project management, SCB process and contract control.

The tasks and responsibilities are all mentioned in the literature review as being part of the role of the contract manager within the IPM model, except project management and contract meetings. However, project management can be seen as implementing management measures and being responsible for the realization of the contract scope within the boundary conditions of time, money, quality and risks. Contract meetings is not mentioned. This can be mentioned by the interviewees of the case study to indicate their irritation on the number of meetings and its effectiveness. Because when analyzing the tasks and responsibilities for the role of the contract manager in the IPM model, most tasks involve some form of communication with other role members or involved parties.

Sub question 3: Which competencies are being asked from a contract manager within the IPM model?

The literature review provided the first version of the conceptual model, consisting of 65 competencies. These competencies were found in different studies on the competencies of the contract manager and project manager and the competencies Rijkswaterstaat has listed for both of them. In the case study, the competencies that were mentioned at least twice and all competencies listed by Rijkswaterstaat were asked to the contract manager and project manager whether they were necessary for their roles. This was a total of 39 competencies. The interviewees had the possibility to add competencies if they found they were missing from the list, which led to four additions. The answers of the interviewees were scored: if the competency was not necessary it got zero points, if it was necessary but less important than others it got 0.5 points and if the competency was necessary and important it got 1 point. All scores were added per role and were stated before in figure 19.

In the literature review the most important competencies are communication, planning and organizing, integrity, analytical thinking, entrepreneurship, leadership, result driven, customer focus, motivate, negotiation, networking skills and organizational sensitivity. When these competencies are split into competencies for the contract manager and the project manager, the competencies planning and organizing, communication, entrepreneurship, result driven, customer focus, integrity, analytical thinking, motivate and negotiation were mentioned most for the contract manager. For the project manager these were communication, leadership, integrity, personal development, analytical thinking, networking skills, organizational sensitivity, approachable, social skills. This can be found in table 7 below.

Table 7: Competencies for the contract manager and project manager mentioned most in the literature review

Overview competencies literature review	Competencies CM Literature review	Competencies PM Literature review
Communication	Planning and organizing	Communication
Planning and organizing	Communication	Leadership
Integrity	Entrepreneurship	Integrity
Analytical thinking	Result driven	Personal development
Entrepreneurship	Customer focus	Analytical thinking
Leadership	Integrity	Networking skills
Result driven	Analytical thinking	Organizational sensitivity
Customer focus	Motivate	Approachable
Motivate	Negotiation	Social skills
Negotiation	Networking skills	Project administration / management competencies
Networking skills	Organizational sensitivity	Planning and organizing

In the case study, 17 of the 43 competencies got a full score of four points. These competencies are all mentioned in the first version of the conceptual model. The competencies that were mentioned often in the literature review, but were not that important according to the case study are entrepreneurship and customer focus. Motivate was mentioned for being less important by only one person and therefore almost getting the maximum score. For the project manager, 23 competencies get a full score. From the most mentioned competencies of the literature review, personal development did not score maximal, as well did analytical thinking. Organizational sensitivity got almost the maximum score because one interviewee scored it less important.

With this case study, the conceptual model is completed and presented. This was a first step in prioritizing the competencies for the contract manager and project manager. The next chapter will continue on the prioritization with the use of a survey.

5. Survey

The previous chapter provided conclusions on the necessary competencies for contract managers and project managers according to the interviewees of four cases. However, to determine the criticality of the competencies a survey will be used. This survey focuses on sub question 7: *“What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?”*

First, the survey protocol and data gathering will be explained in the first section, as well as the analysis. Section 5.2 will discuss the results and section 5.3 will conclude on the outcome of the survey.

5.1 Methodology

As stated in section 2.1.3, a survey is used to gain an overall picture of a phenomenon and to form general valid statements with the determination of statistical relationships. In order to perform the survey it is necessary to draft a survey protocol. This section will discuss the protocol and data gathering, as well as the analysis.

5.1.1 Survey protocol and data gathering

The survey protocol starts with determining the research goal and background. The objectives for the survey are threefold:

1. To determine the critical competencies of the contract manager
2. To determine the differences in competencies between the contract manager and project manager and to test the differences found between them
3. To link competencies to the criteria for successful contract management

In order to meet the objectives a sample size needs to be determined. In the case study, the cases were selected on certain criteria, involving the contract managers and project managers from GPO on projects with a D&C contract in the realization phase. In the survey the D&C contract and realization phase are criteria once again. However, to test whether the results from the case study can be generalized, more departments have to be selected. Therefore the survey will be held under the contract managers and project managers from GPO and PPO at Rijkswaterstaat and the contract managers and project managers from different water boards. The PPO department of Rijkswaterstaat and the water boards are used to test the results for a larger public and to generalize the results for all realization projects using the IPM model. The survey will be sent electronically. The CM's and PM's from Rijkswaterstaat are approached by the department heads by email to participate in the survey and to stress the importance. The contract managers from the water boards are approached by email and asked to participate once again during a community meeting. As the contact information of the project managers from the water boards are unknown, the contract managers are asked to forward the survey to their project managers. This leads to a total sample size that can be found in table 8.

Table 8: Total sample of contract managers and project managers per category

	GPO Rijkswaterstaat	PPO Rijkswaterstaat	Water boards	Total
Contract manager	44	42	60	146
Project manager	50	45	Unknown	95
Total	94	87	60, unknown	241

As stated before, the data will be gathered electronically. To make sure every participant is within the target group, some general questions will be asked first. These questions include the role and department of the participants, in order to make sure that even if the participant does not fully

complete the questionnaire, the answers can still be used and include whether they have any experience with D&C contracts. As all projects within Rijkswaterstaat are executed with the IPM model, this does not have to be included in the survey. However, not all water boards work with the IPM model, therefore this question will be asked. If participants do not have experience with D&C contracts or do not operate within the IPM model, they do not meet the selection criteria and will therefore be directed to the end of the survey. The complete survey protocol can be found in appendix I.

5.1.2 Analysis

The survey consists of general yes/no questions, general questions with multiple choice with only one answer possibility and the topic specific questions have an answer range with a Likert scale, ranging from not important to very important.

The analysis will be done with a statistical software, SPSS. First of all descriptive tests will be performed to get insight into the respondents. The topics will be analyzed with the help of the comparison of the means with the help from the t-test. The t-test compares the mean of the sample to a given number and can be used for interval-scaled data. Therefore the assumption has been made that the questions involving an answering range with a Likert-scale are a quasi-interval scale and can be seen as interval scale (Cohen, 2001; Tilburg University, 2017). The Likert-scale ranged from not important (1) to very important (5). Competencies will be viewed as important from a score of 4 or higher.

5.2 Results

A total of 151 respondents, 63% of the sample, have filled in the survey, of which 28 respondents had no experience with D&C contracts and 5 respondents had no experience with working according to the IPM model. One of these respondents did not have any experience in both areas. The respondents were deleted from the sample, leading to a number of 119 respondents. The division of respondents can be found in table 9 below.

Table 9: Number of respondents per category

	GPO Rijkswaterstaat	PPO Rijkswaterstaat	Water boards	Total
Contract manager	32	24	17	72
Project manager	17	24	6	47
Total	49*	48*	23*	119

*Two respondents did not respond on the question from which department they are, one respondent was working for Rijkswaterstaat GPO as well as the water boards and two persons were working for GPO as well as the PPO department at Rijkswaterstaat.

Unfortunately not all respondents completed the full questionnaire. Therefore for each topic only the respondents who completely answered the questions are taken into account. The number of respondents will be mentioned for each topic.

5.2.1 Critical competencies contract manager and project manager

This topic was answered by 109 respondents, 67 contract managers and 42 project managers, and relates to the most critical competencies for the contract manager and project manager. In order to determine the most critical competencies, it is investigated which competency has the highest mean and for which other competencies it can be stated with 95% confidence that the total population gives the highest mean score to these competencies. For both the contract manager and project manager the highest mean was 4.5. The used p-value is 0.05.

Table 10: Most critical competencies for the contract manager and project manager with t=4.5

Contract manager					Project manager				
Rank	Competency	Mean	p-value	Rank literature review	Rank	Competency	Mean	p-value	Rank literature review
1	Collaboration	4.52	0.847	10	1	Collaboration	4.48	0.863	-
2	Integrity	4.46	0.762	6	2	Binding	4.31	0.176	11
3	Decisiveness	4.40	0.430	17	3	Decisiveness	4.31	0.189	11
4	Risk awareness	4.37	0.348	35	4	Integrity	4.29	0.200	3
5	Communication	4.24	0.057	2	5	Anticipation	4.26	0.136	-
					6	Communication	4.26	0.117	1
					7	Helicopter view	4.24	0.092	-

t-test, t=4.5, p-value<0.05

For both the contract manager and project manager collaboration stands out as being the most critical competency. Both type of managers share some competencies: integrity, decisiveness, communication and collaboration. These overlaps can be explained by the management aspects of their role. Each role has its own team that has to be managed, including collaboration, decisiveness and communication. As being part of a governmental organization, integrity is important for everyone. Besides this, there are role specific competencies. For the contract manager this is risk awareness. The contract manager needs to make sure that the risks are determined for every decision and remain balanced. For the project manager the role specific competencies are binding, anticipation and helicopter view. These competencies can be explained by the project manager being the overall manager that needs to have an overview over all domains and who is involved in team building.

When the test value is lowered to 4.4, more competencies are viewed as critical, for each role there are ten. The critical competencies in that situation can be found in table 11.

Table 11: Most critical competencies for the contract manager and project manager with t=4.4

Contract manager					Project manager				
Rank	Competency	Mean	p-value	Rank literature review	Rank	Competency	Mean	p-value	Rank literature review
1	Collaboration	4.52	0.292	10	1	Collaboration	4.48	0.582	-
2	Integrity	4.46	0.611	6	2	Binding	4.31	0.517	11
3	Decisiveness	4.40	0.981	17	3	Decisiveness	4.31	0.529	11
4	Risk awareness	4.37	0.842	35	4	Integrity	4.29	0.491	3
5	Communication	4.24	0.236	2	5	Anticipation	4.26	0.382	-
6	Anticipation	4.24	0.185	35	6	Communication	4.26	0.359	1
7	Analytical thinking	4.24	0.176	6	7	Helicopter view	4.24	0.292	-
8	Negotiation	4.19	0.132	6	8	Approachability	4.19	0.158	5
9	Binding	4.16	0.064	17	9	Result driven	4.17	0.133	11
10	Making judgements	4.16	0.056	17	10	Motivate	4.12	0.074	11

t-test, t=4.4, p-value<0.05

With this larger pool of competencies, the distinction between the contract manager and project manager becomes clearer. They share six competencies: collaboration, integrity, decisiveness, communication, binding and anticipation. As stated before, these overlaps can be explained by the

management aspect. The other five competencies are role specific. For the contract manager the competencies are risk awareness, analytical thinking, negotiation and making judgement. These competences are all related to the contract. For the project manager the role specific competencies are helicopter view, approachability, result driven and motivate. These competencies relate to the overarching role of the project manager.

Tables 10 and 11 both show a large discrepancy between the ranking of competencies based on the survey and the ranking of the conceptual model based on literature. There might be a few explanations for this. First of all, the currently asked competencies from Rijkswaterstaat are used as a basis in the conceptual model. As the survey is held amongst contract managers and project managers of two departments, the currently asked competencies of Rijkswaterstaat are not complete and do not match practice. This can be seen by the competency of collaboration, which is seen as most critical, but is not a necessary competency according to Rijkswaterstaat. The same holds for the competencies communication and risk awareness. Secondly, the survey asked for the critical competencies of the contract managers and project managers according to employees who have that function. Therefore it shows what is critical to the contract managers and project managers themselves. They know what they need in practice and are most specialized in this field, however they also view these competencies with a certain colored perspective. This is not an objective viewpoint. Thirdly, literature on contract management and project management competencies is not specific for the construction industry. As there is no scientific literature available on this specific sector, literature on competencies from other sectors was used. It might be possible that the competencies in the construction sector differ from other sectors.

Differences between water boards, PPO and GPO

The previous section provided the critical competencies for the project manager and contract manager for projects with a D&C contract within the IPM model. However, the respondents are from different organizations and different departments. Therefore, in this section it is analyzed whether there are differences in the critical competencies for different organizations and departments. As explained in section 3.2.1 the departments GPO and PPO are both from Rijkswaterstaat. They differ in the size of their projects: PPO is responsible for projects below 65 million, GPO is responsible for projects above 65 million. The GPO department has its origin in the construction service (in Dutch: Bouwdienst) and infrastructure service (in Dutch: Dienst Infrastructuur). The employees from this department have a stronger technical background. The PPO department is a young and dynamic department which has its origin in regional departments with an advisory and contract management function. The water boards are organizations in the Netherlands responsible for the water management, level and clean water. There are 22 water boards in the Netherlands.

GPO department Rijkswaterstaat

From the GPO department of Rijkswaterstaat, there are 43 respondents: 27 contract managers and 16 project managers. The same criterion is used to determine the critical competencies: there should be 95% confidence that the total population gives the competency a mean of 4.5. For the GPO department this is a larger list of competencies. This can be explained by the number of respondents: the less respondents, the more influence each response has. The critical competencies of the contract manager and project manager from the GPO department at Rijkswaterstaat can be found in table 12.

Table 12: Most critical competencies for the contract manager and project manager of the GPO department with t=4.5

Contract manager GPO Rijkswaterstaat				Project manager GPO Rijkswaterstaat			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Collaboration	4.41	0.722	1	Collaboration	4.32	0.557
2	Integrity	4.37	0.625	2	Binding	4.25	0.432
3	Risk awareness	4.33	0.591		Anticipation	4.25	0.432
4	Negotiation	4.22	0.281	4	Communication	4.19	0.361
5	Decisiveness	4.19	0.230	5	Motivate	4.19	0.324
	Making judgements	4.19	0.230	6	Approachability	4.13	0.277
	Result driven	4.19	0.230	7	Decisiveness	4.13	0.252
8	Stress resistance	4.15	0.178	8	Integrity	4.06	0.227
9	Communication	4.07	0.108	9	Helicopter view	4.06	0.177
10	Anticipation	4.07	0.100	10	Leadership	4.06	0.159
11	Analytical thinking	4.04	0.079		Environmental awareness	4.00	0.135
12	Persuasiveness	4.00	0.056	12	Result driven	4.00	0.135
	Planning and organizing	4.00	0.056	13	Governance sensitivity	3.94	0.114
14	Helicopter view	3.96	0.080	14	Organizational sensitivity	3.94	0.076
				15	Making judgements	3.81	0.073

t-test, t=4.5, p-value<0.05

Collaboration is still the most important competency for both the contract manager and project manager. Negotiation is more important to the GPO contract manager than in the total pool. The competency that was important according to the total pool of contract managers but that is missing for the GPO contract managers is binding, while this is still as important for the project managers. Added competencies for the GPO contract managers are stress resistance, persuasiveness, planning and organizing and helicopter view. Planning and organizing and persuasiveness can be viewed as role specific competencies, while stress resistance and helicopter view hold for all IPM management roles.

The competencies for the project manager from the total pool are still valid for the GPO project manager. The competencies are expanded with leadership, environmental awareness, governance sensitivity and organizational sensitivity. These are management competencies, but are fitting for the project manager as the project manager is the overarching manager of the IPM model.

PPO department Rijkswaterstaat

There are 40 respondents from the PPO department: 40 contract managers and 40 project managers. This analysis entails the competencies of which with 95% confidence can be stated that the total population gives the competency an average of 4.5. The critical competencies for the PPO department can be found in table 13.

Table 13: Most critical competencies for the contract manager and project manager of the PPO department with t=4.5

Contract manager PPO Rijkswaterstaat				Project manager PPO Rijkswaterstaat			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Collaboration	4.70	0.134	1	Collaboration	4.45	0.716
2	Integrity	4.60	0.560	2	Binding	4.40	0.385
3	Decisiveness	4.55	0.748	3	Integrity	4.35	0.419
4	Communication	4.55	0.716	4	Decisiveness	4.30	0.189
5	Binding	4.50	1	5	Anticipation	4.25	0.234
	Empathy	4.50	1		Helicopter view	4.25	0.204
7	Risk awareness	4.45	0.748		Communication	4.25	0.135
8	Analytical thinking	4.35	0.267		Risk awareness	4.25	0.056
	Anticipation	4.35	0.267	9	Customer focus	4.20	0.069
	Persuasiveness	4.35	0.186		Result driven	4.20	0.069
11	Negotiation	4.30	0.237				
12	Social skills	4.30	0.134				
13	Approachability	4.25	0.330				
14	Planning and organizing	4.25	0.135				
15	Making judgement	4.20	0.097				
16	Monitoring progress	4.15	0.090				
17	Openness	4.05	0.095				

t-test, t=4.5, p-value<0.05

The competencies from the PPO contract managers are more soft skill oriented. This might be explained because the PPO department has focused on soft skills since its establishment in 2013. Empathy and binding have high scores and social skills and openness are added to the list of critical competencies. Other added competencies compared to the GPO department are approachability and monitoring progress. For PPO the project manager all the competencies entail the competencies of the total pool. The added competencies are risk awareness, customer focus and result driven. Result driven was also present for the GPO project managers, but risk awareness and customer focus are not.

Water boards

From the water boards, fifteen contract managers responded and six project managers. The number of project managers is too low to form conclusions, as with this number all competencies have a p-value above 0.05 and therefore for each competency it can be stated with 95% confidence that these competencies are critical to the total population. For the contract manager some conclusions can be drawn, based on the analysis. The critical competencies for the contract managers from water boards within the IPM model can be found in table 14.

Table 14: Most critical competencies for the contract manager of the water boards with t=4.5

Contract manager water boards			
Rank	Competency	Mean	p-value
1	Collaboration	4.53	0.806
2	Decisiveness	4.47	0.865
3	Risk awareness	4.40	0.458
4	Integrity	4.33	0.313
5	Binding	4.27	0.220
	Analytical thinking	4.27	0.220
7	Market oriented	4.27	0.150
8	Anticipation	4.20	0.199
	Problem analysis	4.20	0.199
10	Negotiation	4.20	0.108
	Persuasiveness	4.20	0.108
12	Communication	4.07	0.211

N=15, t-test, t=4.5, p-value<0.05

The competency binding that was not important for the GPO department, but was for the PPO contract managers is also important for the contract managers from the water board. Risk awareness and decisiveness score higher than for the total pool. Added competencies are market orientation and problem analysis.

Differences between competencies for contract managers and project managers from different function scales

The survey entailed a general control question about the function scale of the respondents, to make an analysis of competencies per function scale possible. However, the total number of respondents per function scale are too low to draw any statistical conclusion, as the number of respondents of each group ranged between four and 22. Some did not know their scale and the rest did not answer this question.

5.2.2 Critical competencies for criteria successful contract management

The case study has resulted in six criteria for successful contract management by the contract manager. The six criteria are the amendment process, legality of payments or SCB process, satisfied client, satisfied contractor, prevent problems and solve problems. For each criterion, the survey has determined which competencies can be stated as being critical to these criteria by the total population with 95% confidence, by comparing the mean to be four, which corresponds to being important. This section will mention the critical competencies according to the contract manager and the differences with the project manager.

Process of amendments

The criterion of process of amendments has eight critical competencies according to the contract managers, being negotiation, collaboration, decisiveness, cost awareness, integrity, making judgments, risk awareness and persuasiveness. All these competencies can be explained in the light of the tasks the process of amendments entails. Changes have to be measured to the contract, the costs and the risks involved, the contract manager has to negotiate on the price for the changes with the contractor and collaborate with the contractor, without losing integrity. There are some differences with the critical competencies for this criterion according to the contractor. The competency decisiveness is not seen as critical, while the project managers have added analytical thinking and being market oriented. This can be seen in table 15.

Table 15: Critical competencies for the criterion process of amendments

Contract manager				Project manager			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Negotiation	3.92	0.737	1	Integrity	3.82	0.597
2	Collaboration	3.92	0.694	2	Negotiation	3.68	0.355
3	Decisiveness	3.81	0.448	3	Cost awareness	3.57	0.161
4	Cost awareness	3.81	0.399	4	Risk awareness	3.50	0.109
5	Integrity	3.79	0.452		Collaboration	3.50	0.105
6	Making judgments	3.65	0.145	6	Persuasiveness	3.46	0.092
7	Risk awareness	3.60	0.103		Analytical thinking	3.46	0.066
8	Persuasiveness	3.56	0.088	8	Making judgements	3.39	0.051
					Market oriented	3.39	0.051

N=48 t-test, t=4.0, p-value<0.05

N=28

Legality of payments

The criterion of legality of payments, also called the SCB process, involves three critical competencies according to the contract manager: integrity, meticulousness and risk awareness, as can be seen in table 16. The legality of payments is an important element for which the contract manager cannot lose his or hers integrity. It is also a process that has to be performed accurately and with knowing the risks involved when this is not done properly. The project managers agree on integrity, but also state project administration being critical to the legality of payments.

Table 16: Critical competencies for the criterion legality of payments

Contract manager				Project manager			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Integrity	3.90	0.696	1	Integrity	3.57	0.260
2	Meticulousness	3.52	0.078	2	Project administration	3.32	0.062
3	Risk awareness	3.48	0.052				

N=48 t-test, t=4.0, p-value<0.05

N=28

Satisfied client

A satisfied client was the third determined criterion for successful contract management by the contract manager. Five competencies are determined to being critical for a satisfied client, being integrity, governance sensitivity, collaboration, communication and approachability, which is stated in table 17. According to the project managers, only the competency of integrity is critical to this criterion. For the other competencies it cannot be stated with 95% confidence that all project managers find those competencies critical for the criterion of a satisfied client. The client is an internal client within the organization. Therefore governance sensitivity is important and the contract manager has to be approachable. Integrity remains important for a governmental client, as well as collaboration and communication.

Table 17: Critical competencies for the criterion satisfied client

Contract manager				Project manager			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Integrity	3.65	0.241	1	Integrity	3.21	0.064
2	Governance sensitivity	3.56	0.109				
3	Collaboration	3.50	0.090				
4	Communication	3.42	0.055				
	Approachability	3.42	0.055				

N=48 t-test, t=4.0, p-value<0.05

N=28

Satisfied contractor

The fourth criterion for successful contract management is a satisfied contractor. The contract manager is the first contact point towards the contractor. The following competencies are critical for a satisfied contractor: collaboration, approachability, empathy, communication, market focus, integrity, flexible behavior, decisiveness, openness and binding, which can be found in table 18. The project managers agree on the criticality of the competencies of collaboration, communication, approachability and market focus. For the other competencies it cannot be stated with 95% confidence that the total population of project managers find those competencies critical for a satisfied client.

Table 18: Critical competencies for the criterion satisfied contractor

Contract Manager				Project Manager			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Collaboration	3.92	0.741	1	Collaboration	3.43	0.158
2	Approachability	3.79	0.423	2	Communication	3.36	0.113
	Empathy	3.79	0.423	3	Approachability	3.36	0.107
4	Communication	3.71	0.254	4	Market focus	3.25	0.061
5	Market focus	3.67	0.169				
6	Integrity	3.60	0.155				
7	Flexible behavior	3.60	0.103				
8	Decisiveness	3.58	0.142				
9	Openness	3.56	0.111				
10	Binding	3.52	0.075				

N=48 t-test, t=4.0, p-value<0.05

N=28

The contractor has to perform according to the contract, but situations can occur in which this is difficult. For those situations, collaboration, communication, empathy and flexible behavior are necessary competencies for the contract manager. The contract manager has to be approachable to the contractor and needs to be open and binding. As the contract manager is the contact point towards the market, market focus is a critical competency. Decisiveness is important to make clear towards the contractor what is expected. Integrity is a competency that the contract manager always should have.

Prevention of problems

The contract manager should strive for the prevention of problems. This is the fifth criterion for successful contract management. The critical competencies according to the contract managers in order to prevent problems are collaboration, anticipation, empathy, problem analysis, communication, helicopter view, risk awareness, openness, analytical thinking, integrity and decisiveness. The project managers agree with this for the competencies of anticipation, collaboration, integrity and communication as can be seen in table 19. According to the project managers, binding is a competency that is also critical, but this was not mentioned by the contract managers. This is a competency that scored very high as overall critical competency for the project managers. This might be an explanation on why this is critical according to them.

Table 21: Interchangeability of the roles, separated by department

	Contract manager				Project manager			
	All (N=47)	GPO (N=19)	PPO (N=14)	Water boards (N=10)	All (N=25)	GPO (N=11)	PPO (N=14)	Water boards (N=0)
Yes, interchangeable both ways	46.8%	63.2%	42.9%	20%	28%	18.2%	35.7%	-
Tasks PM by CM, not the other way around	21.3%	26.3%	21.4%	10%	0%	0%	0%	-
Tasks CM by PM, not the other way around	2.1%	5.3%	0%	0%	12%	9.1%	14.3%	-
No, not interchangeable	29.8%	5.3%	63.6%	70%	60%	72.7%	50%	-

The table shows that there are two perspectives in the overall analysis, as the highest percentages can be found for the answer options 1 (yes, interchangeable) and 4 (not interchangeable). Besides this, it is remarkable that both roles think that they can take over the other role, but the other role not theirs. This can be seen by the contract managers scoring for 21.3% that they can take over the role of the project manager but not the other way around, while the project manager's score is 0%. For the tasks of the contract manager being performed by the project manager, of the contract managers 2.1% chose this option while 12% of the project managers chose this. Based on these scores, no clear conclusion can be drawn.

Between the departments and organizations there are some differences. The majority (63.2%) of the contract managers from GPO Rijkswaterstaat think that the roles are interchangeable both ways and that otherwise the contract manager can take over the role of the project manager, but not the other way around. This is different from the project managers from GPO, as 72.7% thinks that the roles are not interchangeable. PPO has a more shared perspective by the contract managers and project managers on this topic as the differences between the contract managers and project managers are smaller. There still are two sides on the topic: within the pool of contract managers and project managers a small majority thinks that the roles are not interchangeable, while almost half think they are completely interchangeable. From the water boards there are no respondents from the project management side. According to the contract managers, 70% thinks that the roles are not interchangeable.

5.2.4 Differences between roles

The case study has resulted in ten differences between the contract manager and the project manager. The survey was used to test whether these statements are agreed upon by the total population with 95% confidence. The scale of these questions ranged from 1, totally disagree to 5 totally agree, with 3 being neutral.

Table 22: Statements of differences between the contract manager and project manager and the test results

		Mean	p-value (t=4)	p-value (t=4.5)
1. The contract manager is the contact point towards the market.	CM + PM (N=72)	3.75	0.106	
	CM (N=47)	3.81	0.366	
	PM (N=25)	3.64	0.083	
2. Project manager needs more helicopter view than the contract manager.	CM + PM (N=72)	3.60		
	CM (N=47)	3.19		
	PM (N=25)	4.36		0.327
3. Contract manager needs more negotiation than the project manager.	CM + PM (N=72)	3.60		
	CM (N=47)	3.72	0.145	
	PM (N=25)	3.36		
4. The CM needs more knowledge on UAG-GC, contract and procurement than the PM.	CM + PM (N=72)	4.33		0.218
	CM (N=47)	4.26		0.218
	PM (N=25)	4.48		0.866
5. The project manager is responsible for IPM team.	CM + PM (N=72)	4.38		0.346
	CM (N=47)	4.23		0.169
	PM (N=25)	4.64		0.230
6. The contract manager needs to be meticulous and know the contract in detail.	CM + PM (N=72)	3.61	0.307	
	CM (N=47)	3.51		
	PM (N=25)	3.80		
7. The project manager needs more political sensitivity than the contract manager.	CM + PM (N=72)	3.92	0.564	
	CM (N=47)	3.66	0.103	
	PM (N=25)	4.40		0.327
8. The project manager needs more organizational sensitivity than the contract manager.	CM + PM (N=72)	3.42		
	CM (N=47)	3.02		
	PM (N=25)	4.16	0.212	
9. The contract manager needs blue management drives.	CM + PM (N=72)	2.67		
	CM (N=47)	2.45		
	PM (N=25)	3.08		
10. The contract manager is more market oriented than the project manager.	CM + PM (N=72)	3.22		
	CM (N=47)	3.28		
	PM (N=25)	3.12		

t-test, t=4.0, p-value<0.05 / t-test, t=4.5, p-value<0.05

The only statements to which the contract managers disagreed, was statement 9, about the necessity of blue management drives for the contract manager. However, this was a very small disagreement, as the mean is 2.45, being in between disagree and neutral. This can be seen in table 22. The project managers were neutral on this topic, but this only holds for the sample, as no statements can be given on the whole population. On the statement that the contract manager is more market oriented than the project manager also no statement can be given on the whole population.

The statements were tested on the significance of being agreed with, scoring 4 or agree to very agreed with (4.5). Statement 1 holds and both the project managers and contract managers agree on the contract manager being the contact point towards the market. The second statement, the project manager needing more helicopter view than the contract manager, is very much agreed on by the project managers. For the contract managers the p-value was significant and therefore no statements can be made. The contract managers do agree on needing more negotiation skills than the project managers. For the project managers no statement can be made. Both parties agree very much on the statement that the contract manager needs more knowledge on the UAV-GC, the contract and

procurement and on the statement that the project manager is responsible for the IPM team. The sixth statement, the contract manager needs to be meticulous and know the contract in detail is surprising, as this statement has a higher mean for the project managers than the contract managers, while it involves the contract manager. However, together it can be stated that they agree with this statement. They also agree upon the project manager needing to be more politically sensitive than the contract manager. The project managers do also think this regarding organizational sensitivity, while the contract managers do not.

According to literature, the roles of the contract manager and project manager differ, as they have different function descriptions. This is supported by the case study, in which the contract managers and project managers were asked about the daily tasks and responsibilities, in which no overlap was found. The only overlap between the roles, according to the interviewees, is present in the management aspect: both roles are managers who have their own team. However, in competencies more overlap was found. This might be explained by the level of implementation of the competencies. It can be concluded that contract management is a separate role of the integrated project management model as well as project management is.

5.2.5 Training of competencies for the contract manager

The last topic that was researched with the use of the survey was the competencies for which the contract managers should follow a training or course, according to the contract manager and project manager. Forty-six contract managers have provided an answer and twenty-five project managers. The results can be found in table 23 below.

Table 23: Competencies for which a training is necessary for the contract manager

Contract Manager				Project Manager			
Rank	Competency	Mean	p-value	Rank	Competency	Mean	p-value
1	Negotiation	3.35	0.570	1	Negotiation	3.32	0.659
				2	Collaboration	3.16	0.407
				3	Integrity	2.80	0.093
				4	Market focus	2.76	0.060
				5	Communication	2.76	0.052

N=46, t-test, t=4, p-value<0.05 N=25

It was tested for which competencies it can be stated with 95% confidence that the total population of the roles find it important that the competency will be trained. According to the contract managers, this is only the competency of negotiation. The project managers have also stated this competency as being the most critical. The other competencies are collaboration, integrity, market focus and communication.

5.2.6 Comments from respondents

Besides testing the competencies for the different areas and testing the differences between the roles of the contract manager and project manager, the respondents had the opportunity to make comments on the topics. The most commented topic was about the training of competencies. According to 7 respondents, competencies are difficult to enhance through training: a person has these capabilities or not. If you know that you are lacking a certain skills you can learn to deal with it, but you will never be very strong in this competency. Besides this, according to the respondents it depends on the wishes and needs of the contract manager which competencies should be trained. The best training would be job rotation between the client and contractor, according to one respondent. According to others, the knowledge on laws and regulations and integrated contracts should be improved.

Other comments included the differences between contract types. The competency profile will not depend on the contract type and the necessary competencies and even interchangeability of the roles depend on the projects and the individual. The last comment entailed the differences between the roles, for which the communication towards the internal client is cause for conflicts. The IPM line of the project manager to the internal client conflicts with the UAV-GC line of the contract manager with the internal client. In practice it is difficult to make clear agreements on this between the contract manager and project manager and this is the case for multiple projects.

5.3 Conclusion

This chapter discussed the results of a survey sent to 241 contract managers and project managers on the necessary competencies and differences between both roles, in order to provide an answer to sub question 7: *“What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?”* Of the 241 contract managers and project managers, 151 have responded, ultimately leading to 119 respondents working in an IPM team with experience with a D&C contract. This section will conclude on the results and provide an answer to the sub question.

The critical competencies for both the contract manager and project manager were researched. The critical competencies for the contract manager are collaboration, integrity, decisiveness, risk awareness and communication. For the project manager the critical competencies are collaboration, binding, decisiveness, integrity, anticipation, communication and helicopter view. The project manager and contract manager share some competencies, which can be explained by the management aspect of both roles. The role specific competency for the contract manager is risk awareness; for the project manager it is binding, anticipation and helicopter view. The ranking critical competencies do not match the literature. This might be explained by the use of the competencies of Rijkswaterstaat in the conceptual model, which turn out to be incomplete and insufficient. Another explanation is the colored viewpoint of the contract managers and project managers who had to rank the competencies based on their own tasks and responsibilities. The third explanation is that the literature on contract management and project management competencies does not hold for the construction sector.

Differences are found between the departments GPO and PPO from Rijkswaterstaat and the water boards in the Netherlands. For the GPO contract manager negotiation becomes more important and the competencies stress resistance, persuasiveness, planning and organizing and helicopter view become critical. This might be explained by the strong technical background of the employees. The project managers critical competencies are expanded with leadership, environmental awareness, governance sensitivity and organizational sensitivity. The PPO department differs in having more critical soft skill competencies such as empathy, openness and social skills. This is explained by the ambition of the department to improve the soft skills since the establishment in 2013. The critical project managers competencies are expanded with risk awareness, customer focus and result driven. For the water boards no conclusions can be drawn for the project managers, as the number of respondents, six, is too low. For the contract managers, the critical competencies are added with binding, analytical thinking, market oriented, anticipation, problem analysis and persuasiveness.

The table includes the ranking per role according to the literature review. The most important competency according to the literature review for the contract manager is the competency of planning and organizing. This competency is not critical according to all respondents in the contract managers role. The competency is on the twelfth place for the GPO department and on the fourteenth place for the PPO department. Communication and leadership are the most important competencies for the project manager according to literature, but leadership is not found as critical in the survey. It was only found critical by the GPO project managers, on the tenth place. Collaboration, the most critical

competency for the project manager, not different for any department, was not mentioned in any scientific research or document from practice. This also applies to anticipation and helicopter view. The only competency that was mentioned by both the contract manager and project manager as one that should be trained by the contract manager is the competency negotiation. According to the project manager, other trainable competencies are collaboration, integrity, market focus and communication. Others commented that competencies are very difficult to train and that it depends on the skills of the individual and the project. It is more important to enhance the knowledge on laws and regulations and integrated contracts.

The case study had resulted in six criteria for successful contract management by the contractor, for which the survey determined the critical competencies per criterion. For each criterion 3 to 12 critical competencies were determined. An overview of the critical competencies per criterion can be found in figure 21 below.

Process of amendments	Legality of payments	Satisfied client	Satisfied contractor	Prevention of problems	Solving problems
<ul style="list-style-type: none"> •Negotiation •Collaboration •Decisiveness •Cost awareness •Integrity •Making judgements •Risk awareness •Persuasiveness 	<ul style="list-style-type: none"> •Integrity •Meticulousness •Risk awareness 	<ul style="list-style-type: none"> •Integrity •Governance sensitivity •Collaboration •Communication •Approachability 	<ul style="list-style-type: none"> •Collaboration •Approachability •Empathy •Communication •Market focus •Integrity •Flexible behavior •Decisiveness •Openness •Binding 	<ul style="list-style-type: none"> •Collaboration •Anticipation •Empathy •Problem analysis •Communication •Helicopter view •Risk awareness •Openness •Analytical thinking •Integrity •Decisiveness 	<ul style="list-style-type: none"> •Collaboration •Communication •Integrity •Problem analysis •Negotiation •Decisiveness •Empathy •Approachability •Risk awareness •Analytical thinking •Flexible behavior •Creativity

Figure 211: Criteria for successful contract management and the corresponding critical competencies

The interchangeability that has been discussed in the case study chapter was also tested in the survey. As well as in the case study, there are two sides on this topic: a small majority thinks that the competencies are not interchangeable, while almost half states that it is interchangeable. This is different for the GPO department, as 63.2% of the contract managers thinks that the roles are interchangeable, while 72.7% of the project managers think it is not. If the roles are interchangeable, in general the project managers think they can take over the role of the contract manager and not the other way around, while the contract managers think that they can take over the role of the project manager and not the other way around.

The differences between the roles found in the case study are agreed upon by either the contract manager or project manager, except for the market orientation that lies more with the contract manager and the blue management drives of the contract manager. For both no statements could be made for the whole population and for the blue management drives there was even an average of 2.45, meaning a small disagreement, while the project managers were neutral in this. This statement was the only one that was included because of the case study and was not supported by literature. Both roles have some corresponding competencies, which might differ in levels of competency. It can be concluded that contract management and project management are separate roles within the integrated project management model.

6. Conclusions & recommendations

This research has investigated the critical competencies of the contract manager for projects with a D&C contract in the realization phase within the IPM model in relation to the project manager. This chapter is divided into four sections. Section 6.1 will conclude on the sub questions and main research question. Section 6.2 provide recommendations to Rijkswaterstaat, the largest infrastructural client organization implementing the IPM model. Section 6.3 will discuss the limitations of the research and section 6.4 will recommend topics for further research.

6.1 Conclusions

Contract management in large client organizations and the critical competencies of the contract manager are topics on which limited research is available. This research has added knowledge to the existing literature and fulfilled the practical interest in this topic. The conclusions will be presented through the answers for each research sub question and the main research question.

Sub question 1: How is contract management in construction projects defined, based on the IPM model?

Contract management is defined as the process of systematically and efficiently managing contract creation, execution and analysis for maximizing operational and financial performance and minimizing risks. The IPM model is a collaboration model in which five areas of expertise for projects are represented: project management, management of project control, technical management, environmental management, stakeholder management and contract management. Contract management within the IPM model is defined as the responsibility for a process-based control of the determination of the procurement needs, the drafting of the procurement plan, the contract preparation, tendering and contract management (contract monitoring) within the boundaries of time, money, quality and risks.

Sub question 2: What is the role of the contract manager in construction projects within the IPM model?

The role of the contract manager within the IPM model is to monitor the progress and performance and to intervene when operations are not in line with the contract. The contract manager is the representative towards the market and in case of changes to the project or unexpected events, the contract manager should find solutions together with the market parties. The role of the project manager is the one primary responsible for reaching the project results within the predetermined boundaries for time and budget and the representative for the internal client. The project manager steers the project team, guards the mutual interfaces within the team and binds the individual role keepers as a team and enhance the team spirit.

Sub question 3: Which competencies are being asked from a contract manager within the IPM model?

Analysis of different sources on contract management and project management competencies have provided the first version of the conceptual model of necessary competencies. This conceptual model included the competencies asked by Rijkswaterstaat for both roles. The conceptual model consists of 65 competencies. The most important competencies are communication, planning and organizing, integrity, analytical thinking, entrepreneurship, leadership and result driven. With the use of the case study the conceptual model was improved. Of the 65 competencies, 39 were presented to the interviewees to score for importance and eventually four competencies were added by the interviewees. Seventeen competencies of the 43 got a full score and were all included in the first conceptual model. The competencies that were mentioned often in the first conceptual model, but

were not found important according the results of the case study are entrepreneurship and customer focus. The analysis of the case study completed the conceptual model of necessary competencies.

Sub question 4: What are the challenges for a contract manager that come with a Design and Construct contract in the realization phase within the IPM model at Rijkswaterstaat?

Every project has its own complexity and uniqueness. The challenges for a contract manager lay in this uniqueness and approach towards it. The contract manager has to make sure the contract is lived up to and agreements are met, but when this is not the case, the contract manager should act. Therefore it is necessary to understand the risks involved and to know what motivates the contractor.

The Design and Construct contract type poses for different challenges than other contract types do for the contract manager, as the collaboration with the contractor becomes even more important. The contract manager needs to anticipate and cannot lean back. The necessary competencies for this do not depend on the contract type according to the case study. The contract type will be the foundation, but eventually the individuals involved in the project will determine the necessary competencies and challenges that the contract manager has to deal with.

Sub question 5: In what way do the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?

The IPM model is a collaboration model in which the roles are equal to each other. However, in practice the role of the contract manager and project manager tend to weigh more than the other roles. There are some overlaps between the roles, such as that every IPM role member has a team and is a manager.

Besides these overlaps, much more differences between the roles can be found. According to the interviewees in the case study, none of the mentioned daily tasks and responsibilities of the contract manager and project manager show any overlap. The most important difference lays in the contact point towards the market, which is the role of the contract manager and the representative towards the internal client, which is the project manager. Other differences are that the project manager is responsible for the IPM team and the contract manager should have more knowledge on the UAV-GC, the contract and procurement. Besides this, the project manager needs to have more political sensitivity and more helicopter view, as the project manager needs to keep an eye on all other IPM roles, while the contract manager can focus on his or her own tasks. Challenges for both managers lay in the communication towards the contractor and the internal client, as the contract manager is responsible for the first one while the project manager is responsible for the second. In practice these communication lines tend to get troubled, leading to undesired situations.

Sub question 6: Which criteria can be distinguished to determine whether contract management will be successfully conducted by the contract manager?

Six criteria have been determined for successful contract management by the contract manager. These criteria are process of amendments, legality of payments, satisfied client, satisfied contractor, prevention of problems and solving problems. All determined criteria are also present in the literature on successful contract management.

Sub question 7: What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?

This sub question has led to the determination of the critical competencies for the contract manager and project manager within the IPM model and a Design and Construct contract in the realization phase. The critical competencies for the contract manager are collaboration, integrity, decisiveness,

risk awareness and communication. The project manager shares four competencies with the contract manager and has three different competencies. The shared competencies can be explained by the management aspect of both roles. The critical competencies for the project manager are collaboration, binding, decisiveness, integrity, anticipation, communication and helicopter view. The ranking of critical competencies for the contract manager and project manager differ from the literature. A few explanations are possible: Rijkswaterstaat does not currently ask the right set of competencies, which was used in the conceptual model; the respondents had to score competencies based on their own tasks and responsibilities, which are the most specialized respondents, but have also a colored viewpoint; the literature on contract management and project management competencies does not match the construction industry.

Differences can be found between departments and organizations using the IPM model. The GPO department has more role specific competencies determined as critical such as making judgements, persuasiveness and planning and organizing, the PPO department is focused more on soft skill competencies such as empathy, openness and binding, while the water boards have extra competencies listed as critical such as problem analysis and market orientation. However, for all contract managers working within organizations using the IPM model it can be stated with 95% confidence that the competencies mentioned in the previous paragraph are critical.

Besides this, the critical competencies are determined per criterion for successful contract management by the contract manager. These are stated in figure 21 on page 65.

The answers of the sub questions have led to answering the following main research question:

What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase in the Netherlands?

The critical competencies depend on the role of the contract manager within the IPM model, as being the authorized contract representative and contact point towards the market. This entails responsibilities such as the process of amendments, the process of system based contracting for performance measurement and the financial incentives and risk management for the realization phase of projects. In order to be able to perform these tasks, the contract manager needs the competencies collaboration, integrity, decisiveness, risk awareness and communication. Of these competencies, risk awareness is specific for the contract manager, the other critical competencies the contract manager and project manager have in common.

6.2 Recommendations for Rijkswaterstaat

In this section a few recommendations will be made to Rijkswaterstaat, especially to the GPO department.

First of all, the critical competencies of the GPO department as discussed in section 5.2.1 should be implemented in the “meetlat” (Dutch for ruler) as this research has shown that these competencies are critical. The meetlat can be improved, as it is currently not specified to role specific competencies. This should be done for both the contract manager as well as the project manager.

Based on this research, from now on it can be determined which capacities a person should have in order to successfully participate on projects with a D&C contract in the realization phase. This report should be used for determining the right person for the job. This can be done for the complete realization phase, but when problematic situation in the area of the amendment process, legality of payments, prevention of problems, solving problems or striving for a satisfied contractor or client can

be expected, the critical competencies for these criteria can be used to select the right contract manager.

The criteria for successful contract management can be implemented within the organization in order to professionalize the organization on this criteria and to use the criteria to evaluate the project afterwards. The criteria for successful contract management can be used in performance evaluations. Successful contract management can be measured with the use of the aforementioned criteria.

The research has shown that, especially for the GPO department, there is a discrepancy in the opinions on interchangeabilities between the roles of the project manager and contract manager. This discrepancy was first detected in the networking event between the project managers and contract managers, it was supported by the case study results and concluded with the survey. The management of the department should determine which view is desirable for the organization: having interchangeable roles in order to prevent compartmentalization or to clearly separate the roles in order to stimulate knowledge and expertise. This does not involve temporary interchangeability in case of illness or holidays, but long-term interchangeability.

Every contract manager should do a basic course on procurement law, project management courses such as IPMA or Prince2 and do a training to improve the negotiate competency. The case study and survey has shown support for this. Another suggestion to improve professionalism and competencies is practical experience by linking a junior employee to a senior employee.

The last recommendation involves the conflict in communication lines with the internal client. The contract manager communicates with the client on matters involving the UAV-GC, while the project manager has meetings because of the IPM line with the internal client. Because of this conflict in communication, it occurs that the contract manager and internal clients discuss matters that would actually imply the presence of the project manager. It is recommended to make this communication line more clear, by for example determining that the project manager and internal client have meetings for which the contract manager only should be present if it involves tasks of the contract manager. By implementing such a strategy, the project manager will no longer be left out of important decisions.

6.3 Limitations

This research has encountered some limitations which have to be taken into account when considering the results of this research.

First of all, this research has only taken into account the client's perspective on the critical competencies for the contract manager in relation to the project manager. This will limit the relevance of the research to client organizations.

There is no existing scientific research on the critical competencies of the contract manager in the infrastructural sector. Therefore the general descriptions of the competencies are used in order to determine the critical competencies and not the behavioral aspects of each competency. Therefore only the applicability of competencies are determined and not on what level the competencies should be present.

Unfortunately, the number of respondents for certain topics or sections were quite low. Therefore it was not possible to determine the critical competencies for the project managers of water boards or differences in function scales.

This research has used a combination of desk research, case study and survey in order to provide an answer to the main research question. One of the benefits of this methodology is that a conceptual model is formed based on other research into competencies. There are many competencies and

descriptions of competencies. By analyzing previous research, a basis of competencies is present that can be tested. Without this, there would be too many possible competencies. Besides this, a scientific foundation is present, but it is tested to practice, in which the respondents will point out where the differences lay with the theory. With this research methodology the existing literature on competencies is adjusted to the construction industry. A downside of this methodology is that the contract managers and project manager had to score the competencies of their own function. This makes it possible that the respondents will check by themselves for each competency if they possess this or not. However, by using the contract managers and project managers, the specialists on the necessary competencies are interviewed, as they experience and know best which competencies are necessary in practice. By choosing the IPM model as a boundary, the relevance of the research is narrowed to the organizations in which the IPM model is implemented. However, the IPM model is implemented more and more in construction organizations, as well on the client side (Rijkswaterstaat, water boards) as well as on the contractor's side. Therefore this research is relevant to more organizations than only the GPO department of Rijkswaterstaat.

6.4 Further research

This research developed a first determination of critical competencies for the contract manager and has its limitations. This suggests topics for further research.

It would be interesting to compare the results of this research to the contractors viewpoint. It might be that the contractor experiences situations differently for which they would expect different competencies.

Research into the function scales of the contract manager and project manager might lead to scale specific competencies. Another research on focusing the competencies per contract type might lead to different results.

It would be interesting to see in what way the levels of competencies differ between roles. For example both the GPO contract manager and project manager have listed helicopter view as a critical competency, it might be that these competencies differ in levels of implementation. Therefore it would be interesting to research the different levels of the competencies and their behavioral indicators.

The case study was focused on projects with D&C contracts from the GPO department, while in the survey both the GPO and PPO departments from Rijkswaterstaat were included. As discussed in chapter 5, it might be possible that the differences found in critical competencies between the departments can be explained by the differences in origin of the departments or that the tasks, responsibilities and challenges of the departments differ that much. These differences can be investigated in further research.

This research has investigated the differences between the contract manager and project manager and the differences from literature were supported by practice. However, the effects of these differences were left out of scope. For further research it is interesting to research the effects of these differences between the contract manager and project manager and to determine whether this is cause for conflict or that it leads to better collaboration between the roles.

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Appendix A: Tasks and responsibilities of other roles

Literal translation of Expertgroep Projectmanagement (2008).

A.1 The manager project control

A.1.1 General description and role within the project

Integral control on risks regarding time, money, quality and scope is the primary condition for successful integrated project management. Deviations in time, money or quality are caused by risks that occur: non-scheduled events or uncontrolled processes. The effects of occurred deviations in quality will typically increase the expense of time and money. By determining during the project what risks have the biggest effects on planning and cost, management measures can be used to reduce unwanted effects. Careful project management means for the project managers insight into the state of affairs in the field of quality, money, time and scope at any time in the project.

For each activity it must be demonstrated what it has achieved, what it costs and how long it has lasted. Integrated project control ensures the control of time, money and quality (technique) during the lifecycle. Control is based on risk management. The manager project control and thus also the risk manager is the manager of the processes on risks; the responsibility for the management of the risks associated with the stakeholder manager, technical manager and contract management lies with the relevant role keepers.

Risks are associated with activities. Integrated project control is therefore made up of:

- *scope management*, the control of scope including the changes to the project;
- *financial management*, the control on expenditure and income as well as income and expenses in present, past and future;
- *cost management*, the control by means of key figures and various forms of estimates;
- *planning management*, the management of the aspect of time during the lifecycle of a system, as well as the MIT/SNIP milestones;
- *risk management*, the identification and management of the risks of a project, on the aspects quality, money and time;
- *quality management*, the control of quality within the project;
- *information management*, the delivery of reliable information correctly and in time for the management cycle;
- *document management*, the accessible and traceable capturing of documents.

The activities within the project are accounted for on the basis of the results of these management processes. Integrated project management is acting on the basis of information provided by integrated project control. An important aspect in this is also the principle that the check on the control aspects will be separately identified and is not an integral part of the work of the interacting party. In this way, at any time, independent and objective understanding of the status quo of a project is possible. Rijkswaterstaat focuses on integrity, effectiveness and efficiency. By coupling time, money, quality and risks to activities it makes it easier to show at what time and for which activity money and time has been made available.

The manager project control is responsible when it comes to project wide control of projects on the aspects of time/planning, money/budget, quality, scope and risk management. The manager project control is also responsible for the project wide progress reports and document management.

The manager project control is both evaluative (primarily on the functioning of the system and the internal processes of the project) as he is supporting and is therefore an important sparring partner for the other key roles. He lines up independently.

A.1.2 Tasks

- The manager project control organizes and leads the project control team and the staff within project control.
- The manager project control steers the project controllers
- The manager project control is on behalf of and in consultation with the project manager intermediary between project organization and line organization (capacity management)
- The manager project control ensures in time feedback to project managers and line managers
- The manager project control ensures a (updated) project plan
- The manager project control ensures a PPI planning
- The manager project control ensures an integral (PRI) estimate
- The manager project control delivers the project control part of the cost estimate
- The manager project control ensures document management
- The manager project control ensures quality system implementation and management
- The manager project control composes progress reports
- The manager project control manages the scope change process
- The manager project control ensures the project embedding in the management cycle (relation between management contracts)
- The manager project control steers the risk management progress
- The manager project control adds risks within his area of expertise, actualizes and governs these within his area of expertise and implements management measures
- The manager project control is responsible for all purchasing belonging to the organizational costs of the project (called (internal) costs, such as facility services, housing and such), the contract manager is responsible for all purchasing belonging to the outsourcing costs (such as construction contracts, research contracts and engineering contracts). Besides this for (internal) costs must be made in accordance with the line
- The manager project control is the first point of contact for review, (internal) audits, and such

A.1.3 Responsibilities

- The manager project control is responsible for the realization of the planning, financial management, in time payment, risk management, scope management and document management.
- The manager project control is responsible for the proper control of the project contract in compliance with (SMART) agreements.

A.1.4 Specific role accents of the manger project control

The accents mentioned below are related to the role and thus not function related, as is established in the job classification of Rijkswaterstaat. The competences from the job classification remain in full force. In particular there is searched for distinctive accents relative to other roles within the IPM model. Generic accents like 'collaboration are ignored here.

- Operation control
- Information analysis
- Planning and organizing
- Cost-conscious acting

A.2 The stakeholder manager

A.2.1 General description and role in the project

The stakeholder manager is responsible for the social embedding of the project and is thus the intermediary between the project organization and its surroundings. This environment is formed by all project involved parties. The demands and agreements with the stakeholders are delivered from the stakeholder management to the technical management. The stakeholder manager is responsible for the interaction with the surrounding area to get the project realized within the public and private preconditions. In this connection the stakeholder manager and his team ensures going through various planning procedures, obtaining permits, preparation of (administrative) agreements, (re) laying of cables and pipes, real estate business, claims handling and environmental, archaeological and explosives investigations. The stakeholder manager is concerned with the social embedding in the project and is therefore an intermediary between the (project) organization and its surroundings. Public-oriented network management is placed central. The stakeholder manager attempts to foster understanding and trust in the environment to achieve effective collaboration with surrounding parties. Intensive contact and consultation at official and administrative level is necessary to achieve this. This will be conducted by the stakeholder manager, assisted by the project manager and/or the principal director or HID, depending on the nature and context of these consultations. The stakeholder manager has a clear signaling function in the project team to proactively signaling the environment issues which may have internal and external influence on the project quality.

A.2.2 Tasks

- The stakeholder manager organizes and leads the environment management team.
- The stakeholder manager knows the environment and collects timely necessary information for strategy, progress, realization and organization of the project for realizing the assignment
- The stakeholder manager directs the administrative conditioning, including the cables and pipes, permits, (administrative) agreements, integration / design, real estate, claims handling, archeology and explosives.
- The stakeholder manager imposes and maintains contacts at official level with the own function key individuals and organizations.
- The stakeholder manager collects demands and requirements at environment parties and contributes these to the project team (inter alia at the technical manager and project manager)
- The stakeholder manager translates technical project information to stakeholders and directors.
- The stakeholder manager directs communications and conditioning
- The stakeholder manager ensures the communication with the environment in relation to the project. For this purpose he takes care of a communication plan for the education and information and complaints.
- The stakeholder manager ensures for (regularly updated) stakeholder analysis and formulates a stakeholder strategy which connects to the phase and purpose of the project.
- The stakeholder manager ensures traffic safety and coordination with the infrastructure provider and traffic manager
- The stakeholder manager is in charge of environment-related consultations outside the project, not only from their own team but also from the teams contract, technology and project management.
- The stakeholder manager provides environment-related information as a contribution to the contract review for deals as well as contract management
- The stakeholder manager provides the environment technical part of the cost estimation

- The stakeholder manager carries within his area of expertise risks, updates and controls those within his area of expertise and implements management measures

A.2.3 Responsibilities

The stakeholder manager is responsible for internal/external relationship management from the project organization and puts forward consultations with internal roll holders, such as traffic manager and infrastructure provider.

- The stakeholder manager is responsible for proper exchange of information between project organization and surroundings.
- The stakeholder manager is responsible for surroundings, such as a communication plan, stakeholders analysis, stakeholder strategy.

A.2.4 Specific role accents of the stakeholder manager

The accents mentioned below are related to the role and thus not function related, as is established in the job classification of Rijkswaterstaat. The competences from the job classification remain in full force. In particular there is searched for distinctive accents relative to other roles within the IPM model. Generic accents like 'collaboration' are ignored here.

- Operation control
- Information analysis
- Planning and organizing
- Cost-conscious acting

A.3 The technical manager

A.3.1 General description and role in the project

The technical manager is first of all focused on realizing the desired technical result for the client. For this all requirements are laid down which should lead realization and use of a system. The technical manager designs a system accordingly to the demands of the client. An important tool here is the functional specification. By using the technical management, it is possible to steer on demands during the lifecycle of a project. This means: does the system as we design it, realize and use to satisfy the requirements? The usual scheme for this is systems engineering (SE).

The technical manager is responsible for the substantive technical contribution to the project. In order to perform this properly the technical manager does not need in-depth technical knowledge, but subject-specific process knowledge. Especially in the planning study phase a general subject-specific process knowledge is required.

Under the responsibility of the technical manager, the technical scope in the form of (functional) specifications is formulated for market parties, thereby making use of the systematics of systems engineering. The technical manager also contributes in the form of technically substantive input in the formulation of the system, process and product tests to market parties during the construction phase as part of SCB (System-based contracting). Here, the technical manager contributes in the form of coming up with risks, including identifying test plan and contribute to the implementation of the system, process and product tests. All under the responsibility of the contract manager.

It is clear that the objective must be close collaboration with stakeholder management (wishes, requirements and restrictions from environment) and contract management (translation into contract terms and in later stage technical input into the contract management). The technical manager is responsible for the technical contribution to the processes covered by the responsibilities of the

contract manager, stakeholder manager and project control manager. Here the continuous focus on risk management matters.

A.3.2 Tasks

- The technical manager organizes and leads the technical team.
- The technical manager makes a technical contribution to investigations such as ground, groundwater, traffic, environment, air and noise.
- The technical manager is responsible for enabling the right (technical) knowledge for the project
- The technical manager is responsible for the evaluation and review of the technical design to the specification and other agreements
- The technical manager monitors the technical scope and provides this to the manager project control
- The technical manager is involved in the changes, particularly relating to the technique.
- The technical manager contributes to the assessment of offers.
- The technical manager performs his tasks in accordance to the “Guidance Systems engineering in the civil engineering sector
- The technical manager delivers the top specification (planning study phase)
- The technical manager translates the requirements/wishes to functional specifications
- The technical manager composes the functional requirements
- The technical manager composes the technical process requirements for the tender specification
- The technical manager harmonizes the tender specification with relevant stakeholders.
- The technical manager takes care of the planning study phase of the technical reports as well as the MER of sufficient quality for decision making. To this end, consulting with advisers/ specialists is necessary. Mandatory tests (MIT / SNIP) will be planned in consultation with the manager project control and the contract manager.
- The technical manager provides the risks within his area of expertise, updates and controls them within his area of expertise and implements control measures.
- The technical manager provides the technical contribution to the contract control (delivery of technical risks, partly determining the test plan and providing input to the system, process and product tests.
- The technical manager has input for the composition of the hand-over file.
- The technical manager has a technical input to the process of delivery and hand-over
- The technical manager adapts with the national services of RWS for the technical aspects of the project. He enables the necessary knowledge for this
- The technical manager maintains contacts with the knowledge institutes through the national services for the technical aspects of the project.
- The technical manager delivers the technical part of the cost estimates

A.3.3 Responsibilities

- The technical manager is responsible for monitoring the proper implementation of the technical process in accordance with the assignment (executed by the contractor)
- The technical manager is within the project organization responsible for coordinating, guidance and advice to the embedding of technology in the project. For example, consultation with the project manager and area manager in the event of heavy integration requirements.
- The technical manager is responsible for the interpretation of the effects and mitigation / compensation measures in the process note.

- The technical manager is responsible for the steering of engineering firms (among others MER impact studies) and will ensure that the engaged market parties deliver products of sufficient quality
- The technical manager is responsible for the realization of the program of demands (question specification 1, "the what") and related products, as well technical process demands (Question specification 2, "the how")
- The technical manager is responsible for the integrated security (including internal, external security and health & occupational health and Safety). Detailed agreements on this matter are made together with other key roles wh the team under responsibility of the technical manager.

A.3.4 Specific role accents of the technical manager

The accents mentioned below are related to the role and thus not function related, as is established in the job classification of Rijkswaterstaat. The competences form the job classification remain in full force. In particular there is searched for distinctive accents relative to other roles within the IPM model. Generic accents like 'collaboration' are ignored here.

- Operation control
- Information analysis
- Planning and organizing
- Cost-conscious acting

Appendix B: Interrelationships and dependencies within the core roles of the IPM model

Literal translation of Expertgroep Projectmanagement (2008).

The IPM model and organizational structure designed in the five role model is a cooperation model. The five roles within IPM model distinguish themselves, but even more important: possess in the context of the cooperation relationships and dependencies. This chapter will elucidate on the relationships and dependencies between each role.

B.1 Relation between stakeholder manager and technical manager

- The stakeholder manager assesses the needs and demands of the stakeholders and interested parties after agreement has been reached over the problem/task, mainly during plan study phase c.q. the preparation phase,. The technical manager evaluates what is and what is not technical possible (scope and boundaries) and thereby sets the technical and functional specifications. The project manager will be involved for large integration choices with big (financial) consequences or political sensitive choices.
- The stakeholder manager couples the possible solutions back to the interested parties in a transparent and understandable way.
- The plan study phase and realization phase are being brought together in a better way through mutual cooperation between the stakeholder manager and technical manager.
- Overlap of realization phase and planning study phase, the so-called intertwining, could add value to the result: Market creativity is used before all is legally closed over an Infrastructure Decree or a contract with the market. The relation of the stakeholder manager, technical manager and also the contract manager is here of big importance.
- At maintenance projects we know the 'preface' (a short exploration) executed by the district (infrastructural provider and traffic manager), in which the stakeholder manager also has a coordinating role. He ensures that legal and conditioning aspects and maintenance needs are adequately translated into the contract.
- The stakeholder manager ensures a clear interpretation of the functional requirements towards the interested parties, together with the technical manager. (Targeted language).
- In conclusion, it is important both in construction and in maintenance projects to involve stakeholder management in an early stage to reach optimal cooperation with technical and contract management.

B.2 The relation between the technical manager and the contract manager

- The contract manager should determine the market strategy based on existing risk and in relation to the depth of the detailed solutions. The technical manager thereby contributes solutions, options and specifications from a technical point of view.
- A translation of technical and functional specifications (TM) to contractual (CM) provisions takes place.
- The contract manager is required to carry out a market scan during the exploration phase. Before starting the plan study phase, both a PSC and a PPC are mandatory and a market consultation is optional. By application of these instruments, the moment of purchase and the contract type will be determined. What the marketability of solutions and options in a given environment are, are hereby discussed.
- The technical manager contributes to the total system, with which the contract manager must approach the market.

- The technical manager sets tests to assess the contractor on risky processes and products, based on his expertise. The technical management is responsible for the quality of the tests.
- The technical manager provides test capacity to the contract management (matrix).
- The contract manager is responsible for timely testing and also for the actions that emergence from the tests. He is also responsible for the payment to the contractor.
- With proposed changes from the contractor, technical read reviews will be executed by the technical management. If necessary, the stakeholder manager will inform the interested parties and test the changes on public and private law restrictions.

B.3 The relation between stakeholder manager and contract manager

- The stakeholder manager provides feedback of environmental aspects to interested parties, through the contract manager (or the technical manager). For example, think of construction or noise nuisance, especially in the realization phase.
- As more environment issues be put on the market, the stakeholder manager will lean more towards the contract manager.
- From the needs of the environment, the stakeholder manager will reveal these issues in the contract with the market, through the technical manager (in specifications) and the contract manager, depending on the risk profile.
- If stakeholder management is outsourced more and more to the market, the stakeholder manager will, depending on the size of the risks, specify to the contract manager which tests in relation to the environment should be carried out at the contractor's.
- The stakeholder manager must be able to explain the choosing or the chosen form of contracts to the stakeholders during each phase. He also has to be able to indicate how the contract management will take place during the realization (in easy talk).

B.4 The relation between manager project control and remainder roles

- The manager project control composes the project management plan and the (internal) quality plan and effects thereby other roles and attention fields.
- The manager project control provides the internal quality control and thus has an interface with all other roles and has a partially supportive role.
- The manager project control is responsible for risk management and thus affects all roles.
- The manager project control is responsible for cost management and scope control and thus affects all roles with this.
- The manager project control has cost expertise within his team and ensures support of the technical team and the contract team (estimates).
- In the context of risk management, the other roles are challenged by the manager project control.

B.5 The relation between project manager and remaining roles

- The project manager has overall responsibility for the entire project towards his or her client and has overall control and thereby affects all roles.
- The project manager is responsible for accountability reporting towards the client, which is drawn up by the manager project control.
- The project manager manages the team and ensures the monitoring of the mutual interfaces and thus affects all roles.
- The project manager provides for teambuilding and engages in a timely manner when there is no team cooperation.
- The project manager supports the remainder roles when requested.

- The project manager has often administrative contacts with the stakeholder, together with the stakeholder manager, in the context of the environment. Besides this, the region is primarily responsible for the environmental contacts. This means that, in particular a Head Engineer-Director or director puts claim on administrative contacts.
- The project manager provides sufficient resources from the line organization for his or her project and let it get managed by the manager project control.
- The project manager provides an escalation model, both within the project organization as well as in collaboration with the contractor.
- The project manager asks for independent tests regarding the project team and its operation if the project manager deems necessary.
- The project manager does not only focus on its responsibility towards the project team, but also to his client. In addition he has a sense of the influence that is important for his project. The project managers knows when to escalate in a timely manner within his project.

B.6 Ten precepts

For each role within a project and with it the five core roles, ten precepts have been determined. These are derived from the control model large projects.

The ten precepts:

Business-like behaviour:

1. A project starts with a clear project assignment; clearness towards all partners is sought and vague agreements are avoided.

Open communication with the higher management levels and the network operator

2. Risks are not kept to ourselves, but are discussed with the management
3. Setbacks will not be accountable to one person, but it is accountable how this is communicated and the way in which an attempt was made to control elements.
4. Uncertainties are communicated as well as its size; no false certainties will be presented
5. The internal client, network operator and politics are included in the considerations for the iron triangle time, budget and quality

Pro-active attitude towards risks

6. Uncertainties are tried to get into view as early as possible, in order to be able to steer and eliminate them.

Governance and political sensitivity

7. There is an antenna for political or governance sensitive issues and it is made sure pro-actively that issues that might lead to questions to the Members of Parliament or Minister will be passed along, in order to minimize surprises.
8. Providing incorrect and/or incomplete information to the parliament is a mortal sin.

Business operations

9. For a professional project organization good business operations are necessary; an approving (accountants) judgment is a must to this
10. In a professional organization the judgment of an auditor should also be included.

Appendix C: Explanation of competencies

This appendix gives a definition of the competencies and their behavioral indicators used in the final version of the conceptual model. The definitions and their behavioral indicators are based on Bonnstetter and Brooks (2003); Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2014); Technische Universiteit Eindhoven (n.d.); Gewest Gooi en Vechtstreek (2009); Competentiewoordenboek (2012); Carrièretijger (2017); IFV (n.d.); Competentiewoordenboek De Spoorwegen (2006).

Act innovative

Innovative thinking and acting; see opportunities for innovation of processes, products or services; preference for trying out improvements over maintaining existing ones.

Behavioral indicators:

1. Associates with ease, sees relations quickly
2. Combines own ideas and those of others to new solutions
3. Come up with ideas that are fundamentally different than thus far thought up by others
4. See new uses for existing tools
5. Breaks through existing ways of thinking
6. Experiment with possibilities, trying out different approaches

Analytical thinking

Dissecting situations or an amount of information in major and minor issues. Seeing interrelationships and penetrate to the core.

Behavioral indicators:

1. Selects the right information from diverse sources
2. Makes a distinction between major and minor issues
3. Creates a logical structure in a plurality of information
4. Forms relationships between information and / or questions
5. Distinguishes cause and effect
6. Uses different angles in analyzing

Anticipation

Foresees developments that affect the work and act accordingly

Behavioral indicators:

1. Indicates on any anticipated developments in a timely manner
2. Appoints the actions to be taken for planned developments
3. Acts timely in the provision of an opportunity or critical situation

Approachability

Being easily approachable on a social level. Being receptive towards others have to say.

Behavioral indicators:

1. Is easy to talk to

2. Does not create thresholds: makes sure to being accessible to another. Seeks the presence of others
3. Diminishes the distance to others by taking on an informal attitude.
4. Is open to others and takes along the contribution of others. Listens seriously to what others have to say.
5. Has an inviting appearance, makes eye contact and emits nonverbally to being approachable.

Binding

Applying synergy in a group of employees, encouraging mutual involvement and motivate employees to achieve effective cooperation.

Behavioral indicators:

1. Invites employees to give their input
2. Inspires employees
3. Ensures that cooperation and cohesion are created
4. Ensures continuous and open communication among others by setting a good example
5. Encourages people by finding solutions to barriers between people
6. Organizes decision-making in such a way that everyone can contribute to create a good support
7. Builds and maintains relationships with people and groups within the network
8. Seeks common interests in the relationship with stakeholders and is therefore able to realize the own objectives

Collaboration

Contributes actively to a common result or troubleshooting even when the subject involved is not of immediate personal interest.

Behavioral indicators:

1. Seeks the collaboration
2. Adjusts own work off on others
3. Shares knowledge, information and ideas with others
4. Shows interest in the ideas of others
5. Contributes to good mutual relations
6. Helps others if necessary
7. Puts the common result above personal interest where necessary

Communication

Make ideas and opinions clearly to others, using plain language, gestures and non-verbal communication or by a report or document that has the correct set-up and structure, is grammatically correct and that contains the correct language or terminology for the receiver.

Behavioral indicators:

1. Speak in plain language and explains jargon
2. Checks whether their interlocutor has understood the message
3. Explains his or her point of view in short terms to others
4. Tries to clarify unclear statements or signals
5. Uses intonation or gestures to support what he or she wants to say

6. Adjusts language to his or her interlocutor on
7. Uses correct language in letters, notes, e-mails etc
8. Uses short, clear sentences in texts
9. Uses form and build to create a clear structure in a written message
10. Connects well in written language with the specific needs and circumstances of the target group
11. Formulates complex issues and clear
12. Formulates sensitive issues tactfully, fits his or her choice of words to purpose and audience

Cost awareness

Think and act aimed at optimal use of time, money and other resources; consideration of financial implications and attention to limiting costs.

Behavioral indicators:

1. Handles resources under management with care
2. Considers cost and return well against each other
3. Monitors time of activities in order to reduce costs
4. Is price-conscious when entering into financial transactions
5. Think in businesslike manner about the deployment of people and resources
6. Thinks about the financial consequences of plans and actions

Creativity

Provides genuine solutions for problems related to the function. Devises new procedures to replace existing ones.

Behavioral indicators:

1. Viewing issue from different angles
2. Consider unconventional solutions to a problem
3. Provides new ideas
4. Using existing possibilities on a different way
5. Imagines new processes, services or products

Customer focus

Investigating needs of the customer and act accordingly. Anticipating customer needs and give high priority to service and customer satisfaction.

Behavioral indicators:

1. Examines the needs of the customer
2. Deepens in the organization and the interests of the customer
3. Responds quickly and accurately to questions and complaints
4. Foresees customer needs and plays into that.
5. Seeking (together with the customer) to the most appropriate solutions
6. Takes responsibility for implementation of agreements If desired
7. Informs customer satisfaction

Decisiveness

Being easily approachable on a social level. Being receptive towards others have to say.

Behavioral indicators:

1. Is easy to talk to
2. Does not create thresholds: makes sure to being accessible to another. Seeks the presence of others
3. Diminishes the distance to others by taking on an informal attitude
4. Is open to others and takes along the contribution of others. Listens seriously to what others have to say
5. Has an inviting appearance, makes eye contact and emits nonverbally to being approachable

Empathy

The ability to perceive and understand the feelings and attitudes of others. The ability to place oneself 'in the shoes' of another and to view a situation from their perspective.

Behavioral indicators:

1. Shows interest in the feelings, needs and backgrounds of others
2. Deals tactful with norms and values of others
3. Shows understanding for the feelings, needs and backgrounds of others
4. Take the position, needs and interests of others into account
5. Creates an environment where feelings and needs can be discussed

Entrepreneurship

Signaling and balancing market opportunities for both existing and new products / services; capitalize these opportunities in order to achieve business advantage.

Behavioral indicators:

1. Seeks changes and opportunities
2. Dares to tackle new things
3. Come up with new ideas for knowledge and applications, products or services.
4. Performs market or environment research
5. Indicates what investments are needed to respond to market opportunities
6. Dares to take responsible risks in order to gain a certain advantage

Environmental sensitivity

Show to be well informed about organizational, social and political developments or other environmental factors (within or outside the organization), and use this knowledge effectively for their own job or organization.

Behavioral indicators:

1. Follows relevant developments outside the organization
2. Identifies developments and conditions that affect the own field of work
3. Translates external developments and conditions to the own field of work

Flexible behavior

If problems or opportunities arise change own behavior style in order to achieve the objective.

Behavioral indicators:

1. Chooses an approach that suits the situation
2. Matches goals to changing circumstances
3. Adapts their own behavior if the situation requires it
4. Switch easily between topics or tasks
5. Adjusts own view based on new information

Governance sensitivity

Taking account of the impact of developments, decisions and actions for the ministers, the administration and the administrative top.

Behavioral indicators:

1. Knows policy and administrative and political rules, relations and interests
2. Is aware of developments in politics and in the political and senior civil servants
3. Recognizes political and administrative sensitivities, risks and opportunities and act accordingly
4. Keeps track of decisions and actions taken into account the consequences for ministers and senior civil servants
5. Checks with the right people whether there is support

Helicopter view

Keeps oversight over parts and the whole of an issue or project data.

1. Behavioral indicators:
2. Recognizes the big picture and has an eye for the details of an issue or project data
3. Can take a step back and look at things from a distance
4. Can detach themselves from one part to oversee the big picture and the overall process
5. Recognizes developments and trends, both within the organization and discipline and beyond, it can interpret and translate them into their own work situation

Independence

Take action that are based more on personal conviction rather than a desire another to do a favor. Set their own course.

Behavioral indicators:

1. Form an own opinion, no matter what others think
2. Brings own ideas, even if it is known that others do not agree.
3. Continues to support a taken position without losing sight of feasibility
4. Follow deliberately its own approach, even when others make objections
5. Does not avoid a business disagreement

Integrity

Maintaining generally accepted social and ethical standards in activities related to the function.

Behavioral indicators:

1. Is aware of the norms and values within the organization.
2. Adheres to the values and rules of the organization
3. Prevents conflicts of interest
4. Treats others with respect
5. Behaves in accordance with the standards and codes of conduct governing the function
6. Raise the issue of compliance of norms, values and manners if necessary
7. Continues to act integer even when seduced to do otherwise
8. Deals careful with confidential information

Leadership

Giving direction and guidance to employees as part of their duties; adapt style and method of management to concerned employee / group of employees and situation.

Behavioral indicators:

1. Distributes responsibilities among team members
2. Gives clear instructions to a group of employees
3. Stimulates individual team members to collaborate
4. Organizes decision-making such that everyone can contribute
5. Neutralizes any friction within the team
6. States clearly the expectations on performance and the results to be achieved
7. Stimulates and coaches the employee in the search to solutions
8. Provides feedback on the performance and achievements
9. If necessary clear instructions are given to the employee on how he/she can achieve the desired result

Making judgements

Data and alternative courses of action are weighed in the context of relevant characteristics and realistic assessments are made.

Behavioral indicators:

1. Makes a judgment based on facts, arguments and considerations.
2. Takes into account all relevant aspects
3. Considers alternatives
4. Involves feasibility and potential impact in the assessment
5. Supports a conclusion or position with arguments

Market focus

Shows to be well informed about market developments and technology.

Behavioral indicators:

1. Have a basic knowledge of the market in which the organization operates (products and services, target audience, key players)
2. Takes actions in order to translate actual needs to new services, products, publicity

3. Acts proactive and innovative with regard to changing market factors

Meticulousness

Work accurately and precisely

Behavioral indicators:

1. Works precise and careful
2. Identifies and corrects defects and inadequacies, even in cases of routine work
3. Complies with the regulations or agreed quality standards
4. Examines regularly the quality of own work

Monitoring progress

Establish and monitor procedures in order to monitor the progress of tasks or activities of employees and to ensure the roles and responsibilities.

Behavioral indicators:

1. Determining benchmarks and milestones on measuring quality and outcomes in advance
2. Check the progress of activities and the quality of the products.
3. Informs all stakeholders on the progress.
4. Signals deviations from the agreements on time and quality.
5. Undertakes timely actions when deviations are likely to occur.

Motivate

Encourages involvement and action from others.

Behavioral indicators:

1. Takes action to make others enthusiastic
2. Shows confidence in others, for example by giving them challenging goals
3. Makes achievements and contributions of others visible
4. Shows appreciation for shown engagement and performance
5. Shows the personal commitment to the organizational goals
6. Sets an example in word and deed

Negotiation

Effectively communicating own views and arguments and discovering and identifying common goals in a way that leads to understanding and acceptance by both parties.

Behavioral indicators:

1. Determines its own boundaries and possible commitments for the negotiation
2. Seek objectives, arguments and underlying interests of his or her partner
3. Gives reasons why proposals of his or her partner are not acceptable
4. Is tenacious in his or her position and carefully with regard to the relationship
5. Actively seeks to win-win situations in the longer term
6. Mentions arguments on the right moment, pressures or relaxes the situation

Networking skills

Developing and maintaining relationships, alliances and coalitions within and outside the organization and use this to obtain information, support and cooperation

Behavioral indicators:

1. Makes and maintains contacts with relevant persons and organizations to the own function
2. Use the network to achieve the objectives of the organization in the right time
3. Approaches the right people for support, cooperation and influence.
4. Interacts with relevant people and organizations
5. Helps people from the network if this is important for its own function or organization, now or later

Organizational sensitivity

Acknowledging impact and consequences of its own decisions or actions in other parts of the organization; Identifying interests of other parts of the organization.

Behavioral indicators:

1. Knows the policies, rules, relationships and interests in the organization.
2. Is aware of relevant developments within the organization and possible partners.
3. Recognizes sensitivities, risks and opportunities and acts accordingly.
4. Takes into account the consequences for the organization in case of decisions and actions
5. Checks with the right people whether there is support

Personal development

Insight into own strengths and weaknesses. On this basis, take actions to increase / improve their own knowledge and skills and thus improve performance. Actively focus on self-development.

Behavioral indicators:

1. Works actively in new material or a work situation
2. Keeps relevant knowledge and skills up to date
3. Is actively seeking for learning experiences
4. Learns from own experience and mistakes
5. Asks for feedback
6. Uses feedback and suggestions from others
7. Implements acquired knowledge, insight and skills in practice
8. Shows insight into their own strengths and weaknesses

Persuasiveness

Using the right style and arguments to try to convince others of a particular point of view and attempt to obtain approval of certain plans, ideas or products.

Behavioral indicators:

1. Uses logical and relevant arguments
2. Adjusts arguments and style to the audience
3. Uses the right arguments in the right moment
4. Bring a proposal or argument with certainty and enthusiasm

Planning and organizing

Effectively determining goals and priorities and point out necessary time, actions and resources to achieve certain goals.

Behavioral indicators:

1. Translates a given purpose or result in activities for themselves or for others
2. Creates a realistic estimate of the time, people and resources needed for the job
3. Keeps in mind the agenda of those involved
4. Bases the schedule if necessary on ongoing processes and developments
5. Ensures that the necessary staff and resources are available at the right time
6. Organizes the work so that it is transferable and reporting is possible

Problem analysis

Identification of problems; Recognizing the important information; making connections between data. Identify possible causes of problems; search for relevant information.

Behavioral indicators:

1. Makes connections between data
2. Indicates the information required for proper imaging
3. Identifies the possible causes of a problem
4. Uses effective methods in order to gather the relevant information

Result driven

Focuses actively on achieving results and objectives and demonstrates a willingness to interfere on disappointing results

Behavioral indicators:

1. Formulates concrete goals
2. Translates goals into concrete agreements
3. Gives a high priority to achieving results
4. Provides the agreed results at the agreed time

Risk awareness

Have sufficient awareness of risks in the area and look objectively at the risks, dangers, solutions and the context (such as company, organization, etc.) thereof.

Behavioral indicators:

1. Is extra vigilant in case of possible imminent risks
2. Ensures fast communication on (new) risk developments
3. Makes a proper assessment of risks and measures to be taken

Sensitivity

Demonstrating awareness of other people and the environment as well as its own influence on it. Shows behavior that testifies to the recognition of the feelings and needs of others.

Behavioral indicators:

1. Takes into account the circumstances of the other

2. Shows understanding for the feelings of others
3. Allow others to prove their value
4. Shows to see the consequences of their own actions on the environment

Social skills

Being amongst others without difficulty. Approaches others easily and mingle comfortably in company.

Behavioral indicators:

1. Goes to others outside the own department if this is desirable for the proper performance of their own job or in the public interest
2. Maintains informal relationships with others inside and / or outside the organization
3. Makes easily contacts in an unfamiliar social environment

Stress resistance

Continue to perform effectively under time pressure, in adversity, disappointment or opposition.

Behavioral indicators:

1. Continues to work controlled and efficiently in difficult conditions such as work and time pressure or risks
2. Remains calm and react calmly in adversity, resistance and criticism
3. Allows for himself clear boundaries at work and time pressure
4. Makes the personal stress for themselves manageable, for example by relativizing

Vision

Distance themselves from daily practice. Developing an image of the future and based on this determining the course of the own function or organizational unit.

Behavioral indicators:

1. Develops a vision of their own field, discipline or organization
2. Translates developments in a future vision for their own field, discipline or organization
3. Sets current issues and developments in a long term perspective

Work interdisciplinary

Within an interdisciplinary collaboration, the disciplines need each other to solve a problem. The mutual influence determines the content. The insights will arise beyond the borders of their own profession. Disciplines overflowed into each other in the artistic end product and are difficult to distinguish.

1. Work with others in an interdisciplinary, intercultural and international professional environment

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Appendix D: Interview protocol

Date:

Location:

Interviewee:

Interviewers:

I. Introduction with explanation for the interview and other students

Dear Sir/Madame,

This interview is presented to you by a group of students from Delft University of Technology, who are conducting a research as a final step of their master award of Construction management and engineering. The questionnaire is a collaborative attempt at collecting more data regarding the general concept of contract management in infrastructure and building environment, and thus to contribute to the body of knowledge regarding this field. The information gathered from your practical experience as contract/project managers is very important in making our research a success and it will be used solely for study purposes and not otherwise.

Graduate Students:

Georgi Vachev

Lisette van Wijngaarden

Marcos Solis

Polina Veleva

Wouter Eitjes

In this interview the focus is on the realization phase. We would like to ask you to answer all questions with this in mind. However, if you can find links within different phases, please elaborate on this.

Broad, general, starting point, practice to

- Background
- Client/ Contractor/ Consultant
 - Educational background
 - How many years of experience? Career path (working experience only in public sector or private as well?)
 - What kind of contracts?
- Innovative contracts: DBFM, DBFO
- Infrastructure/ Building
- Best Value Procurement, Performance measurement

II. General questions on contract management

This set of questions will be general questions on contract management: how it is viewed by the contract manager and what the tasks and responsibilities are.

1. What is contract management to you?
2. What do you think is the main purpose/goal of contract management?
3. How does contract management change when the parameters of projects change?
Parameter: complexity, type of contract, level of risk, repetitive or new projects

4. Which competences of a contract manager are important in the realisation phase? (what exactly he/she thinks his position of a contract manager is)
5. What are the main responsibilities for a contract manager?
6. What are the main difficulties for the contract manager?
What is your first answer?
Do you concur that the main difficulties are:
 - *(what role do you see for the contract manager in)*
 - *Translating the client's objectives/goals/wishes into contract terms*
 - *Dealing with stakeholders*
 - *Change management*
 - *Conflict resolution*
7. What is unique for contract management in the built environment (construction industry)?
8. How does contract management relates to project management?
9. Can you tell us how the other phases (planning/tender) of the contract management lifecycle impact the realization (construction/operation/maintenance) phase?

III. Performance measurement

This part aims at investigating the general concept and drivers for performance measurement as a first step for further elaboration on the topic. First, it will try to get an overall idea of what project success means to different stakeholders and what are the most important criteria they use to measure it.

Q methodology explanation:

A methodology of studying subjectivity by ranking a number of elements.

A distinction between success factors and success criteria should be made and explained.

- Success criteria are: the set of principles, standards or measures used to judge the success or failure of a project” (Korbijn, 2014, p.9)
- While the success factors are: “the set of circumstances, facts, or elements which, when influenced, increase the likelihood of success” (Korbijn, 2014, p.9).

This interview will focus on success criteria.

10. Having in mind the projects who have been involved, what do you think is the most important in measuring your project success?

Additional questions should be asked

- *about the first 3 criteria ranked with most important and least important role*
- *why the neutral criteria are ranked as neutral*
- *how do you think you can influence those criteria (in which project phase?, which are the other stakeholders influencing it)*
- *do you have any criteria missing from the list*

11. What are the current processes/ strategies to use performance measurement in your organization?
12. Does performance measurement have an added value for the project success or for your organization? (define your main drivers for measuring the performance of the contractors or your own organization)
13. In what way does the information you received from the measured performance during the execution of the project (and on its final submission) support your decision-making process on a daily basis and help you steer the project towards a certain direction?

14. What are the difficulties of measuring performance?
15. Who should be involved in the development of performance measurement? Do you think contractors should be engaged in the development of performance measures, as they will oversee their own work? Engaged means they do it themselves, or be part of it?

IV. Relation and Experiences

As contract manager, you are dealing with the different parties of the contract.

16. What do they want to achieve with collaboration, what is the outcome ?
17. How do you ensure/support/create collaboration in contract management? Do you have the tools for this?
18. Do the other parties also share an interest in collaboration?
19. Have you experienced changes in the scope of a contract? Can you tell us some experience?
20. In managing a conflict, what are the most important drivers for decision making?

21. What can be currently improved in management of contracts?
22. What would you like to change about the way contract management is performed at this moment? (swot)

V. Closing of interview

Thank the interviewee for the participation

23. Do you have any final remarks regarding this interview? Something else need to be add on your behalf/perspective?
24. At a later stage, would you be willing to participate in an additional survey/interview?

Appendix E: Results from general interviews

Together with other graduate students from the TU Delft on the topic of contract management, general interviews have been held with contract management experts. The interviewees came from different sections of the infrastructural sector and included contract managers and a contract management department head from Rijkswaterstaat, contract managers from Rijksvastgoedbedrijf, contract managers at the clients' side from consultancies, contract managers from the water authorities and contract managers from the contractors side from two major contractors. In total fourteen interviews have been held. In this section the results from the interviews will be presented and compared to the literature discussed in the previous paragraphs. The topics will consist of contract management (responsibilities and difficulties), competencies, differences between contract management and project management, the influence of the contract lifecycle on contract management in the realisation phase, uniqueness of contract management in the built environment and possible improvements to contract management. Besides this, the comments from project managers and contract managers from a networking event from Rijkswaterstaat are included in this paragraph also. This networking event had as general topic the relation between project manager and contract manager.

E.1 Contract management, responsibilities and difficulties

During the interview one of the questions asked, was "What is contract management to you?" and "What do you see as the main purpose of contract management?". Open questions were used in order to determine what the definition of contract management is according to the interviewees and to test the responses with the literature. The general answer from all interviewees was, that contract management is to make sure that you will get what was promised in the contract. This was the response from contract managers from the client side, as well as from the contractor's side. One of the contractors' contract managers said:

"Contract management is to make sure that we do what the contract is about. So we don't do too much, or too les. It is the management of interpretations of the contract."

One of the main objectives of contract management was seen as:

"aligning the objectives of both parties and safeguarding the interest."

This corresponds with the literature, as a definition of contract management was being the process to ensure that both parties to a contract fully understand their respective obligations and that these are fulfilled as efficiently and effectively as possible to provide the best value for money. However, as literature showed a contract management lifecycle, that included the contract set-up or contract creation, execution and contract close-out, not all contract manager experts agreed on where contract management will start. One said:

"Contract management starts after the tender is done and the contract is signed. It is about managing the contractual relationship between the parties involved, about making sure everyone fulfills their part of the contract, to make the process go smoothly and to make sure the contract is working."

However, another contract management expert said that it starts earlier and also involves the planning phase, as contract management is also about what and how it will be in the contract. One of the experts said that this has changed in the past few years:

“If you had asked me this a couple of years ago, you would probably have received a different answer. Contract management starts at the procurement phase, thus at the exploration of the procurement need. To determine what the network problem is, how to procure it, carry out the contract and to transfer it to the administrator in the region. All contract managers have to oversee the entire process, so that they know what is required in each phase. This is a development that only started 3,5 years ago.”

The main responsibilities is coherent to the purpose of contract management as it entails the interaction between the client and contractor to realize the work, to make the different parties work together in collaboration and to understand the mechanisms involved and to make them work smoothly. It also includes the justification of the payments, amendment process and dealing with subcontractors. A difficult element of contract management is the high administrative level in the last phase, as that is something that doesn't have the focus of the contract manager. Other difficulties mentioned, are the risks involved, poorly written contracts, the tension with the market and when to intervene. At the networking event of Rijkswaterstaat, the general opinion was that the D&C philosophy was 6-7 years ago to leave everything to the contractor and to 'sit on one's hands'. This opinion has changed, as you should be more involved now.

“Big risks are at stake. It is difficult to get to know the thoughts of the other party.”

And:

“I think we are bad at allocating the risks in the first place. This leads to mistakes and flaws in the contract. And when something like this happens, the contract manager has to solve this problem in a way that there is not an escalation.”

Another opinion:

“On the one hand you have to maintain the contractual line, on the other hand you have to make sure you deal with it in a good way and to maintain the right atmosphere. It is difficult to determine when to intervene.”

This last citation shows the tension that will always be there between the client and the provider, but that the relationship between the client and contractor is something that always should be worked on.

E.2 Contract management competencies

The literature study discussed the need for selecting the right person for the job, as competencies can influence project performance, but also team performance. One consultant literally agreed to this by saying that:

“Competencies are important, as the contract manager should be fit for the job.”

The other interviewees did not go into the necessity of competencies, but discussed the necessary competencies for a contract manager. Also with the interviewees, there was a separation between technical skills and soft skills. Everyone agreed to the necessity of soft skills. Competencies were mentioned such as helicopter view or thinking about the bigger picture, analytical thinking, political sensitivity, networking skills, planning and organising, result oriented, communication, being open to people, negotiation and collaboration. However, a discrepancy in answers came on whether the contract manager should have a good technical knowledge or not. Someone who was a supporter of having a technical background said:

“He has to have a good technical knowledge. He does not need to know everything about it but he has to be able to understand the problems. You cannot say if a solution is good or bad if you do not understand it.”

Or:

“What you will see that when contract managers do not have any idea about the content of the project, they tend to be very strict in the letter of applying the contract. If you apply the letter of the contract, you will never solve the problem. The problem should be solved by the people. Experienced people tend to look to what is behind the contract.”

However, another opinion was:

“I don’t think the contract manager needs to have technical background, as it is more important to have a view of the total picture – helicopter view. The soft skills to make the people work are most important. Of course, you have to know what is UAV-GC and what is a road and everything, but even a guy studies philosophy can do contract management.”

E.3 Differences contract management and project management

In the IPM model, a separation has been made in tasks and responsibilities of the contract manager and project manager, while there is no difference in competencies according to the Functiegebouw Rijk and Meetlat from Rijkswaterstaat. In the interview, a question was asked about the differences between contract management and project management. The answers from the interviewees could be placed into two different opinions: those who think there is an actual difference and those who think this is very minute. For example:

“I would say contract management is a part of the project management. In each project it is different. Sometimes the project manager and the contract manager are basically the same person. It depends on the situation – what is the project, how is the organization of the project structured or not. Not all organizations use the IPM model.”

This is of course something that has to be taken into account. Not all organizations use this separation between the project manager and the contract manager as the IPM model does.

Another expert said:

“There is no difference in the construction phase in the Dutch situation. The project manager only comes at the escalation phase. It is hard to differentiate. There is also a tight relation between the manager project control and the contract manager. And everyone should know what is in the contract.”

However, other voices support the differences between the contract manager and project manager.

“There are differences in the integral responsibilities. The project manager is responsible for the entire project and the contract manager for only a part. The project manager is responsible for the external contacts and client, while the contract manager is responsible for the relation with the market, regulation and procurement laws. The project manager needs to make the choices between scope, budget etcetera. This is something you have less as a contract manager. The similarities are that both are responsible for a working team and to obtain the right information. Both are mainly involved in management rather than the details.”

And:

“The project manager is internally and responsible for the escalation process. The contract manager is management the contract on a day to day basis.”

Or:

“The contract manager gets more in the lead when the project becomes closer to the realisation phase. The project manager will probably give a different answer to this. There is a bit of tension there and it is important that the project manager stays involved in the project and receives all the information. Both are process managers, both want to manage it and be the boss. In the end the project manager is the boss, but it is a rather complicated collaboration sometimes. Sometimes the project manager wants to involve himself in the work of the contract manager. This can complicate things as the project manager has a role in the escalation model. If he is already involved, then this is no longer possible.”

Whether the contract manager could become a project manager or the other way around, someone said:

“Once you are a good project manager you can become a contract manager. It is difficult the other way around or even impossible. You have to oversee all the possibilities, escapes, etcetera to become a contract manager. Now a project manager has a more internal role, getting the budget fixed, keeping the organisation representing. The contract manager is more dealing with product and party is executing the party.”

At the networking event of Rijkswaterstaat a theorem was whether contract managers and project managers are exchangeable. This led to a discussion with different opinions as mentioned above. Some said that different competencies are necessary, while others agreed with the last citation, that the contract manager needs more knowledge and that you can grow towards a contract manager, but not replace him.

E.4 Influence of other phases

According to the literature, the activities prior to contract award have a strong impact on the contract management process. Not all interviewees agree to this. Some say that there is no relation as you don't know with whom you are going to deal later on, or that it can even be an advantage if you're not involved in the previous phases, because you will then have a clear view. However, others agree that it has a strong influence:

“I am a supporter of continuity, that you are confronted yourself by the choices you have made in an earlier phase. The contract manager needs to be the same the moment the realization phase starts. The choices you make in the start are of influence on the realization. When the central members are replaced multiple times, you miss the continuity and you will notice that the project will deviate from the initial course.”

And:

“Looking backwards, it was a miss that the contract manager only got involved at a very late stage of the procurement process when all the choices were already made when the contract was close to being signed. At the moment we involve the contract manager in the exploration phase. The knowledge of how things go in the realization phase has certainly an impact at how the contract is formed.”

According to one contract manager:

Generally, the better the contract is prepared, the less problems you have later.”

E.5 Uniqueness of contract management in the built environment

When the question was asked what the uniqueness of contract management in the built environment is, all contract managers agreed: it is set in a unique environment, because of the different clients, surroundings, and people involved. This was also mentioned of being a reason why the construction industry is lacking innovation, as discussed in the literature study.

“Each project is unique and set in a unique environment. Even if you have similar projects but different people working on it, it makes it different. This is one of reasons why we, in the construction business, are so bad at learning and transferring knowledge, Because you have someone who worked on a certain project, then he goes to work on another one, and the knowledge stays with him. Most people are not very much concerned about sharing this knowledge. And this is not only between the different companies because they want to keep their competitive advantage.”

E.6 Possible improvements to contract management

As contract management in the construction sector is a developing field of study, the interviewees were asked where they would see improvements for contract management. The answers to this question were very personal and therefore very diverse. One of the answers that was shared by more interviewees was about risk allocation.

“The risk allocation should be improved. Many risks are borne by the market now, but should be borne by the party that can better bear the risk.”

And:

“Making sure there is a better balance between getting the best risk division – good price and contractor and making sure there will be good collaboration, because now there is a mismatch – you have a competitive procurement phase and then you have to work together. So, you have to make sure the mismatch is not that big.”

Other answers were based on the competencies. According to an expert, there should be more focus on the soft skills and the relational part. A suggestion about forming a baseline for contract management such as there is one for project management was made.

Besides this, one interviewee commented that there should be more invested in the relationships:

“Try to build trust from the beginning. When two personalities of two organisations don’t fit, you have to change this in my point of view.”

Also an additional comment was made on the mandate of the contract manager:

“The contract manager should get more latitude to act on his own insight. There should be more continuity in contract management, so set the same contract manager on the project for a longer time. There should be looked into that, how to ensure it. This might be better for the project.”

Another comment was on the implementation of contract management in the organisation. Rijkswaterstaat has implemented contract management with the IPM model for almost ten years. However, at the Rijksvastgoedbedrijf, there is no department for contract managers, but they are flown in from different parts of the organisation. Voices rose on creating a new department for contract management at the Rijksvastgoedbedrijf.

Appendix F: Case study protocol

F.1 Background

Research into the competencies of contract managers is lacking. There has been a lot of research done into the competencies of the project managers. These researches show that competencies such as communication, collaboration, leadership and negotiation are important competencies. For the competencies of the contract manager, information from Rijkswaterstaat is used. These documents mention competencies as planning and organizing, networking, integrity and result driven are important.

This case study will be used to provide an answer to the following main research question: “What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase of Rijkswaterstaat in the Netherlands?”

The main research is divided into the following six sub questions:

- What is good contract management in construction projects?
- What is the role of the contract manager in construction projects within the IPM model?
- Which competencies are being asked from a contract manager within the IPM model in the realization phase?
- What are the challenges for a contract manager that come with a Design and Construct contract within the IPM model at Rijkswaterstaat?
- In what way does the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?
- What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract?

F.2 Design

A multiple-case design will be used, since the unit of analysis will be a project and there are many different projects at Rijkswaterstaat, from which a few will be selected. As the unit of analysis is a project in each case, it is a holistic design. This is chosen, as the contract manager and project manager of each case (of both there is one per project) will be interviewed for their opinions.

The object of study are the necessary competencies for the contract manager in a D&C contract at Rijkswaterstaat.

A few propositions are:

- There is much overlap in the competencies of the contract manager and project manager
- The competencies asked by Rijkswaterstaat are outdated and insufficient
- There is no clear set of competencies
- There is no distinction between critical and non-critical competencies

F.3 Case selection

The criteria for case selection follow from the main research question and sub questions. The follow criteria are maintained:

The case should be a project:

- Within Rijkswaterstaat

- With a Design and Construct project
- From the department GPO (Grote Projecten en Onderhoud)
- Currently in the realisation phase
- With contract managers and project managers from the GPO department at Rijkswaterstaat

F.4 Data collection

The data for analysis will be the answers provided in the interviews. Interviews will be held with the contract managers and project managers of each selected project. The interviews will be recorded (with the permission of the interviewee) and will be transcribed. The data will be stored through keeping the original recordings and the transcriptions of the interviews.

F.5 Analysis

In order to interpret the case study findings it is necessary that terms are mentioned during the interviews and not only descriptions of competencies. This is the case as Atlas TI will be used to analyse the results, for which codings and terms are essential. When only descriptions are mentioned during the interviews, this has to be rewritten within the transcription.

Questions will be asked about the necessary competencies for the contract manager, on the differences and overlap in the tasks and competencies of the contract manager and project manager, on the currently asked competencies by Rijkswaterstaat and on good contract management.

The following outcomes are possible: (1) extra competencies are mentioned by the contract or project managers and they contract and project managers agree on the competencies identified in the literature. (2) the contract managers and project managers only mention the competencies they (think they) possess themselves and that these competencies are the only important ones. (3) Every manager mentions a different set of competencies and no consensus can be reached on the necessary competencies. (4) no clear set of competencies is necessary according to the contract managers and project managers.

F.6 Plan validity

In order to check the plan validity, the checklist of Höst en Runeson (2007) below is used.

Table F.1: Case study design checklist. Source: Runeson and Höst (2008).

Case study design checklist items
1. What is the case and its units of analysis?
2. Are clear objectives, preliminary research questions, hypotheses (if any) defined in advance?
3. Is the theoretical basis—relation to existing literature or other cases—defined?
4. Are the authors' intentions with the research made clear?
5. Is the case adequately defined (size, domain, process, subjects...)?
6. Is a cause–effect relation under study? If yes, is it possible to distinguish the cause from other factors using the proposed design?
7. Does the design involve data from multiple sources (data triangulation), using multiple methods (method triangulation)?
8. Is there a rationale behind the selection of subjects, roles, artifacts, viewpoints, etc.?
9. Is the specified case relevant to validly address the research questions (construct validity)?
10. Is the integrity of individuals/organizations taken into account?

In order to have construct validity, multiple sources are used: the contract manager of the project will be interviewed in each case, as well as the project manager. Also experts on competencies and the

IPM model within Rijkswaterstaat will be interviewed, such as the HRM department as well as Freek Wermer.

For this research, cases are selected that represent the projects of Rijkswaterstaat with a Design and Construct contract that are in the realization phase. The findings in this research can be generalized for other projects with the same criteria. In a survey that is part of this research, the results will be validated and checked for other criteria, such as different organisations, other contract types and phases of the project.

F.7 Results

The results of this case study will be used to form a conceptual model, together with the results of the literature study and will be used as input for a survey. This survey will be held through the whole GPO department and other departments and organizations. The results of the case study will be reported in a document, together with the transcriptions of the interviews.

F.8 Schedule

Schedule of case study, involving planning, data collection, analysis and reporting

Table F.2: planning

Week starting date	Element
14 November	Get feedback on interview protocol and questions
14 November	Make appointments for interviews
28 November – 12 December	Interviews, data collection
12 December – 26 December	Analysis of data from interviews & writing relevant sections

F.9 References

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Appendix G: Interview protocol contractmanager

I. Introductie (15 minuten)

Doel: kennismaking en richting geven aan interview. Daarnaast eventueel vragen naar achtergrondinformatie

- Voorstellen
 - Toestemming vragen voor opname, uitleg hoe interview zal worden behandeld
 - Uitleg over het onderzoek en het doel van het interview
 - Achtergrond van geïnterviewde *indien niet bekend*
 - Welke opleiding heeft u genoten?
 - Hoeveel jaar bent u werkzaam bij Rijkswaterstaat?
 - Welke functies heeft u gehad voordat u in de rol van contractmanager terecht kwam?
1. Kunt u kort een toelichting geven over het huidige project waar u mee bezig bent? Wat is het verloop? Zijn er bijzonderheden?

II. Rol en taken van de contractmanager/projectmanager (25 minuten)

Doel: inzicht krijgen in benodigde competenties bij projecten in de realisatiefase met een D&C contract en het benoemen van de outputindicatoren van contractmanagement

2. Er is een uitgebreide taakomschrijving beschikbaar vanuit Rijkswaterstaat, maar wat ziet u als uw dagelijkse werkzaamheden als contractmanager/ bij DIT project in de realisatiefase? Zijn deze taken afhankelijk van de subfasen (opstart, uitvoering, close-out)?
3. Welke competenties heeft u nodig voor deze werkzaamheden? En bij welke subfase horen deze?
4. Waren deze competenties specifiek voor dit project of gelden deze voor elk project?
5. Zijn er problemen geweest in het project waarbij u een extra beroep heeft moeten doen op bepaalde competenties? Zo ja, welke?
6. Welke taken kunt alleen u als contractmanager uitvoeren? *Onderbouwen*
7. De competenties die u hiervoor genoemd heeft, zijn uiteraard nodig voor het op een juiste manier uitvoeren van contractmanagement. Wanneer is contract management op een goede manier uitgevoerd?
8. Welke vervolgoopleidingen of trainingen zijn nodig om een goede contractmanager te worden?
9. In welke competenties zouden contractmanagers nog getraind moeten worden?
10. Welke competenties zijn specifiek voor een D&C contract, ten opzichte van een DBFM of traditioneel contract?

III. Het IPM model en de structuur bij Rijkswaterstaat (25 minuten)

Doel: achterhalen of er bij de implementatie van IPM gekeken is naar competenties en het effect op de competenties van de rollen contractmanagement ten opzichte van projectmanagement

11. Enkele jaren geleden is het IPM model geïmplementeerd bij Rijkswaterstaat. Hoe werden de IPM rolhouders verdeeld? Werden hier verschillende competenties voor gevraagd?
12. Hoe heeft u de implementatie van het IPM model ervaren?
13. Kunt u aangeven waar de rollen van Projectmanager en Contractmanager bij Rijkswaterstaat overlappen? (indien nog niet goed beantwoord, anders naar vraag 12)
- a. Waar ziet u verschillen?

- b. Welke gevolgen heeft dit voor de competenties van beide rollen?
14. De rollen van projectmanager en contractmanager vallen binnen Rijkswaterstaat in dezelfde functiefamilie en hebben dezelfde basiscompetenties. Hoe denkt u hierover? Is een scheiding noodzakelijk? (eventueel meetlat voorleggen)
15. In mijn literatuuronderzoek heb ik de gevraagde competenties van Rijkswaterstaat vergeleken met diegene die in wetenschappelijk onderzoek zijn gevonden. Kunt u van de volgende competenties aangeven in hoeverre u deze als competentie bij het huidige project ziet? *Lijst uit literatuuronderzoek voorleggen en onderbouwing vragen*
16. Zijn er nog competenties die bij deze lijst ontbreken?

IV. Afsluiting (5 minuten)

- Uitwerking ter validatie sturen
- Vertrouwelijkheid garanderen
- Eventuele aanvullende vragen per email?
- Meewerken aan vervolvenquête
- Interesse in eindrapport?
- Bedanken

Bijlage

Resultaat competenties volgens literatuuronderzoek

Appendix H: Case study results

This section will discuss the results from the interviews with the contract managers and project managers of each individual case. The results of the problems of the cases will be discussed, followed by the tasks and responsibilities of the contract manager and project manager, the necessary competencies and additional competencies necessary especially for this project, the differences between the contract manager and project manager, differences in contract management between D&C contracts on the one hand and DBFM and RAW contracts on the other hand, the criteria for properly conducted contract management and their views on the necessary competencies for the contract manager and project manager.

H.1 Case 1

The first case is an infrastructural project that is currently for three years in the realization phase and as it was one of the selection criteria, has a Design and Construct contract. The project is expected to be realized in 2018. The contractor is a combination of multiple contractors and Rijkswaterstaat is the executing party for the client consisting of the government, province and municipality. The budget for the project is between 100 and 200 million euros.

H.1.1 General description of the project and problems

Even before the planning study phase finished, Rijkswaterstaat started with the selection of an executive party. In 2012 the decision was made to apply Best Value Procurement to the project. With the contracting party, Rijkswaterstaat went through the pre-award phase from the Best Value Procurement. This allowed Rijkswaterstaat to have ample time to discuss the proposal of the contractor with them. This has led to one of the problems that this project has. As the procurement phase ran at the height of the economic crisis in the Netherlands, the tenderer decided to make a minimal financial proposal. Even though EMAT was used, the financial terms remain crucial. A firm conversation was held about this topic with the management of Rijkswaterstaat and the management of the contractor's combination. Then it should not become a problem, but the IPM team knew that it was not ideally. According to the project manager, the contractor is doing his job well, but when there is a change there is a lot of discussion on the price. This had also its effect on two other problems that occurred in the project. The first was that the area that had to be investigated for explosive devices had become larger due to regulations and that the type of ammunition was expected differently, making it necessary to use a different research approach. The costs for the larger area and different research technique were way too high, according to the contract manager. This conflict continued for two to three years within the project. Finally, a settlement agreement was made in which the costs were determined with the help of a committee. The other issue concerned the issue of licences, as the quality team of the municipality did not agree with the planned sound barriers and the municipality did not want to disregard this recommendation, which is very odd as the municipality was involved in the plans for the infrastructural project. Eventually the municipality disregarded the recommendation of the quality team and issued the license. This issue led to delays of certain aspects of the project and to extra costs.

The project is a complex project as it is realized within a dense area with highway junctions, railroads and large municipalities. The IPM team has seen some changes as the contract manager is changed a year ago and the project manager last year. This means neither of them were involved in the project start-up. In the collaboration with the contractor there are some issues, but as this is a Best Value project, the contract manager has to trust the contractor to manage the risks and to manage the contract from a distance. The project manager pointed out that besides the issues, the contractor continues with the project and that they can trust him to do a qualitatively good job. The downside is

that the contractor is lacking environmental awareness and is not aware to what is really important for the client.

H.1.2 Tasks and responsibilities of the contract manager and corresponding competencies

Both the contract manager as well as the project manager were asked about the tasks and responsibilities of the contract manager within this project in the realization phase. The contract manager pointed out that he is called “the manager of all changes” as he has to implement change on time, he is responsible for correct and timely payments and the process of system-based contracting (SCB). Also he has to make sure that “hassle is timely crushed”. He sees hassle as something that in general leads to changes or is about the prevention of a change. The project manager agreed to this by mentioning the process of amendment requests (in Dutch: “verzoek tot wijziging”, abb. “VTW”), being able to make analyses on different levels of abstraction and switch between these levels and knowing when to involve the other IPM roles.

When they were asked which competencies were necessary for these tasks, both of them mentioned the competence of being meticulous. The contract manager has to be very precise, read carefully, to check what is the situation and to check this with the contract. The contract manager needs to have an eye for detail, to be precise and meticulous. The project manager added that the contract manager should work fairly structured. The competency meticulously was not mentioned in the conceptual model, but is similar to accuracy. Therefore this will be viewed as the same competency.

The contract manager as well as the project manager mentioned the management drives. They value it very much to know which colors each person is, in order to understand why people display certain behavior. Especially the project manager found this a very useful tool, as well as other tools such as the Belbin team roles and the enneagram. The project manager explained that the contract manager should have the color blue, to create certainty and to be successful in planning and organizing. The project manager should be green to connect people, but this project manager was also orange and red, leading to results and fast actions. The contract manager agreed to the necessity of being a blue person as a contract manager.

H.1.3 Tasks and responsibilities of the project manager and corresponding competencies

The project manager was asked about his or her tasks within this project. The first answer was being a jack of all trades. When everything runs smoothly, the job is very simple, unless the project manager wants to be involved in everything. The main task is being the sparring partner of the other IPM roles. Another main task is being the link between the IPM team and the (internal) client, to provide all parties with information. Within the team, the project manager has to connect the roles and keep everyone aboard. To be able to connect everyone, the project manager needs to have information himself and be aware of the major things happening in the project like the process of amendment requests. In case of issues with the contractor, the project manager will be involved as part of the escalation line.

The competencies necessary for these tasks and responsibilities are collaboration, acting innovative to be able to tackle problems, creativity, switching which can be seen as adaptability and unifying leadership. This last competency is an overarching term for leadership, team coaching/building, helicopter view and vision. As all these competencies are included in the results of the literature review, this competency will be split into the aforementioned four (Reynaarde Talentontwikkeling, n.d.). The competency of acting innovative is used for the way to tackle the problem. First the project manager will scan the situation and determines the amount of time for a decision: does it need to be in days, weeks, or even months. Then the right people need to be involved. The project manager needs to scan, analyze and assess continuously what is happening.

H.1.4 Competencies specific for this project

The contract manager and project manager were asked which competencies were specific for this project, compared to others and what made this project unique in terms of competencies. For the contract manager, the competency specific for this project was persuasiveness. Some moments in the project the contract manager has to say: stop it, we are going to do it this way, this is the approach and this is how we are going to proceed. That is persuasiveness. This competency is necessary to get long-standing issues from the table. This will continue until you say how to proceed. Another competency was tenacity or perseverance. You have to do it together until the end of the project. Some issues and changes are difficult, but you cannot stop working on it, you have to continue.

The project manager explained the choice of the client for the project manager, as this project manager is very strong in the collaboration with the contractor, the political/governance sensitivity with the municipality. This project needed someone who is very strong in these competencies. Other important competencies are having a helicopter view, process management and binding people, as this project is not technological complex, but is complex in people management and environmental awareness.

H.1.5 Differences and overlaps between the contract manager and the project manager

A part of the interview entailed the differences and overlap between the contract manager and project manager. The project manager and contract manager agreed that they both have an own line with the internal client. For the contract manager this line runs through him to the market, the line from the internal client runs through the project manager towards the project (team). They also stand together when issues with the contractor arise. However the contract manager is the first contact point to the contractor. If this was not the case, this would give distortions. Both managers also have their own team: for the contract manager this team consists of a manager procurement, someone responsible for amendment requests, someone responsible for the SCB process and a lawyer. These are all advisors. The team of the project manager is the IPM team.

Differences lie in their tasks and responsibilities. As the contract manager is the first contact point for the contractor, he needs to know the contract in detail. If the contractor says something, the contract manager can check the specific section of the contract which entails the issue. The project manager is responsible for the team and has to make sure that the team functions efficiently. To translate this to competencies: the project manager needs a much better helicopter view, more social skills, more organizational and governance sensitivity and a better leader, while the contract manager needs to be meticulous, market oriented and cost aware.

H.1.6 Interchangeability of the contract manager and project manager

The overlap between the contract manager and project manager leads to the question whether the roles of the contract manager and project manager are interchangeable. On this topic the project manager and contract manager differed in opinion: the contract manager thinks that some project managers can take over the role of the contract manager as they have the skills and knowledge for it. They all are experienced technicians who have done sufficient projects. However, the contract manager does not want the project manager meddling in his work and thinks that the roles are interchangeable for just one direction.

The project manager points out that they might come a long way in fulfilling the others tasks as the roles of the project manager and contract manager are the closest to each other from the five roles, but that they both would not be happy in those roles and that the project manager should not be put in the role of the contract manager

Besides interchangeability, it might be that the roles need a clearer distinction. In this, the contract manager and project manager also differ. The project manager says that a clearer distinction is not necessary, as in practice one looks at the skills and competencies of the manager for the job. Then it would show that the project manager does not get any enjoyment out of the role of the contract manager. The contract manager says that a clearer distinction is necessary, as the contract manager should have more patience and meticulousness for the tasks, while the project manager wants to see the overall picture.

H.1.7 Differences in D&C contracts compared to DBFM and RAW

On the question whether D&C contracts differ from DBFM and RAW contract in terms of competencies, the contract manager points out that a DBFM contract is much more juridical than a D&C contract. According to the project manager, the main difference lies in the duration of the contract, as a D&C project is handed over to the own management organization, while a DBFM project remains an incident on the network for more than 25 years. This does not mean that you have to anticipate more in DBFM contracts than in D&C contracts, as in a D&C contract you also have to anticipate on certain effects. RAW contracts are seen as much more technical by the contract manager, because in case of different amounts there will already be a contract change. The type of contract does create certain basis conditions, but in each contract type you have to work with the individuals and teams.

H.1.8 Criteria for properly conducted contract management

The contract manager and project manager were asked which criteria they think determine whether the contract manager has done his tasks well. The contract manager mentioned all amendment requests being handled or the amount of requests still in the process, all payments going correctly and a functioning SCB process, no more unsolved contract issues and the project being within time.

The project manager mentioned the same criteria – all amendment requests being handles, legal payments and no more unsolved issues – but added the satisfaction of the client and of the contractor. The contractor should have gotten a fair price and a reasonable contracting party. The contract manger should find the balance between responsibility, legality and efficacy, the social purpose and the costs. Besides from this, the project manager added not to try to quantify it too much, but to look at it from a qualitative point of view.

H.1.9 List of competencies and competency training

Each interviewee was asked for their opinion on the necessity of the competency in their role as contract manager or project manager in this specific project within the realization phase. In this section the explanations of certain answers worth mentioning will be provided. According to the contract manager, acting innovative is very suitable for the contract manager as the real innovations are within the building process and to see how things could go differently in terms of tickling market parties for innovations. The contract manager does not have to be very binding, as the contract manager can allow himself to focus on his own part. Communication is a competency that is very focused on the meticulousness of communication. This should be very detailed. Decisiveness is not important for the contract manager as he has no mandate to operate in. All decisions will be made by the project manager. Environmental awareness is important as the contract manager should know where the interests lay. Flexibility is a competency that is semi-important for the contract manager, as he should be able to have a flexible attitude, but not all of the time. Helicopter view is also semi-important as the contract manager should have an overview, but on a smaller area than the project manager. Process monitoring is important for the contract control. Negotiation is important for the contract manager in his relation with the market parties. Personal development is a competency that everyone should have in order to grow and to perform better. Project administration is not an important competency for the

contract manager, but he suffers most from a bad project administration. Therefore he should be aware of it and also to know where to find certain documentation. Social skills are semi-important, since the contract manager can allow himself to be in a bad mood from time to time. Working interdisciplinary is very important because he has to be able to work with the technical and environment manager for the effects of certain changes. The contract manager added the competency of meticulousness to the list, as the contract manager should be very focused on details.

Some competencies will need training to be able to function properly as contract manager. These competencies are negotiation and networking skills. Other courses to be followed should be conflict management and a general contract management course.

For the project manager, acting innovative is very important, to see what is happening and to act accordingly and within the right time frame. Cost awareness is very important, but this is the case for all IPM role keepers. Creativity is a competency related to acting innovative. You need both to deal with crisis situations. Integrity is very important, because when you don't stand strong to temptations, you will be lost. Market-oriented is a competency that the project manager should have, but that is far more important to the contract manager. Process monitoring is important on a certain level of abstraction to see what is happening and what the effects are for others. On a detailed level this is more important to the manager project control. Motivation is very important for team building and to get everyone along. Personal development is important as you need to look at yourself after certain issues and to reflect if you acted in the right way. Problem analysis is very important as you are continuously assessing whether a problem arises or not. Being servicing is important towards the other IPM role members to see if the project manager can help them in any way.

The project manager did not point out certain competencies for training, but had the opinion that the culture for personal development is very important. As a project manager it is more important to learn to assess situations from different viewpoints than to train specific competencies.

H.2 Case 2

The project of case two involves a so-called wet renovation project with a D&C contract. The contract sum is around 100 million euros, the project is in the realisation phase for over a year and contractor is a combination of contractors with different disciplines.

H.2.1 General description of the project and problems

The main contractor is a party which main operations are not in the infrastructural sector. This is a difficult situation, as they do not have any knowledge on steel or dredging. When problems arise, the design has to be changed, but steering is difficult as they procure these tasks. This has the effect that the planning has to shift every time, which is difficult for the contractor. However, the contract manager points out that this makes the project fun for him. Also the different main sectors of the contractors lead to cultural differences among the consortium partners. This project lacks certain area knowledge at Rijkswaterstaat; the knowledge has left the organisation with the reorganisation, because nothing was put on paper. The organisation tries to diminish that by maintaining elements their selves and by allocating the risks to the party who is best able of managing them. Some risks are tendered with the use of EMAT. The contractor scored highly on these elements, but they try to back out of it now, as they see that the promises made will cost a lot of money. The main contractor is very financially driven, as well are they project manager and director of the main contractor. This makes the collaboration a bit clouded.

Some time ago there was an issue between the IPM team and the main contractor. A major change had to be implemented and it was discussed what was necessary in order to do this, as well as the

financial consequences. This was difficult for the main contractor because they are financially driven. Because of this, the main contractor had implemented the work in their planning, but did not share this to the contract manager of Rijkswaterstaat. This brought difficulties to the contract manager, because he could not see whether the contractor was behind on schedule and could therefore not legalise the payments. Another difficulty for the contract manager and project manager lies in the structure of the project team of the main contractor. They did not want to mirror the IPM model for cost reasons – while most of the contractors from the infrastructural sector do – leaving the contract manager out of the project team of the contractor. This provides an escalation problem, because the Rijkswaterstaat contract manager’s counterpart is the same as the project manager’s counterpart from Rijkswaterstaat. The complexity of this project therefore lies in the collaboration with the contractor and the surroundings of the project. It is a renovation project and the project manager made the following analogy: you have to replace elements of the car while it is driving. That is a different situation than the construction of a new infrastructural work.

H.2.2 Tasks and responsibilities of the contract manager and corresponding competencies

According to the contract manager, the main responsibility is knowing when to intervene and when to let the contractor proceed with something that might go wrong. The contract manager quoted professor Ron Weele, by saying “Contract management is 90% people management and 10% money.” As a contract manager one should manage the project by managing the agreements within the contract, the interaction between the technical manager (TM) and contractor and contract and contractor. Because of the lack of area knowledge and the fact that it is a renovation project, the project team and contractors are often confronted with a situation a little bit different than they expected. The contract manager checks whether the risks are properly managed by the contractor and whether the quality systems of the contractor are in order. The contract manager has to perform tests and has to attach consequences to this. The project manager agrees with these tasks, but elaborates more on the topic. According to the project manager, the contract manager is the primary point of contact for the contractor and can be seen as “THE guy from Rijkswaterstaat”. The contract manager is responsible for the execution of the contract by the contractor and has to control the contract. The contract manager has to implement changes in the contract – the process of amendment requirements – and to anticipate on deviations. The contract manager has to do project and contract consultations and perform tests and report towards the project manager. The point of view from the project manager is that these tasks are specific for the contract manager and cannot or should not be done by someone else.

According to the contract manager, the main competencies necessary for the tasks and responsibilities mentioned above are collaborating with different parties and to be able to approach parties differently and to switch between these approaches. The project manager mentions different competencies for the tasks of the contract manager: behave businesslike, negotiation and result driven.

The project manager also discussed the management drives and pointed out that the contract manager should be very blue. The more blue, the better for the project. The contract manager should also with blue behavior towards the other members of the IPM team. When you have multiple colors as a person makes it harder for you and for your team, as you will start meddling with many things by thinking and talking about it, while those tasks are the responsibility of another IPM role.

H.2.3 Tasks and responsibilities of the project manager and corresponding competencies

The tasks and responsibilities of the project manager are broader and related to the IPM team: the project manager is the daily leader of the IPM team. Therefore he has to create good collaboration within the team, to determine the right path together with the other members and formulate agreement who does what. The project needs to be divided in to smaller workable pieces by the project

manager and he has to see the end result very clearly and what is less important. He supports the contract manager when issues occur with the contractor but also ensures good collaboration with the contractor. The project manager needs to anticipate things, listen carefully and to act timely. The project manager will talk about facts and needs to be persuasive in order to determine the right path together. The project manager also manages the larger risks of the project. When everything goes according to plan, the project manager has easy tasks. He is more about the process and the collaboration. The contract manager agrees to this as he states that the project manager is more about steering the project.

Competencies that are mentioned together with these tasks and responsibilities are being result driven, knowing how to motivate people and have organizational and environmental sensitivity. Other competencies are communication, leadership, persuasiveness and decisiveness. Process management is a competency mentioned by the project manager that was not included in the conceptual model yet. According to the project manager this is a very important competency as not only the result is important, but also the way to get there.

H.2.4 Competencies specific for this project

Managing the collaboration with the contractor is different in this project, because the contractor handles it differently than others. The contract manager and project manager are not eager to send letters with notices of default, but the attitude of the contractor asks for a different approach. The contract manager did this by sending a negative review. A negative review will affect the chances of the contractor in a new procurement. This was handled by the contractor on the management board level, because they did not want this negative effect. The contractors' project team was ordered to improve the collaboration for a better review in the next quarter. The contractor started acting more indulgent after this. This is a different approach for the contract manager.

Another element that is specific for this project, is the lacking of the contract management counterpart at the contractors side. Because of this, the project managers' counterpart is the same as that of the contract manager from Rijkswaterstaat. This causes problems in the escalation line of the project, because when the contract manager is having issues with the contractor, the project manager has to deal with the same person. There is no escalation opportunities. Therefore the IPM team determined that the project manager won't be present in meetings between the contract manager and the counterpart from the contractor, but that the contract manager and the project manager will discuss possible issues before the meetings between the contractor and the contract manager.

The contractor is behaving businesslike, making it necessary for the IPM team to behave more businesslike than they are used to. Also the ability to negotiate is much more present in this project according to the project manager. One should not be conflict-avoidant and should be able to make a distinction between the business and the person who you are dealing with. These elements can be translated into the competencies entrepreneurship and negotiation. Not being conflict-avoidant means that you want to stand for what you want and to get that. This can be seen as persuasiveness. Being able to make a distinction between being businesslike and not to discharge it on the person itself is some sort of professionalism. This is placed under this competency.

According to the contract manager, he tries not to act differently than in other projects. However, in this project this are often a little bit different than expected, leading to necessary changes. This can be translated into flexibility. Because of the missing counterpart, the contract manager and project manager need to communicate much more than in other projects. Also understanding of organizational sensitivity is much more present.

H.2.5 Differences and overlaps between the contract manager and the project manager

The project manager and contract manager share the opinion that their roles share some overlap. According to the contract manager, all IPM roles need to be approachable, need to collaborate, to motivate and to be open to one another. Also there is overlap in the interaction with the contractor, as the counterpart is missing and the project manager and contract manager discuss how to proceed. This is confirmed by the project manager, who states that the direction has to be determined together. Also every team member is a manager giving them the same necessary competencies as a basis.

However, there are also differences to be distinguished between the project manager and the contract manager. According to the last one, the contract manager is leading in the meetings with the contractor. The contract manager also has the tendency to dive more into the content while the project manager keeps a helicopter view. The contract manager needs to have more technological knowledge content wise and looks whether the planning is realistic, if the risks are managed properly and if enough equipment is deployed. Also the project manager needs to have more organizational sensitivity, as he has more external contacts than the contract manager.

The project manager agrees completely with the contract manager, as he has responded that the contract manager is THE guy from Rijkswaterstaat and has daily contact with the contractor, the contract manager is more into the content, tests whether everything complies to the contract or that changes are necessary. The competency helicopter view is of much more importance to the project manager. He adds that the project manager is more involved in the process and collaboration and he is the only one who can steer everything from his role. The process management asks for something different than contract control and negotiation is a competency primary for the contract manager. However this does not mean that the project manager does not need to have this competency. Environmental sensitivity is of the utmost importance for the project manager, while for the contract manager it is not very important. SCB meetings are part of the contract manager, but the direct line from the client to the market through the contract manager is not very convenient for the project manager. He thinks that he should be involved in all meetings with the client, because otherwise decisions are made of which he does not have any knowledge.

H.2.6 Interchangeability of the contract manager and project manager

According to the contract manager, he performs quality and performance tests on the contractor. The project manager is not able to directly perform these tests, as he does not know the system behind these tests. The contract manager is able to predict the results of the test before the test is performed. However, there are people who are contract manager on one project and a project manager on the next. Those people are interchangeable between the roles. This supports the opinion of Rijkswaterstaat that states that the roles are interchangeable, according to the contract manager. He agrees to the fact that there is currently a lack of distinction between the two roles and both roles have the function title of project leader. One minor difference is the need for different competencies for the project manager. As he has more external contacts, more organizational sensitivity is necessary.

The project manager has a different opinion. The interchangeability is present, as the contract manager has the tendency to take over the roles of the technical manager, the project manager or the manager project control. This varies with the type of contract manager. A more clear distinction would be necessary, as competencies differ. The contract manager has more businesslike behavior and more negotiation skills. The contract manager needs to have content knowledge of the contract to see if all elements comply while the project manager needs to have process management skills and is more into the collaboration. When a clearer distinction is made, the line from the client should always go through the project manager and the contract manager should be included when meetings are about SCB. The steering lines need to be very clear. This is more easy to work with for all parties.

H.2.7 Differences in D&C contracts compared to DBFM and RAW

The DBFM contract is a difficult concept according to the project manager. It took some time before the benefits were clear. It is a contract type for which not all contract manager as suited. A training program is necessary as well as a certain level of abstract thinking. The competencies do not differ much, only the level of the necessary competencies. You have to anticipate better, steer more on the process and the financial aspect is far more complex. This contract type leads towards a service instead of a product. This leads to a different judgement of the contractor and asks for higher requirements to the skills.

According to the contract manager, you need to keep distance to the project in both contract types, which is most difficult for the technical managers as they want to be involved and come up with solutions. However, the distance is further in DBFM contracts. In those contract types, the focus is more on the system of system engineering and verification, while D&C contracts are more focused on the content. The contract manager has the opinion that a DBFM contract is not that beneficial, as it can be seen as buying on credit. The trend is that the F is diminishing and the contract will be transformed towards a DBM contract.

The differences between RAW and D&C lay in the fact that the D&C contract has a higher level of abstraction than RAW. In D&C the contractor is tested for its solutions through SCB, while in RAW the amounts of materials are correct. Therefore the level of abstraction runs from RAW as it has the lowest level through D&C to DBFM.

H.2.8 Criteria for properly conducted contract management

The contract manager and project manager of this case were very clear on the criteria for properly conducted contract management by the contract manager: he should make sure no one is surprised by something. The project manager explained that this means that you have to see deviations beforehand and act to it. Other criteria according to the project manager are a properly functioning process of amendment requests and SCB process.

H.2.9 List of competencies and competency training

According to the contract manager, acting innovative is not important, since the project is in the realization phase and no new things have to be developed. The contract is signed and is the starting point to steer on the contract. Acting innovative would be suitable in the contracting phase. Being approachable should count for every IPM role member. Binding is a very woolly competency, but it should be present to connect technical manager, the risk manager and planner together as contract manager. Collaboration is something that is embedded within the genes. Communication depends on the type of communication: towards third parties it is a competency for the environmental manager. However the contract manager has to communicate within the team and towards the contractor, so it is a very important one. Creativity is not necessary, as the contract manager follows the contract. Agreement is agreement and not creativity. The contract manager should have more decisiveness than the project manager as you have to make decisions fast and not stay awake at night about it. Helicopter view is semi-important, as the contract manager has the tendency to dive into the content, while sometimes you have to get an overview to see the issues and effects. It is also important for the project manager to have the helicopter view competency and to raise the awareness of the contract manager when the contract manager dives too much into the content. Independency has lost its importance due to the collaboration function of the IPM model. This used to be more before the IPM model was implemented. Market orientation is less present in the realization phase as an contractor has already be contracted. Negotiation is very important and is also something that should be trained by the contract managers, next to a masterclass contract management. Personal development is something

that everyone should do, but which is independent from being in a project. Sensitivity is something that men are not good at and is therefore not a necessary competency according to the contract manager. Stress resistance is very important, without it you cannot function. Vision is not important as the contract manager knows what to do, this is regulated. Risk awareness is also something that is embedded in the genes.

To the project manager acting innovative is a less important competency. Analytical thinking is much more important to get to the essence of a problem. Binding people is one of the core competencies of the project manager to enhance collaboration and therefore very important. Everyone should be cost aware according to the head engineering director, but is not a primary competency for the project manager. Entrepreneurship is a difficult competency, as seizing opportunity could be beneficial for the project, but also has a change of going wrong. However without entrepreneurship no innovation. Flexibility is important in order to move along with the projects as they are subjects to change. Helicopter view is important to stand above the matter and is more important to the project manager than to other roles. Market oriented is not important in the realization phase and not to the project manager. Monitoring progress is not a necessary competency for the project manager as he will receive this information from other roles. Negotiation is much more important for the contract manager than the project manager. Being open is connected to trust: you have to be open in order for people to trust you. Therefore it is an important competency. Stress resistance is important as otherwise you would not be able to enjoy your work.

H.3 Case 3

Case three is an infrastructural project that is in the realisation phase for almost a year. The project is executed by Rijkswaterstaat on behalf of the government, province and municipality. The contract sum is above 300 million euros and is contracted by a contractors combination. Due to a packed agenda, the project manager of this project is not interviewed. This case will therefore only contain the opinions of the two contract managers who are involved in this project.

H.3.1 General description of the project and problems

The project is a very complex project in a dense environment, where in temporary construction situations the roads almost go through the living rooms of the local residents, so to speak. That is quite radically. The project is executed by Rijkswaterstaat on behalf of three governmental authorities as mentioned before. These three parties need to form an unequivocal picture. This asks for many meetings and answering questions of a management consult or steering group, in order to communicate a clear plan to the involved parties. This needs to be done early in the project, even though the project has not been in the realization phase for long time. Besides this, it adds political complexity to the project.

Despite the early point in the realization phase, issues have risen with the contractor, as the tendered contractor has the strong opinion that what he has offered, will also be the final result. However, in the opinion of the contract managers, the agreement was based on an offer with minimal requirements, an EMAT review and the opportunity to offer added value. This package is the contractual obligation of the contractor. When the contractor has made some initial assumption and processed this in his offer, but that would lead to a breach of contract, the contract managers will hold him responsible for it. In this situation it is very important to agree on a joint picture.

H.3.2 Tasks and responsibilities of the contract manager and corresponding competencies

The daily tasks and responsibilities of the contract managers vary day by day as many things come up every day. Emails, discussions the IPM team members and the contractor determine very much the daily tasks. There are standard processes that are running every day and that influence the contract

managers. Those processes are amendment requests, payments, SCB and tests. These are standard processes which lead to activities for the contract managers, but those are parts of the whole picture.

Competencies that were discussed for the tasks mentioned above were decisiveness, but that is determined by the process. One of the contract managers fulfills the IPM role of contract manager, while the second contract manager is part of the contract management team. The team leader steers the team and has to control processes. The competencies leadership and process management are important for this.

During the interview the management drives were discussed. The blue drive plays a role in reporting what is happening and in forming the processes. However, being completely blue in a management drives point of view is also not beneficial for the project as this can ultimately lead to clashes. Other important elements are to pick up signals and to draw a line: to here and no further. These elements are associated with the orange and red drives. According to the contract managers you should guard the boundaries of your contract.

H.3.3 Tasks and responsibilities of the project manager and corresponding competencies

As stated before, the project manager of this case is not interviewed due to time constraints. The contract managers however, shortly gave their views on the daily tasks and responsibilities of the project manager. According to them the project manager is clearly not the primary contact person for the contractor, even though he tended to take on that role. The project member's main responsibility is making the IPM team function and has an eye for the staff. Another responsibility is the T-reports.

H.3.4 Competencies specific for this project

The tasks in this project differ from other projects. The constellation of these contractors and governmental agencies brings a unique situation. For this project the main competency according to the contract management role keeper is courage: to tell the parties to start acting. This can be seen as the competency of persuasiveness. The contract management team member also mentioned specifically this competency. Another important competency specific for this project is governance sensitivity. One really needs to understand all the actors at play and the environmental awareness of the influence the project has on local residents. Communication is also important in this.

The uniqueness of this project lies in the urban environment that offers little leeway. You have to take into account the local residents. In case of problems for the residents, they will call the alderman, eventually leading back to the project team. Therefore you should also be very risk aware. The last specific competency mentioned was helicopter view. They explained that it is very easy to dive into the content, but sometimes you have to get into the helicopter to see signals and to understand the effects things will have on the execution and control of the contract. Only then you will see whether elements are unrelated or whether they are all coherent.

H.3.5 Differences and overlaps between the contract manager and the project manager

The fact that you have to keep a distance from the project because of the D&C contract requires a lot from people. There comes the role of the project manager in sight, as he is responsible for a functioning team. However, nowadays it becomes quite difficult for the project manager to oversee the total playing field: there is the IPM team and you have to make sure that everybody does what he or she should do. However, underneath those roles also happens a lot. When the project manager is not informed by the IPM role keepers, it becomes very difficult to manage the team. The contract manager is more involved in the relationship with the contractor and can therefore earlier notice signs of things going wrong. The contract manager should also keep the boundaries of the contract safe and they are more content oriented. They understand the main features of the procurement procedures, UAV-GC,

SCB, and claim history. In their opinion, with all due respect towards the project managers, are the procedures of the project managers such as the T-reports much simpler. The difficulty of the project manager is keeping the team together.

H.3.6 Interchangeability of the contract manager and project manager

The contract managers stated that according to the theory the contract is only a part of the project. However in practice everyone focuses on the contractor, when the contract is awarded. Everybody drops their pen and tries to do business with the contractor. However, the contract manager is the official contract representative towards the contractor. The other members should be aware of the fact that the contractor and contract are only part of a much larger picture.

The project manager of this project had the tendency to try to sit in the chair of the contract manager and became the primary contact point towards the contractor, certainly in the previous phase. This clouded the collaboration and expectations about who is the primary contact. This led to confusion, which is something you should be keen on that it won't cause any problems.

Still, they are both indifferent about having a stronger division between the contract manager and project manager. In their opinion they both need the same competencies, but on a different level. The competencies should be interpreted in the "meetlat" which should clarify the characteristics of the competencies, the different levels within them and on which level you should show certain competencies. This is currently lacking. Therein lies the main difference. The project manager is more focused on the collaboration within the team, while the contract manager is more focused on the contractor. The roles are not completely interchangeable, because of the difference in the interpretation of the competencies. However, within 6 to 12 months you should be able to take over the other role. Because the focus of the contract manager on the contractor, which is lacking for the project manager, it would be better to switch from contract manager to project manager than the other way around.

H.3.7 Differences in D&C contracts compared to DBFM and RAW

Due to time restrictions of the interviewees, the question regarding this topic was not discussed during the interview. However, a general remark on the differences between contract types has been made when discussing a different topic. The contract management team member mentioned that an alliance will ask for something completely different than a D&C or E&C or DBFM, suggesting differences in competencies within these contract types.

H.3.8 Criteria for properly conducted contract management

The contract management role keeper mentioned time, quality and budget as the main indicators for properly conducted contract management by the contract managers. However, this requires some nuances: for quality you have to depend on the contractor. The plan determined up front might be disrupted due to changes and these changes will inextricably lead to a loss of quality, because the contractor does not always get paid more for the changes. The client has the tendency to keep implementing changes while this can only disrupt the contractors plan. Therefore he suggests to let the contractor perform the original plan, this does not cost extra time and therefore no extra costs. Another nuance is that a project that has exceeded the budget does not have to be caused by a nonfunctioning contract manager, but by a badly drafted contract or a decision that was not made in time.

The collaboration with the client and contractor might be indicators for properly conducted contract management. When a project is realized within budget and time and the contractor has earned a balanced profit, it was a beautiful project. However, that remains an ideal picture and sometimes you

have a satisfied client, but a contractor who has a bad taste from this project. That does not mean that the contract manager has performed bad. Sometimes it goes right and sometimes it does not. The contract manager gets paid to comply with the contract and to make sure other parties comply with it. It will be difficult to formulate strict key performance indicators, even though they understand the necessity for the management departments.

H.3.9 List of competencies and competency training

The competency of acting innovative led to a discussion between the two contract managers, as the contract management team member first had the opinion that this was not necessary in the realization phase. When the contract management role keeper argued that they have formed a managerial alliance, they both responded yes, with the comment that it is most important in the procurement phase but also has its influence in the realization phase. Binding the interests of the client with the contractor's and the other way around is very important for the contract manager. However the focus lies in the direction of the contractor, while the project manager would focus it on the team. Collaboration is very important, as you cannot work with a closed door, you have to collaborate with others. This is also the point where friction can occur. Communication is very important, but also in the manner of communication. The collaboration with the contractor can stagnate due to wrong communication. You also have to give an unambiguous signal towards the contractor. Creativity is important during contract formation. However, when it lacked creativity on those moments, you have to act creatively in the realization phase to work within the boundaries of the contract, without breaching the contract. Customer focus is not important as the wishes of the client are formulated in the contract and that should just be realized. Leadership is important, but the contractor is placed in a position of which it is expected for him to be in the lead. Market orientation is not important in this phase. Personal development is important as the organization does not develop. Project administration is important as you should know how to act. Being able to work interdisciplinary is very important as well as risk awareness. That is something you wake up and go to sleep with.

According to the contract managers, there are no specific competencies that should be trained, but some things should be changed in the organization. There is no shared basis present regarding the certification or accreditation of the IPM role keepers. However, everyone should have the same image of risk management and project control. Right now everyone functions within their own container. To get this common denominator, everyone should follow a project management training, a course on SCB, a healthy sense of procurement law and building law. Therefore courses of a half year that can be combined with the regular tasks should be offered.

H.4 Case 4

The fourth case is a wet infrastructural project with a contract sum below 100 million euros that is currently in the realization phase for four years. The contractor is a combination of infrastructural contractors.

H.4.1 General description of the project and problems

This project is characterized by a very problematic history, which has its origin in collaboration. The contract was awarded to the contractor with a price far below the estimation of Rijkswaterstaat. During the first year two issues arose. The first was a different opinion on elements in the functional requirements which translated into the design. The second problem was the presence of asbestos in the shores. This led to stopping the project for more than a year. The contract became a fight agreement and eventually the client decided that a solution needed to be found. Therefore two solutions were implemented: even though the design of the project was not finished and agreed upon yet, the construction was started to prevent further delay and secondly an external party was hired to

break through the issues amongst the IPM role members and the contractor. In hindsight, the first solution may not have been a good one. The idea of the last solution was to get the problems out of the construction trailer to continue the collaboration. However, this did not work out as it was intended. The problems were marked down and the contractual handover was shifted with the intention to end the discussion and to move on. On both sides this agreement did not land well. The opinion of the IPM team was that the problems were caused by a tender price of the contractor that was too low to which they were compensated, while the contractor only got compensated for one third of the total costs. According to one of the interviewees, the IPM team that was on the project in that time, was very inexperienced and the project team from the contractors side was also very young.

These problems led to collaboration issues which were played on the person itself and were not dealt with in a businesslike manner by the different parties. Both Rijkswaterstaat and the contractor work together in the construction trailer to enhance collaboration and they even have a common lunch area, but this has not been used in two years, making clear how the reciprocal feelings were. There was much pressure on the contractor as they are currently having a loss of 9 million euros on the project. Eventually 3 of the 5 IPM team members were replaced and the contract manager role was switched after that twice. The contractors project team was also replaced and after that the collaboration improved. Unfortunately, on the day of the interview with one of the interviewees there was a new set back in the project. The safety could not be guaranteed when a new element had to be installed that day and no quality assurance report could be handed over. Therefore the project was temporarily shut down.

H.4.2 Tasks and responsibilities of the contract manager and corresponding competencies

According to the contract manager, his main task is to have meetings the whole day. This is also an irritation factor for the contract manager as he does not see the positive effect of having more and more meetings. Other tasks and responsibilities include the organization of tests and the planning for testing and implementing changes. Besides this, important elements are to align things with the project manager and the project manager of the contractor to make sure problems are tackled as early as possible and images and expectations are clear.

The competencies that the contract manager connects to these tasks and responsibilities are collaboration. This is the most important one. Because as easy as this project seems from the outside with a small contract sum, the more complicated it is in the collaboration. Collaboration should get the top priority, because collaboration is also working efficiently. You have to collaborate to get the best results for the given price. The work that has been put on hold costs money and could have been prevented. Other competencies are empathy towards the contracting partner and integrity.

The project manager states that the contract manager has a relatively large role within the IPM model. Elements that are part of their tasks and responsibilities are contract control, the SCB process and contract meetings. So the contract manager has to take care of the legality of payments, but is also responsible for secondary contracts. These tasks are connected to the competency planning and organizing. Another addition that the project manager has made about the contract manager, is that the contract manager should have blue drives within the management drives for the SCB process, to be able to work structured.

H.4.3 Tasks and responsibilities of the project manager and corresponding competencies

The project manager in this project is interim project manager due to illness of the project manager. The interim project manager is officially the manager project control and has been taking over the role of project manager for more than half a year. The interim project manager, from now on seen as the project manager of the project, joked about the project manager shifting his tasks towards the

manager project control. Now that he is experiencing the role of the project manager he sees that the project manager's daily tasks and responsibilities are switching, steering, making calls and consulting. The project manager is responsible for the composition of the team and when there are tensions or hassle, the project manager has to deal with it. There is also a role for the project manager in the escalation line towards the contractor, not a direct line. If things do not run smoothly, the project manager is more involved. There is a link with the client, as he has to be informed about certain decisions and to make sure the client supports these decisions. The project manager has a mandate, as he can make financial decisions within the mandate. According to the role descriptions the project manager is responsible for the scope of the project, but this is shifted towards the manager project control. There is a responsibility for collaboration as you have to enhance this to make sure everybody gets along and any friction will be solved. Besides this the project manager is the head of the project management team and has contacts with other authorities. Summarizing, the project manager has to steer the team and actively enhance the collaboration when issues arise. The role of the project manager is seen as larger in startup phase of the realization to set up the collaboration and procedures. Further along in the realization phase it should be quieter for the project manager.

The first competency for these tasks is decisiveness and collaboration in the sense of steering and correcting. Helicopter view is an important competency for seeing the larger picture and not to get involved in everything. Another competency is anticipation, as the project manager has to strategically think about the effects of choices on the long run. All team members should be kept together and make sure everybody feels heard. This is the competency binding that is described.

H.4.4 Competencies specific for this project

This project is characterized by tensions and escalating emotions of team members from both sides. Important competencies for this project are therefore collaboration and communication according to the project manager. Everyone needs to have the feeling of being involved and heard. Therefore it is also important to manage relations and expectations. An extra competency for the project manager is also authority as he is the interim project manager for this project and has to make sure he is seen as the project manager. Authority can be viewed as the competency of impact, as the authority a person has defines the impact he has on people or decisions.

For the contract manager, the competencies mentioned for his daily tasks and responsibilities are also competencies that are much more present in this project than in others. If you would make a graph with collaboration and empathy on the axis, this project would score very high in the top corner. However, these are competencies that are necessary in all projects. Only in this project, collaboration is very important and cannot be seen without empathy.

H.4.5 Differences and overlaps between the contract manager and the project manager

The contract manager formulates one major difference between the contract manager and the project manager: the contract manager works at the front like it is a war. However, as the project manager is responsible for the communication towards the client, the project manager needs to be informed by the contract manager and they need to collaborate together. The project manager is responsible for the internal team structure and organization. This is something that the contract manager could do, but he wants to focus on other things. Therefore the worries are the business of the project manager. In order to manage the internal team structure, the project manager should possess much more helicopter view than the contract manager. There are overlaps according to the contract manager, as they both should be able to take over each other's tasks.

The project manager agrees to these responses by stating that the competencies of the contract manager and project manager are very closely together. They are both market-oriented and the

project manager should also have opinions on changes and be involved in this. Therefore the combination of contract manager and project manager is heavier within the IPM model.

However, the differences lay in the specific knowledge and expertise that the contract manager needs on the UAV-GC, D&C contracts and juridical aspects. Also the contract manager should be more experienced in negotiating and he has more hours available for the project than the project manager. The project manager has a wider knowledge that overarches the roles.

H.4.6 Interchangeability of the contract manager and project manager

As mentioned in the previous section, the roles of the contract manager and project manager are very interchangeable according to the contract manager. It cannot be the case that the contract manager is aware of certain issues and the project manager is not. When the contract manager is not available, the project manager should be able to take over the responsibilities of the contract manager and the other way around. He would argue to put the two roles even closer together.

The project manager partially disagrees as he thinks that there is already a clear distinction present and that the necessary knowledge for both roles are different. The contract manager should have more specific knowledge on the juridical aspects of D&C contracts and the UAV-GC. However, in the project manager's opinion people act too difficult on the switch between those roles.

H.4.7 Differences in D&C contracts compared to DBFM and RAW

The project manager has the opinion that decisiveness is much stronger in D&C contracts than in RAW contracts, as there is a much larger chance of discussions because of the design component in D&C contracts. This is in combination with collaboration, in a D&C contract you cannot make decisions from an ivory tower, while 5 to 6 years ago this actually was the opinion to take more distance.

In a DBFM contract the responsibility has shifted much more towards the contractor as you only pay for availability and empathy is less needed as the availability is defined much more tightly, while in D&C contracts other interests might play a role. The design component of D&C contracts can possibly lead to interpretation differences and conflicts.

According to the contract manager, each project is unique and determines the necessary competencies of the IPM role keepers, while every person is also unique and also determines the necessary competencies. Something that can be stated in general is the fact that you have to act on a different level and that organization won't switch back to RAW contracts. It is therefore more important to have an efficient collaboration.

H.4.8 Criteria for properly conducted contract management

The contract manager addressed two criteria for properly conducted contract management by the contract manager: legality and to prevent as many issues as possible and to act as good as possible when issues actually happen. Everything should be substantiated for legal payments. That is something that is beyond dispute and really should be done by every contract manager. The contract manager has actually done his job well if he acted as good as possible with as little problems as possible.

The project manager also mentioned the legality of projects by using SCB and project controls. Other criteria for properly conducted contract management is the collaboration, especially in D&C projects, as you cannot check certain papers to see that everything is working, while outside no progress is reached. The last criterion is good escalation, something that very depends on the context and circumstances.

H.4.9 List of competencies and competency training

The contract manager of this case had a very clear opinion. All listed competencies are necessary for the contract manager. For example the competency act innovative could not be lacking, as otherwise it would not be possible for the contract manager to be on the same page as the contractor. Problem analysis is also a very important competency that is necessary every day. Sensitivity is important and can be found in reading the body language of the other party. Organizational sensitivity is something very important that tends to be forgotten on the project locations. However you need to understand who to call in situations and to act consciously. The organizational sensitivity is also connected to governance sensitivity. Risk awareness is something you cannot do without, while the contract manager does not see it mentioned in vacancies. The contract manager almost expects this competency to be at the top of the list.

According to the project manager, the competency analytical thinking is very important as emotions tend to increase and you have to determine how the situation really is. Cost awareness is important as the project manager has to operate within the mandate of the client. Market orientation is essential, especially with the new market vision, but this touches the contract manager. Monitoring process is semi-important as the project manager is ultimately responsible, but you should be able to lean on the manager project control. Negotiation should not be necessary when the project is going as planned. Being open is important for the collaboration, but sometimes you consciously choose to not be open. Personal development is very general as everyone should develop themselves. However, project success is not determined by personal development. To be able to work interdisciplinary is very important when you are the one responsible for team building. You have to be able to connect different personalities and different disciplines.

The contract manager states that training competencies is something that everyone should do, however it is more important to couple junior and senior employees for sharing experiences. Another training option is roleplaying with contractors in which you have to take on each other's roles. Then you really see what the effect is of your behavior. In the opinion of the project manager, everyone should improve their knowledge in the evening and follow courses to train specific competencies. However most important is getting experience. Important for professionalizing the organization is team management, steering and leadership and the relation with market.

H.5 IPM expert

The last interview results that will be described here were not related to a specific case or project, but was held because the interviewee can be seen as an expert on the IPM model, the relations between the roles and corresponding tasks and responsibilities. The interviewee is often called the "keeper of the IPM model" as the interviewee has helped develop it and to make sure it is used in the right manner within an organization. The interviewee has also functioned in the role of project manager, giving the interviewee also a practical view on the others. The interview questions in this situation were not focused on a specific project, but did focus on projects in general with the specifics of an D&C contract in the realization phase.

H.5.1 Implementation of the IPM model

The IPM expert was asked about the implementation of the IPM model and the philosophy behind the model. The model was developed in order to facilitate a uniform process for projects all over the country. There was already some experience with projects as the High Speed Link South and some other large projects. The conception was that within a project different interests should be weighed equally and integrally. When one looks at the areas of interest within a project, the formed areas were contract management as this is always present, as well as technical management, project control and

environmental management. These areas were very recognizable for our kind of projects. The interests of the different areas are weighed by different roles. So the philosophy is to never sweep the tension between the different interests under the table, but to weigh them amongst each other to get a balanced solution. Over time this model has been implemented through the organization and people have been trained in the usage of the model and have experienced themselves how the model works in practice. A pitfall of the model is the possibility of compartmentalization within the organization: the feeling that once one is in one specific role you cannot switch to another. This is something the organization has to guard against, but the main benefit is that it is very recognizable and that a random contract manager would be able to talk with a colleague and see that they have been through the same development and can speak the same language.

The model is not an hierarchical model, but has the starting point that all roles are equal. The project manager is drawn at the top (see figure 3 in chapter 3.2.1) as he has the final responsibility. But in the basis, the roles are equal, because otherwise one could never reach collaboration to determine the integral balance. The roles at the edges – the project manager, environmental manager and contract manager – are drawn there as they have relations with the outside world.

H.5.2 Tasks and responsibilities of the project manager and corresponding competencies

The project manager is responsible for steering his team and has to monitor progress. The team is not automatically a team, this has to be formed. Besides this he can help other roles when necessary. Therefore the project manager can be seen as one with many roles. The project manager is put on one of the corners of the triangle, as he has a relation with a dynamic management environment within the own organization, consisting of management staff, head engineering directors (HID's, in Dutch: Hoofd-ingenieur Directeur), Director General, House of Representatives and Minister. This is a very complex situation. The project manager has to be result driven and focused on collaboration between different parties.

These tasks can be linked to the following competencies: the first is result driven as you always have to go for the results. However, it is not only about the results, but also about determining the path towards the result. The project manager should be independent and flexible. He should lead his team by being a leader who also has some charisma. He should have attention to the environment and understand the organization. Besides this he has to anticipate to see three steps ahead, to have governance sensitivity to understand the internal (client)organization, to bind the team and to communicate with all different parties. The last competency mentioned was personal development. However, this is a competency not related to only the project manager, but is a competency that all roles should have. You should be able to reflect on yourself to see how and why you have acted a certain way and to learn from it. Result driven is a competency that is more specific for the realization phase, as in the realization phase something is actually getting build. Competencies that are more general to all phases are anticipating, communicating and binding.

H.5.3 Tasks and responsibilities of the contract manager and corresponding competencies

The contract manager is seen as the primary contact point towards the market. However this leads to some tension, as some market parties only want to deal with the project manager, whether this is done consciously or unconsciously. The second element is that the contract manager is responsible for the contract and the control of it.

H.5.4 Differences and overlaps between the contract manager and the project manager

The overlap between the project manager and contract manager is the relation between them. They are together in the connection with the market. The contract manager is the primary contact towards the contract, but in the case of escalation, the project manager is involved. To be able to do this, the

project manager needs to be informed. Another common element is the management aspect. Both IPM role keepers are managers who have their own teams: they have to listen to each other, build trust, have a common goal and other generic elements.

Differences are in the escalation line: the formal line from the client to the market runs through the contract manager who is also the primary contact point and not the project manager. This might lead to difficulties when the contractor wants to deal with the project manager. Another difference lies in the competencies. Negotiation is a competency that everyone should possess, but that is much more connected to the contract manager.

H.5.5 Interchangeability of the contract manager and project manager

The IPM model implies that there is a tension between roles, who are all responsible for a small part of the same project. The downside is, that each role possesses a small difference, with their own explicit competencies, knowledge and skills. These competencies are translated into the “rulers” (in Dutch: meetlat). During the interview a conclusion was made that different competencies were formulated for the project manager and contract manager, but that this was not communicated into the ruler of the contract manager. This new list of competencies will be included into the conceptual model. This distinction has been made as both roles are part of the function family project manager or project leader in the Function house of the government and that more customized competencies were necessary. This customization shows that a clearer division was necessary into the competencies of the contract manager and project manager, even though a contract manager should be able to grow into the role of the project manager.

H.5.6 Differences in D&C contracts compared to DBFM and RAW

According to the IPM expert, the necessary competencies are independent from the contract type. The differences in the contract types might lead to differences in experience and knowledge, because for example the finance-element in a DBFM contract is something that the IPM managers have been trained for. This requires different knowledge. If you should translate that towards competencies, it might be connected to organizational sensitivity according to the IPM expert. The finance-element led to the involvement of the financial sector with its terminology and different models. If a change should be implemented, the contractor would have to discuss this first with the financier. A DBFM contract asks for the competency of anticipation, but this is also the case for a D&C contract, in which you have to think a few steps ahead. The overlap is the D and B element in a DBFM contract, as this is the same as in a D&C contract. You have to search for any differences.

H.5.7 Criteria for properly conducted contract management

The IPM expert addressed the need for more clear criteria. According to the expert, contract management is properly conducted by the contract manager when the contract manager succeeded to have a good collaboration with the market parties and when there is a result to everyone’s satisfaction. This should refer to both the client as well as the contractor. This satisfaction is the case when the client has the opinion that good agreements were made, there were no discussions and everyone is satisfied and have seen acted upon their interests, which range from making profit to getting quality. Not only the final result is important, but also the process. The team should think that the collaboration with the contract manager went smoothly and the process of SCB should go according to plan. Another element is a satisfied Minister. This will be the case when there were no questions about the project in the House of Representatives. A side comment was made about these criteria, as their results will be determined on who to ask and when.

H.5.8 List of competencies and competency training

The IPM expert stated that many competencies are important for project managers, such as collaboration, communication, cost awareness and customer focus. Creativity is not important. Having a helicopter view is outdated and should be changed in a drone view. With a helicopter view the danger lies in the fact that you don't stand on the ground anymore and that you will lose control of the work floor and the overview. With a drone view you will get the overview while remaining on the ground. You can still control the larger picture without losing the feeling with the ground. It is a nice analogy of how technique can help in competencies. Market orientation is not important for the project manager as according to the IPM model there is another role responsible for the market orientation, namely the contractor. Persuasiveness is important, but if everyone is very strong in persuasiveness you will never reach a general agreement. Risk awareness is therefore much more important. Project administration is not important as this is more a task than a competency. Servicing is important as this project is eventually executed for someone else: the society, the Minister or no matter who.

H.6 Reference

Reynaarde Talentontwikkeling. (n.d.). Samenbindend Leiderschap. Retrieved from <http://www.reynaarde.nl/talentontwikkeling/samenbindend-leidingschap.html>

Appendix I: Survey protocol

“What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase of Rijkswaterstaat in the Netherlands?”

This survey protocol is based on the survey protocol of Case Western Reserve University (2008).

I.1 Background

Research into the competencies of contract managers is lacking. There has been a lot of research done into the competencies of the project managers. These researches show that competencies such as communication, collaboration, leadership and negotiation are important competencies. For the competencies of the contract manager, information from Rijkswaterstaat is used. These documents mention competencies as planning and organizing, networking, integrity and result driven are important.

This survey will be used to provide an answer to the following main research question: “What are the critical competencies of a contract manager in construction projects with a Design and Construct contract within the IPM model in the realization phase of Rijkswaterstaat in the Netherlands?”

The main research is divided into the following seven sub questions:

1. What is contract management in construction projects with the IPM model?
2. What is the role of the contract manager in construction projects within the IPM model?
3. Which competencies are being asked from a contract manager within the IPM model?
4. What are the challenges for a contract manager that come with a Design and Construct contract in the realization phase within the IPM model at Rijkswaterstaat?
5. In what way does the responsibilities, challenges and competencies from a contract manager differ from those of a project manager?
6. Which criteria can be distinguished to determine whether contract management is properly conducted?
7. What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?

I.2 Past work

The survey is part of the larger master thesis on competencies of contract manager. Within the master thesis a literature review has been done on contract management, the IPM model and contract management, D&C contracts and project management and contract management competencies. This literature review was concluded with a preliminary conceptual model on contract management competencies and was the input for a comparative case study.

Within this case study, four cases were selected with the help of selection criteria. The criteria were: being a project from the GPO department at Rijkswaterstaat, with a D&C contract, in the realization phase and project managers and contract managers from GPO and not externally hired. This led to 4 cases: two dry infrastructural projects and two wet infrastructural project from which the contract managers and project managers were interviewed. Each person was interviewed according to the same semi-structured interview, making sure that every interviewee was asked the same question, without leaving room for addition and case specific questions. The results of the case study serve as input for this survey, in which the findings of the case study will be validated and quantified.

1.3 Aims

The aim of the survey is to find an answer to the research question by quantifying the opinions of the contract managers and project managers.

1.4 Objectives

The primary question that will be answered with the survey is “What are the critical competencies according to a contract manager within the IPM model and a Design and Construct contract in the realization phase?” In order to get an answer to this question, competencies need to be scored on their importance for the contract manager. In this situation the critical competency is the dependent variable and the competencies are independent variables.

Other questions that will be answered are which competencies are important for the six distinguished criteria for properly conducted contract management for which each criterion will be the dependent variable and each competency will be the independent variable.

The third set of questions involve the differences between the project manager and contract manager. The interchangeability of the roles of the contract manager and project manager is the dependent variable. The other dependent variables are the theorems.

The last dependent variable is the importance of training, for which the competencies are the independent variables.

1.5 Sample size and population

The population of the survey are all contract and project managers from client organizations using the IPM model and D&C contracts. The total population is unknown. The largest client organization works with the IPM model and uses D&C contracts. The water boards also tend to shift towards the usage of the IPM model. Besides this, larger municipalities start to work with the IPM model. As numbers on this are unknown, the population of contract managers and project managers at Rijkswaterstaat from the department of GPO and PPO and a few waterboards are selected as sample size. The number of contract managers at GPO is 44, the number of project managers at GPO is 50. At the PPO department, the number of contract managers and project managers together is around 85. This will be seen as the sample size for the survey.

1.6 Design of the survey study

The survey will consist of various question types. The general questions on determining whether the responders belong to the sample will be yes/no questions. Other general questions (age and function) will be multiple choice questions for which single answers are permitted. The only question in the survey with a multiple choice answer possibility for which many answers are permitted, is the question on which department the respondent is employed. In Rijkswaterstaat it might be that a manager belongs to one department but also works on projects for the other department.

The topic specific questions will consist of Likert scales with a range from not important to extremely important. One question will have a Likert scale with neutral response permitted, as the response options range from very disagree to very agree.

Different populations will be selected to compare answers between them. The population consists of both project managers and contract managers and three departments: PPO and GPO from Rijkswaterstaat and different water boards.

1.7 Method

The survey will be performed electronically. The potential respondents will be send an email with a link to the survey in order to participate. The service used is the website thesistools.com. The answers of the participants will be stored here, but only accessible for the researcher. The answers will be stored online until the end of April 2017. The answers will be downloaded and can be viewed with the help of Microsoft Excel. As the interview is anonymous, it will not be known who has entered which answer. For time purposes, the survey can be filled in until the end of January 2017. Each week the sample population will receive a reminder to fill in the survey and to thank the participants.

1.8 Planned Statistical Analysis

The software SPSS will be used for statistical analysis. First an descriptive analysis will be performed to examine the distribution of the variables. These data will be used to describe the study participants, and address the descriptive statistics.

Correlation tests will performed to analyze differences between different populations. Besides this t-tests and ANOVA analysis will be used.

References

Case Western Reserve University. (2008). Survey Study Protocol Template. Retrieved from <https://case.edu/emrd/forms/SurveyStudyProtocolTemplate.pdf>