

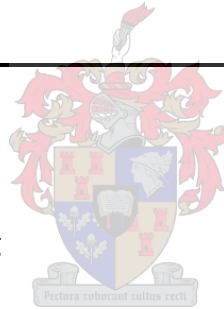
STELLENBOSCH UNIVERSITY

MASTERS THESIS

**Barriers and the success factors
for the implementation of the NEC
within the civil engineering industry
of South Africa**

Assisted by a comparison with the introduction of the new UAV-GC contract
in The Netherlands

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*Thesis presented in partial fulfilment of the requirements for the degree
Master of Engineering (Research) in the Faculty of Engineering at
Stellenbosch University*

Murray & Roberts Chair of Construction Engineering & Management
Department of Civil Engineering

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Declaration of Authorship

By submitting this thesis, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Marijn van den Berg

Date: 12 November 2014

*Coming together is a beginning,
Keeping together is progress,
Working together is success.*

Henry Ford, 1920

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Abstract

Murray & Roberts Chair of Construction Engineering & Management
Department of Civil Engineering

Barriers and the success factors for the implementation of the NEC within the civil engineering industry of South Africa

by Marijn VAN DEN BERG

After its introduction in 1993, the use of the NEC is still limited in the civil engineering industry of South Africa. The benefits of the NEC however appear to be promising. This research identifies the barriers of a NEC adoption. Moreover, in order to recommend strategies and measures to achieve a better NEC adoption, required success factors for a NEC implementation are investigated. Beneficial insights for South Africa are gained from the Dutch UAV-GC introduction experiences.

A literature study is conducted to define the research needs and focus. Both contracts are analysed and compared. These findings are then used to validate the assumed advantages of the NEC by correlating them to the contract content. Subsequently, expert interviews are conducted in which the advantages, disadvantages, barriers for adoption and success factors for implementation of the NEC are explored. Interviews with seven South African experts also contained a short-questionnaire. The short-questionnaire gave a quantitative context as validation for the qualitative advantages. In addition, three interviews with Dutch experts were conducted. In this manner the Dutch UAV-GC introduction experiences were explored. In the research synthesis, findings from the various sources are validated. This is achieved through a comparison of the different methods applied in the study.

The barriers identified as the main cause of obstruction to the NEC adoption are a lack of knowledge, understanding, education, effective training courses and skills in procurement strategy, contract management and general project management. Furthermore, there is a resistance from industry because of the preference for the South African contract forms. Another resistance is from employers, due to the desire for some grey area in their contract form.

Principal success factors necessary for the implementation of the NEC are education, training, promotion, and a proper understanding of the NEC as well as its philosophy and benefits. Consequently, a culture change towards collaborations would be necessary.

In addition employers must apply and improve their procurement strategies. As a result, the NEC would be identified as their best tool for procurement. A helpful success factor, extracted from the Dutch experience, is the requirement for knowledge sharing between governmental bodies in order to guide innovations.

For optimum industry performance by the more frequent use of the NEC, this research has resulted in the following recommendations:

- The industry should not be afraid to question tradition and to initiate the required cultural change towards increasing collaboration
- An influential South African institute should take responsibility for the promotion, monitoring and training of the NEC
- Educate students on the NEC and other contracts based on all possible procurement strategies
- An adoption strategy should be applied for inexperienced NEC parties
- NEC should be used as the stimulator for improvement of South African project management practices in construction projects
- Organize regular knowledge sharing meetings between governmental departments to stimulate and improve innovations
- Employers should improve their procurement practices

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Opsomming

Murray & Roberts Chair of Construction Engineering & Management
Department of Civil Engineering

Hindernisse en sukses faktore vir die implementering van die NEC te midde die Suid-Afrikaanse ingenieursbedryf

Marijn VAN DEN BERG

Na sy bekendstelling in 1993, is die gebruik van die NEC steeds beperk in die Suid-Afrikaanse ingenieursbedryf. Die voordele vir die gebruik daarvan blyk egter tog belowend te wees. Hierdie navorsing identifiseer die hindernisse wat gepaard gaan met die gebruik van die NEC in die bedryf. Die studie ondersoek ook die faktore wat 'n rol speel by die implementering van die NEC, om sodoende strategieë vir 'n meer omvattende gebruik van die NEC aan te beveel. Lesse om 'n nuwe kontrakdokument in die bedryf in te bring word geleer uit die Nederlandse ervaring met die UAV-GC.

'n Literatuurstudie is uitgevoer om die behoeftes en fokus van die navorsing te definieer. Beide kontrakvorms is geanaliseer en met mekaar vergelyk. Hierdie bevindinge is daarna gebruik om die voor- en nadele wat die NEC inhou te bevestig, deur dit te vergelyk met die inhoud van die kontrak. Onderhoude is gevolglik gevoer met industriedeelnemers waarin die voordele, nadele, hindernisse vir en die suksesfaktore vir die implementering van die NEC ondersoek is. Die sewe onderhoude wat met Suid-Afrikaanse deskundiges gevoer is, het elk 'n kort vraelys ingesluit. Die kort vraelys verleen 'n kwantitatiewe bevestiging van die bevindinge. Aansluitend is daar ook drie onderhoude met Nederlandse deskundiges gevoer. Op hierdie wyse is die Nederlandse ervarings ondersoek met die inlywing van die UAV-GC. In die navorsingsintese word die bevindinge van die verskillende bronne bevestig. Dit word bereik deur 'n vergelyking van die resultate van die verskillende metodes wat in die studie gebruik is.

Hindernisse wat geïdentifiseer is as die hoof oorsaak vir die beperkte inlywing van die NEC in die bedryf, is die tekort aan kennis, begrip, opvoeding, effektiewe opleidingskurse, vaardighede in aankoopstrategieë, tekort aan kennis oor kontrakbestuur en ook algemene projektebestuur. Boonop is daar teëstand van die bedryf weens die voorkeur vir Suid-Afrikaanse kontrakvorms. Verdere teëstand word verkry deur werkgewers vanweë die behoefte na grys area in hul kontrakte.

Die belangrikste faktore wat benodig word vir die suksesvolle implementering van die NEC is opleiding, kennis en begrip van die NEC, asook begrip van sy filosofie en voordele. 'n Kultuurverandering, met die fokus op samewerking tussen partye, is noodsaaklik. Werkgewers moet verder hul aankoopstrategieë verbeter. 'n Nuttige faktor vir die suksesvolle inlywing van die NEC, verkry uit die Nederlandse ervaring, is die vereiste vir die uitruil van kennis onder staatsdepartemente om sodoende die veranderinge te lei.

Om die gebruik van die NEC optimaal by die Suid-Afrikaanse ingenieursbedryf in te lei, het die navorsing tot die volgende gevolgtrekkings gelei:

- Die bedryf moet nie huiwer om tradisie te bevraagteken nie. Dit is nodig dat kultuurveranderinge gemaak word om samewerking tussen partye te bewerkstellig
- 'n Invloedryke Suid-Afrikaanse instituut moet verantwoordelikheid neem vir die bevordering, die monitering en opleiding vir die gebruik van die NEC
- Studente moet opgelei word met blootstelling aan die NEC asook blootstelling aan 'n verskeidenheid van aankoopstrategieë
- 'n Strategie moet ontwikkel word om partye wat onbekend is met die NEC daarvan bewus te maak
- Die NEC moet gebruik word as bron wat die Suid-Afrikaanse projekbestuurs- en kontrakbestuursomgewings kan verbeter
- Daar moet skakeling wees tussen staatsdepartemente om sodoende verandering te bevorder en te verbeter in aankoopstrategieë
- Werkgewers moet hulle aankoopstrategieë en praktyke verbeter

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Contents

Declaration of Authorship	i
Abstract	iii
Opsomming	v
Acknowledgements	vii
List of Figures	xii
List of Tables	xiii
Abbreviations & Key Definitions	xiv
1 Introduction	1
1.1 Background	1
1.2 Problem definition	5
1.2.1 For whom is that a problem?	5
1.2.2 Why is that a problem?	6
1.2.3 What is known about the problem?	6
1.2.4 Problem statement - What is not yet known about the problem?	6
1.3 Research objective	7
1.3.1 Research sub-objectives	7
1.4 Research question	8
1.4.1 Research sub-questions	8
1.5 Relevance of the research	9
1.6 Research design	11
1.7 Research scope	13
1.8 Thesis structure	13
2 Literature Review	16
2.1 Definition and impact of a standard construction contract	16
2.1.1 Standard construction contract	17
2.1.2 Contractual risks	18
2.1.3 Construction disputes	19
2.2 Deficiencies of traditional standard construction contracts	20

2.2.1	Traditional standard construction contract	21
2.2.2	The creation of adversarial relations and behaviour	22
2.2.3	Lack of clarity	24
2.2.4	Lack of flexibility	26
2.2.5	Lacking engenderment of project management	27
2.3	Potential for change towards improvement in contracting practices	29
2.3.1	Contracting principles for an effective form of contract	31
2.4	Innovative contractual mechanisms	32
2.5	The NEC as a promising contractual innovation	34
2.5.1	Objectives of the NEC and its related innovations	34
2.5.2	Conformity of the NEC with the principles of modern contracting	37
2.5.3	NEC benefits from international literature	37
2.5.4	Disadvantages NEC	38
2.6	NEC adoption by the South African civil engineering industry and its associated potential and experienced introduction difficulties	39
2.6.1	Adopted standard construction contracts in South Africa	40
2.6.2	Usage percentages of standard contract forms in South Africa	40
2.6.3	Deficiencies in contract management environment	41
2.6.4	Improvements of the NEC for South Africa	46
2.6.5	Barriers for NEC implementation in South Africa extracted from literature	50
2.6.6	Recommendations for a successful NEC implementation	51
2.7	The introduction of the UAV-GC in the Dutch civil engineering industry	52
2.7.1	Adopted standard construction contracts in The Netherlands	52
2.7.2	Procurement strategies in Dutch construction projects	53
2.7.3	Deficiencies in contract management environment	54
2.7.4	Innovations of the UAV-GC	56
2.7.5	Possible barriers for UAV-GC implementation extracted from literature	59
2.7.6	Recommendations for a successful UAV-GC implementation	60
2.8	Literature synthesis	60
2.8.1	Expected answers to the research questions of the NEC3 ECC introduction in South Africa based on the literature findings	60
2.8.2	Comparison between the South African and Dutch contractual developments	64
3	Research Methodology	67
3.1	Methodology: Explanatory and exploratory research	67
3.1.1	Phases in the research	67
3.2	Primary data collection: Qualitative and quantitative	69
3.2.1	Method: Expert Interviews	69
3.2.2	Interview protocol	70
3.2.3	Interview sample	71
3.3	Trustworthiness	73
3.3.1	Validity	73
3.3.2	Reliability	74
4	Research Findings	75

4.1	Contractual analyses and comparison findings	75
4.1.1	NEC3 (ECC)	76
4.1.1.1	The NEC3 family of contracts	77
4.1.1.2	Contractual arrangements in NEC3 ECC	77
4.1.1.3	Required contract documents under the NEC3 ECC	79
4.1.1.4	Structure of the general conditions of the NEC3 ECC	80
4.1.1.5	Arrangement for contractor's design responsibility	83
4.1.1.6	Project management principles in the NEC3 ECC	84
4.1.2	UAV-GC 2005	89
4.1.3	Comparison between the NEC3 ECC and the UAV-GC 2005	90
4.1.3.1	Concluding level of innovation	92
4.2	Expert interview findings from South Africa	93
4.2.1	Current contractual problems in South African civil projects	94
4.2.2	The current extent of the NEC adoption by the South African civil engineering industry	96
4.2.3	Experience and achievements from civil projects in South Africa	97
4.2.4	Is a broader adoption of the NEC seen as an improvement for South Africa by NEC experienced people	97
4.2.5	Advantages of the NEC	98
4.2.6	Disadvantages of the NEC	101
4.2.7	Critical barriers for the implementation of the NEC3 in South African civil projects	102
4.2.8	Required success factors for an implementation of the NEC3 in South African civil projects	104
4.3	Short-questionnaire results from South Africa	108
4.4	Expert interview findings from The Netherlands	110
4.4.1	Contractual problems in Dutch civil projects	111
4.4.2	The motive for the creation of the UAV-GC	111
4.4.3	Advantages of the UAV-GC	111
4.4.4	Disadvantages of the UAV-GC	112
4.4.5	The introduction process of the UAV-GC	112
4.4.6	Critical barriers for the implementation of the UAV-GC in Dutch civil projects	113
4.4.7	Required success factors for the implementation of the UAV-GC in Dutch civil projects	114
4.4.8	NEC benefits for The Netherlands	115
5	Research Synthesis	116
5.1	NEC adoption and implementation in South Africa	116
5.1.1	Should the NEC be broader adopted by the South African civil engineering industry?	116
5.1.2	What are the advantages of the NEC3 ECC?	117
5.1.3	What are the disadvantages of the NEC3 ECC?	118
5.1.4	What are the critical barriers for the implementation of the NEC3 ECC in South African civil projects?	118
5.1.5	What are the required success factors for a broader adoption and successful implementation of the NEC3 ECC in South African civil projects?	119

5.2	Comparison with the UAV-GC introduction in The Netherlands	120
6	Conclusion and Recommendations	125
6.1	Conclusion	126
6.1.1	Limitations	129
6.2	Recommendations	130
6.3	Recommendations for further research	133
A	Innovative contractual mechanisms	134
A.1	Relationship contracting	134
A.2	Target contract	139
A.3	Enforced collaborative and proactive change management system	140
A.4	Integrated contract	144
B	South African standard contract forms	147
C	Interview Protocols	150
C.1	Interview protocol (South Africa)	150
C.2	Interview protocol (The Netherlands)	152
D	Interview Samples	155
E	NEC3 ECC change management system	156
F	Contractual Analysis UAV-GC 2005	160
F.1	Family of contracts	160
F.2	Contractual arrangements in the UAV-GC 2005	160
F.3	Required contract documents under the UAV-GC 2005	161
F.4	Structure of the general conditions of the UAV-GC 2005	161
F.5	Arrangement for contractor's design responsibilities	162
F.6	Project management principles in the UAV-GC 2005	163
G	Contract Clauses	169
G.1	Contract clauses NEC3 ECC	169
G.2	Contract clauses UAV-GC 2005	175
H	Summary Tables South African Expert Interviews	179
	Bibliography	184

List of Figures

1.1	South African construction contract type in 2013 (CIDB, 2014)	4
1.2	Construction-related public capital expenditure (R 'billions) (Pwc, 2013) .	10
1.3	Market capitalisation: JSE vs construction (Pwc, 2013)	10
1.4	Research framework	12
1.5	Logical sequence thesis	14
2.1	Overview of Literature Review - Sub-chapter 2.1	17
2.2	Construction dispute anatomy (Cheung & Pang, 2013)	20
2.3	Overview of Literature Review - Sub-chapter 2.2	20
2.4	Traditional contractual relations (Chao-Duvis <i>et al.</i> , 2013:51)	21
2.5	Overview of Literature Review - Sub-chapter 2.3	29
2.6	Overview of Literature Review - Sub-chapter 2.4	32
2.7	Overview of Literature Review - Sub-chapter 2.5	35
2.8	Overview of Literature Review - Sub-chapter 2.6	39
2.9	Overview of Literature Review - Sub-chapter 2.7	52
2.10	Development of integrated contracts in the Dutch infrastructure project lifecycles (Lenferink, 2013:128)	57
2.11	Overview of Literature Review - Sub-chapter 2.8	61
4.1	Contractual analysis of the NEC3 ECC	77
4.2	NEC3 system	78
4.3	Contractual analysis of the UAV-GC 2005	89
4.4	Comparison between the NEC3 ECC and the UAV-GC 2005	90
4.5	South African expert interviews	93
4.6	South African short-questionnaire	108
4.7	Dutch expert interviews	110
A.1	Partnering success factors (Chan <i>et al.</i> , 2004)	136
A.2	Integrated legal relationships (Chao-Duvis <i>et al.</i> , 2013)	145

List of Tables

2.1	Traditional contract (Chan, <i>et al.</i> , 2010b)	29
2.2	Improved contract (Chan, <i>et al.</i> , 2010b)	30
2.3	South African construction contract type in 2011 (Marx, 2013)	41
2.4	Risk assessment modelling in South African construction industry (Visser & Joubert, 2008)	42
2.5	Standard construction contract comparison (Watermeyer, 2014)	48
2.6	Culture shift stimulated by the NEC (Watermeyer, 2014)	49
2.7	Dutch construction contracting strategies in 2006 (Jansen & Sijpersma, 2006)	54
2.8	Bottlenecks Dutch civil engineering sector in 2006 (Jansen & Sijpersma, 2006)	55
2.9	Reasons for failure in the Dutch construction industry (USP Marketing Consultancy, 2007)	56
3.1	South African interview sample	72
3.2	Dutch interview sample	73
4.1	Likert method of use	109
4.2	Short-questionnaire outcomes	109
A.1	Traditional vs. relationship contracting (MacDonald, 2005)	138
D.1	Interview sample South Africa	155
D.2	Interview sample The Netherlands	155
H.1	South African expert interview findings summary table1	180
H.2	South African expert interview findings summary table2	181
H.3	South African expert interview findings summary table3	182
H.4	South African expert interview findings summary table4	183

Abbreviations & Key Definitions

CIDB	Construction Industry Development Board
SAICE	South African Institution of Civil Engineering
GCC	General Conditions of Contract for construction works
NEC	New Engineering Contract
ECC	Engineering and Construction Contract
BoQ	Bill of Quantities
SCC	Schedule of Cost Components

Construction Contract	Legally binding agreement between employer and contractor.
Standard Construction Contract	Standardized form within a construction contract that describes the general conditions of contract and can be used on many construction projects to save cost and time for drafting a unique contract every project.
General conditions of contract	Defines each contracting party's roles and responsibilities, and the rules by which they are to meet obligations and perform the works they agreed upon.
Works	Work to be carried out and completed as set out in the construction contract.
Employer	The owner or sponsor of the project who appoints the contractor and is responsible for the funding. Can include other representatives acting on his behalf.
Contractor	Person responsible for executing the work.

Chapter 1

Introduction

The introduction of the research firstly provides a short background to the researched problem and after that a problem statement is formulated. Thereafter the research objectives and questions are stated and the relevance of the research is substantiated. Finally, the research design, key definitions and the structure of this document are described.

1.1 Background

As an innovative standard construction contract the NEC (New Engineering Contract) has already been introduced in South Africa 20 years ago. The introduction of the NEC within the civil engineering industry is however of a difficult nature. The context behind the potential of the NEC and its introduction difficulties are introduced in this background.

Problems encountered with traditional standard construction contracts in South Africa

Traditional standard construction contracts are assumed to create an adversarial environment instead of providing an incentive to collaborate on project changes and to avoid disputes (e.g. Thompson, Vorster & Groton, 2000; Chan, Coffey & Trigunarsyah, 2010b and Harmon, 2003). Walker & Davis (1999) describe a transactional nature in the form of a Principal-Agent relationship to be the cause within traditional contract forms. They presume that contractual relationships based on a Principal-Agent theory creates

a struggle for individual benefit maximization instead of mutual benefits. Consequently, it creates adversarial relationships and a lack of trust between the two contracting parties.

Similar to these international observations the South African construction industry is also troubled by an adversarial project environment. The research by Mbachu & Nkado (2007) shows that adversarial relations, service attitudes, contractual claims and disputes are some main constraints in South African construction projects. They furthermore found other contractual problems, such as poorly defined or understood roles and responsibilities and lacking contractual obligations. Consequently projects are infected by opportunistic behaviour, disputes, delay and overspending. With the traditional GCC (General Conditions of Contract for Construction Works), JBCC (Joint Building Contracts Committee) and FIDIC as the mainly used standard construction contracts in South Africa (see Figure 1.1 and Table 2.3 in the Literature Review chapter), they are responsible for the contractual deficiencies being experienced. GCC specific problems are further substantiated by the research of Klingenberg (2014:123), who investigated the GCC 2010. He found alterations to the contract in the interest of employers to be common practice. He concluded that the contract is still one with adversarial undertones and that an understanding of mutual interdependency is not achieved. Another research by Frehse (2013:101) compared the traditional GCC with the hardly used innovative NEC and concluded several points of criticism and opportunity for improvement towards the GCC. Frehse (2013:101) found the NEC to be an improvement on:

- Easiness to understand and apply
- Suitability for all disciplines and across the whole supply chain and procurement spectrum
- The engenderment of good project management
- The overwhelming preference from practice for a single procedure that addresses time and cost impacts together to assess change

NEC as a possible innovative improvement for the South African civil engineering industry

It therefore seems that the NEC creates an opportunity for improvement of the contracting practices within the South African construction industry. The NEC was introduced in 1993 as a collaborative innovation that moves away from the traditional forms of

contract. The NEC is an international family of contracts that facilitate the implementation of sound project management principles and that define the legal relationships. The NEC stimulates partnering and good project management practices by creating shared project objectives, e.g. by target contracts, and furthermore because of the associated requirements for proactivity and collaboration. Enforced requirements for early warnings and risk reduction meetings are some examples from the NEC that require collaboration and proactivity. Through these innovative contractual mechanisms the NEC tries to overcome adversarial behaviour to achieve better project outcomes. Reviews of the NEC within academic literature are generally positive and show positive results from practice on project outcomes and dispute prevention (e.g. Broome & Hayes, 1997; Sun & Oza, 2006; Thompson *et al.*, 2000 and Wright & Fergusson, 2009).

Difficult introduction of the NEC in South Africa

Although the NEC was already introduced into South Africa since the creation of the NEC in 1993, the adoption more than 20 years later is still rather limited within the civil engineering industry. The adoption is more successful in its originating country, the United Kingdom, where it is the Institution of Civil Engineers' (ICE) contract of choice and the only form recommended by the United Kingdom Governmental Office of Government Commerce. Other countries that use the NEC are mainly New Zealand, Australia and Hong Kong. Although South Africa is one of the international countries that adopted the NEC as an accepted standard contract form the NEC ECC (Engineering and Construction Contract) is found to be only used in 2% of the civil projects in 2012 (Marx, 2013). A year later the NEC is still found to be hardly used in construction projects in the CIDB survey of 2013. (CIDB, 2014). The CIDB survey outcomes are presented in Figure 1.1 for 2013 and Table 2.3 in section 2.6.2 of the Literature Review for year 2012.

On the contrary, around 80 % of the civil projects in South Africa used the GCC in 2012 (Marx, 2013). In 2013 the construction projects seem to be executed mainly under the FIDIC and GCC. Therefore it seems that the civil engineering industry tends to hold on to the use of the more traditional GCC because of familiarity and knowledge of legal precedence (Frehse, 2013:101). Alternatively they shift to another traditional contract form by means of the FIDIC.

It must therefore be further investigated if the NEC is an improvement of the contractual practices within construction projects in South Africa and if so, why the NEC is

not broader adopted.

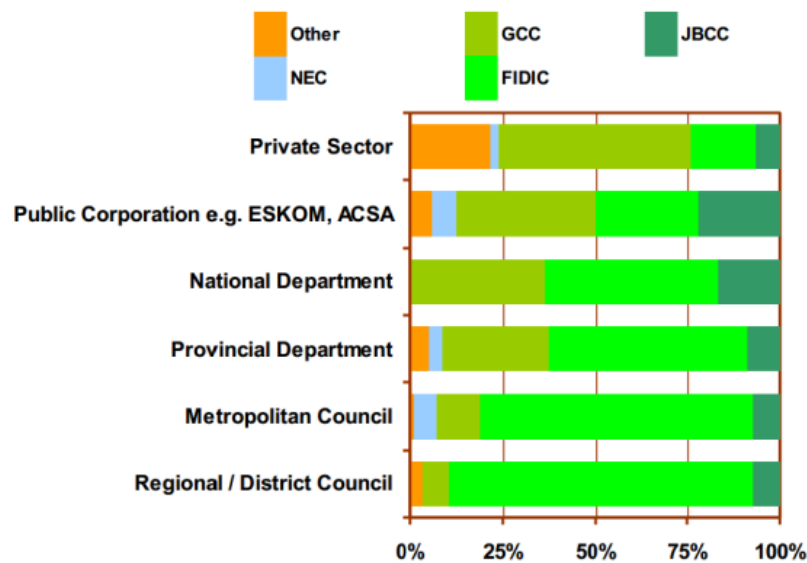


FIGURE 1.1: South African construction contract type in 2013 (CIDB, 2014)

Comparison with the introduction of a new contract, the UAV-GC, in the Netherlands

Similarly to the introduction of the NEC in South Africa, the UAV-GC (Uniform Administrative Conditions for Integrative Contracts) was introduced in 2000 as a new Dutch standard construction contract. The pilot version of the UAV-GC was created in 2000 and after a pilot period of 5 years the UAV-GC 2005 was published. Similar to the NEC it is also seen as a contractual innovation. The UAV-GC however seems to have a more successful adoption, amongst others by the national public employers. For example two of the key civil employers, Rijkswaterstaat and ProRail, now only use the UAV-GC instead of its predecessor the UAV. However, local authorities seem more reserved in the usage of the new contract (Boes & Dorée, 2007:487). The introduction process is today seen as accomplished and the UAV-GC is considered to be a well-considered contract and procurement option by employers. All significant industry actors are aware of the UAV-GC and its processes.

The UAV-GC focusses on the integration of the process, the teams and lifecycles of the project and assigns more responsibilities towards the contractor, for example through a design and construct procurement. The assignment of more responsibilities and therefore risks towards the contractor can lead to more pressure on profit, however if well managed can become a good opportunity to create more profit. The consequent emphasis on the

management of the project risks by the contractor must lead to a higher level of project management and consequently improve project results. In addition, the UAV-GC must create more value for money by involving the contractor at an earlier stage and by using his knowledge in the design stage. This must create an innovative process that leads to more efficient and effective construction. At last the employer shifts parts of his design risks towards the contractor and consequently creates more price certainty upfront. The UAV-GC can therefore also be seen as an innovative procurement strategy.

By comparing the described South African and Dutch innovations and their introduction provides valuable lessons about the critical barriers for the adoption and required success factors for a successful implementation of a new contract by its industry. Before the research objective is presented, the definition of the problem is discussed in the next sub-chapter.

1.2 Problem definition

The adversarial environment within construction projects in South Africa that is created by the general use of traditional contract forms often leads to schedule delays, cost overruns, opportunistic behaviour, disputes and litigation. This commonly leads to a dissatisfied employer due to bad project performances that are associated with lacking collaboration. An opportunity for improvement, by means of the NEC, seems to be present but is not broadly adopted by the South African construction industry. It is not clear yet why the adoption of the NEC is of such a difficult nature.

For the successful adoption of the NEC it would mean that generally all the parties in the industry that work with contracts and procurement must know and understand the NEC and its procedures. The implementation percentages of the NEC should therefore increase and at least reach to an equal share in comparison to the other contracts. Lastly, the implementation of the NEC in construction projects should be according to the right NEC philosophy to benefit the most.

1.2.1 For whom is that a problem?

The adversarial nature of construction projects, reflected from the used contract, is a problem for both the employer and the contractor. Since the adversarial behaviour could

lead to opportunistic behaviour from both sides and has a resulting win-lose environment instead of a collaborative win-win environment, both parties are more prone to losses.

1.2.2 Why is that a problem?

Due to the lack of collaboration resulting from adversarial relations, project performances are often not optimal and therefore employers are not achieving best value for money through the use of a traditional standard construction contract. While the innovative NEC seems to be an available and promising improvement (Frehse, 2013:101), it is still not broadly used (Marx, 2013; CIDB, 2014). This might be a missed opportunity for the construction industry to increase its efficiency and to achieve better project performances.

1.2.3 What is known about the problem?

The contractual causes and problems of adversarial relations in construction projects have been academically researched (Walker & Davis, 1999). Solutions by means of new 'modern principles of contracting' are already proposed (Latham, 1994). The NEC is found to be in accordance to these 'modern principles of contracting' (Lord, 2008). There is already much academic literature available that tested the advantages and disadvantages of the NEC and its improvements to construction project outcomes, the outcomes are mainly positive (e.g. Broome & Hayes, 1997; Sun & Oza, 2006; Thompson *et al.*, 2000 and Wright & Fergusson, 2009). Irrespective of those positive NEC experiences it is found that the NEC is not broadly adopted in South Africa (Marx, 2013; CIDB, 2014).

1.2.4 Problem statement - What is not yet known about the problem?

It is not known why the NEC is adopted with difficulty in South Africa. The question remains what the barriers of implementation are, if those can be overcome and what the associated success factors are for a broader adoption and successful implementation of the NEC. It is furthermore not well-known what the experience is of the minority of completed civil projects executed under the NEC. These experiences might further substantiate why the introduction is difficult or why the NEC deserves a broader adoption.

In addition it is helpful to compare a similar situation in a different environment by reviewing the developments and lessons learned from the introduction of the UAV-GC in The Netherlands. Similarly to the NEC introduction, the critical success factors of the UAV-GC adoption are not well described in literature. Moreover it is not well described which barriers the introduction of the UAV-GC encountered to achieve the adoption by its civil industry.

By comparing the NEC introduction in South Africa with that of the UAV-GC in The Netherlands, the respective critical barriers and success factors can be identified. Also a recommendation is given in this study for the best approach towards a broader adoption of the NEC.

1.3 Research objective

The aim of this study is:

To understand the slow introduction of the NEC in South Africa and to recommend improvements for its introduction.

1.3.1 Research sub-objectives

The sub-objectives of this research are:

1. To identify problems and the associated opportunities for innovation and improvement in the use of standard construction contracts for South African civil projects.
2. To investigate if a broader NEC adoption is beneficial for South Africa based on the present NEC experiences.
3. To identify the similarities and differences between the NEC3 ECC and the UAV-GC, its innovations and its introduction in their respective civil engineering industries.
4. To identify the critical barriers and success factors for the implementation of the innovative NEC in the established contracting environment of the South African civil engineering industry.

5. Recommend possible improvements in procurement and contract management within the civil engineering environment in South Africa.

1.4 Research question

The research objective is achieved by answering the following research question:

What are the barriers for a broader adoption and what are required success factors for the implementation of the NEC3 ECC in South Africa

1.4.1 Research sub-questions

The research has the following sub-questions to answer the research question:

1. What are the contractual problems and innovations in the civil engineering industries in respectively South Africa and The Netherlands?
2. NEC3 ECC introduction in South Africa:
 - (a) Should the NEC be broader adopted by the South African civil engineering industry?
 - (b) What are the advantages of the NEC3 ECC?
 - (c) What are the disadvantages of the NEC3 ECC?
 - (d) What are the critical barriers for the implementation of the NEC3 ECC in South African civil projects?
 - (e) What are the required success factors for a broader adoption and successful implementation of the NEC3 ECC in South African civil projects?
3. UAV-GC introduction in The Netherlands:
 - (a) What has been the motive for the creation of the UAV-GC?
 - (b) How is the UAV-GC introduced into the industry and what are the experiences of the introduction process?
 - (c) What are the advantages of the UAV-GC 2005?
 - (d) What are the disadvantages of the UAV-GC2005?

- (e) What are the critical barriers for the implementation of the UAV-GC 2005 in Dutch civil projects?
- (f) What are the required success factors for a broad adoption and successful implementation of the UAV-GC 2005 in Dutch civil projects?

1.5 Relevance of the research

This thesis research has to be of relevance to the South African society. The relevance is split up in three different components, namely academic, practical and societal relevance. The three different components are subsequently described in the next three paragraphs.

Academic relevance

The academic relevance of the research is reflected by the results from several academic investigations that concluded deficiencies in the use of the current construction contracts in South Africa. Mbachu & Nkado (2007) found many factors constraining project success in construction to be a result of contractual aspects and adversarial relations. Visser & Joubert (2008) ranked legal exposure because of the existence of contractual risks within the standard contract conditions as the fourth biggest construction risk in South Africa. Jerling (2009:97) identified three contractual risks amongst the ten biggest risks that employers generate from the perspective of the contractor. These investigations are discussed in more depth in the Literature Review, section 2.6.3. They underline the importance for South African to reform its contract management of construction projects. Therefore it highlights the academic significance of the question of why a possible opportunity for change through a new and innovative NEC is not more broadly adopted. It has furthermore not yet been investigated what the existing barriers are for a NEC adoption in South Africa.

Practical relevance

The majority of civil projects are those with a public employer and the majority of public construction projects are of a civil nature. The public sector shows, since 2009 and forecast until 2015, a high growth in the public capital expenditure on construction projects, depicted in Figure 1.2.

It is to be expected that construction companies should benefit from the increase in work that public authorities are providing. However, if the share index of all the construction

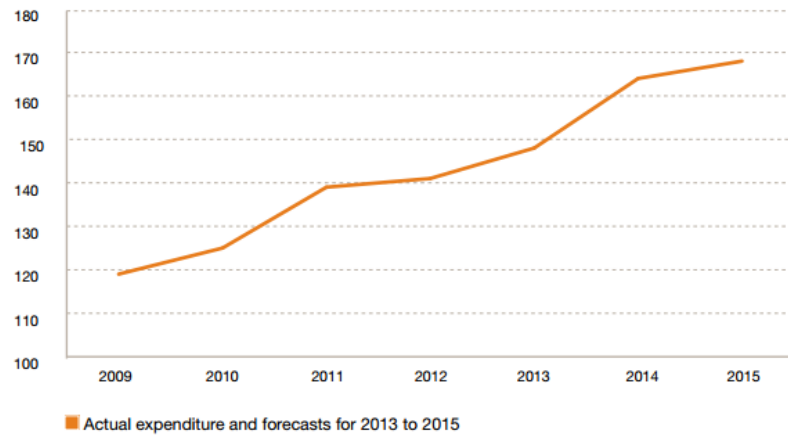


FIGURE 1.2: Construction-related public capital expenditure (R 'billions) (Pwc, 2013)

companies together is compared against the share index of all the companies listed in the JSE it shows no growth of the construction companies against a high growth of the JSE in general, depicted in Figure 1.3. The construction industry can therefore be seen as a less successful and more inefficient industry.

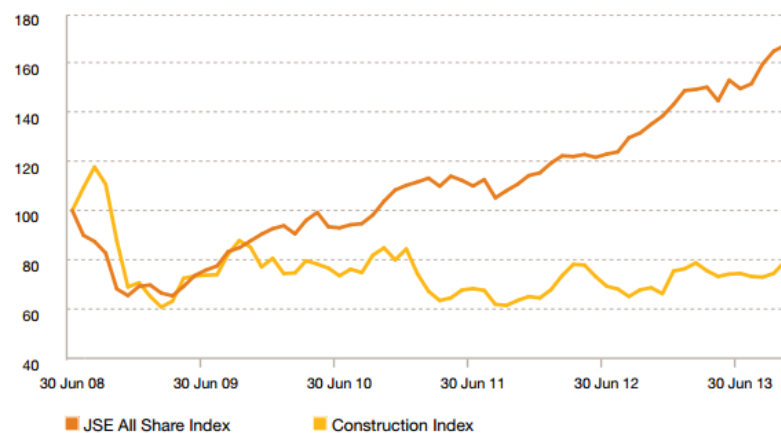


FIGURE 1.3: Market capitalisation: JSE vs construction (Pwc, 2013)

An analysis of the performance of the South African construction industry, conducted by Pwc (2013), shows that there is a necessity and opportunity for the construction industry to improve its performance and efficiency. Furthermore, the report concluded that the price competition between contractors has increased and eroded their margins to the longer-term average of between 2% and 3%. Despite the lower margins for contractors, the problem of projects that run over budget and are delayed is still present in South Africa and troubling the employer. It is therefore of necessity to create more incentives for good project performance by contractors to enable them to increase their profit

margins and to improve the efficiency in the South African construction industry. Many benefits of the NEC are identified by literature that could lead to better project results (e.g. Broome & Hayes, 1997; Sun & Oza, 2006; Thompson *et al.*, 2000 and Wright & Fergusson, 2009). This would possibly invoke an improvement in the efficiency of the construction industry. This again highlights also the practical significance of the question of why a possible opportunity for improvement through an innovative NEC is not more broadly adopted by the South African employers.

Societal relevance

The employer pays for a construction project, which can be private employers or tax payers through public employers. If a construction project is not efficient and therefore more expensive than necessary, the private employer and the government actually could have saved money to spend elsewhere. Especially a saving in the government's expenditure on construction could create an opportunity to use the money for other important societal purposes. Therefore an improvement on the efficiency of the construction industry, possibly by means of the adoption of the NEC, is also of societal relevance and should be investigated.

1.6 Research design

The research is divided into four phases and is designed as represented in the research framework in Figure 1.4. This sub-chapter will discuss the four different research phases.

Phase 1: Literature review

A literature study is conducted to further study and to validate the problem statement. The literature review investigates what is already known about the problem and composes expected answers to the research sub-questions, based on the available literature. Shortcomings are identified as the motivation of this research.

Phase 2: Contractual analysis and industry perspective

In the Literature Review differences and similarities in contracting developments between South Africa and The Netherlands are identified. In phase 2 these findings are expanded by a contractual comparison of the NEC with the UAV-GC and by expert interviews. The expert interviews are furthermore conducted to further identify the expected potential of the NEC and to identify the industry barriers and required success

factors for the implementation of the NEC in South African civil projects. From the Dutch expert interviews the introduction experiences with the UAV-GC are explored.

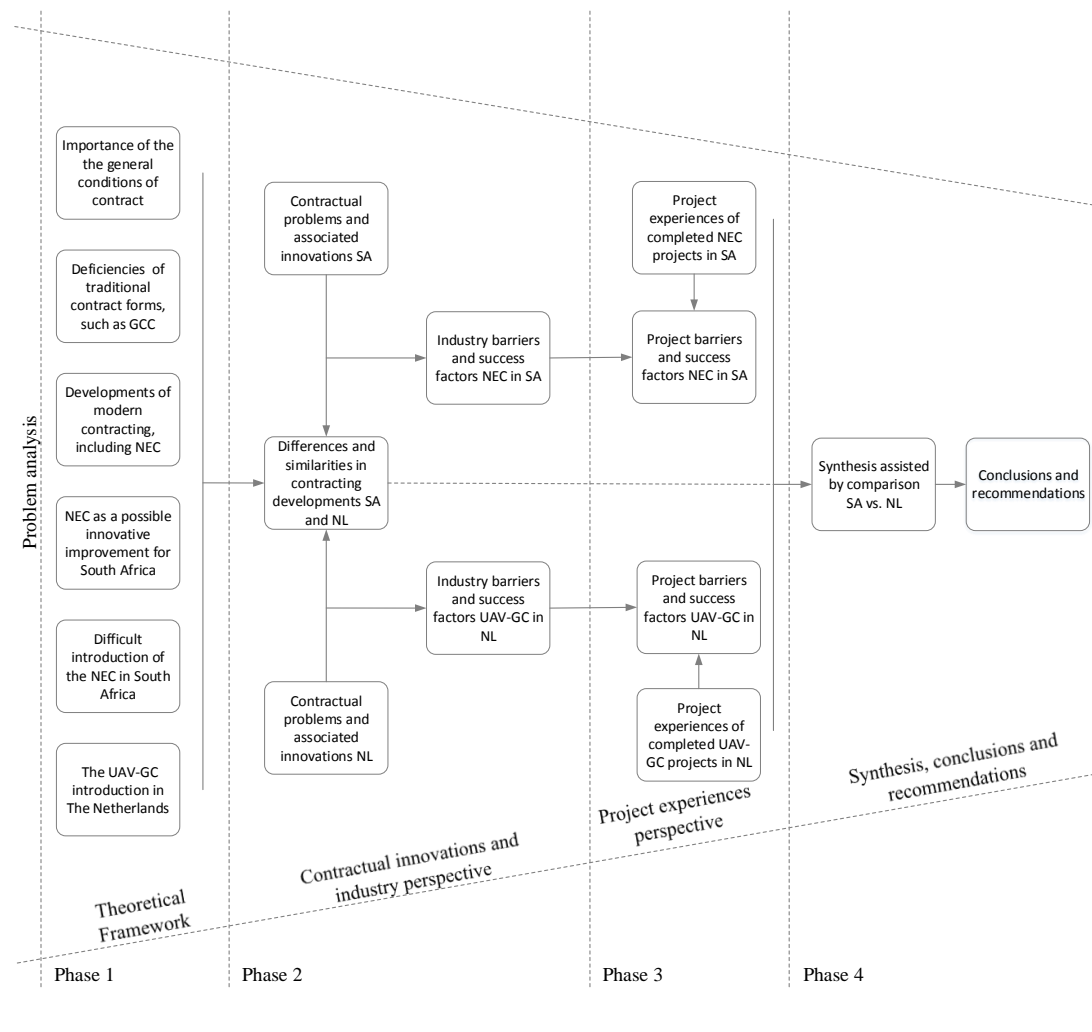


FIGURE 1.4: Research framework

Phase 3: Project experiences perspective

The third phase is focused on a project level. From the expert interviews the current achievements, benefits and experienced difficulties of the contracts within construction projects are evaluated. In addition, the barriers and the required success factors for a successful implementation of the investigated contracts are identified at project level.

Phase 4: Synthesis, conclusions and recommendations

After the data collection has been completed and analysed, the research findings are validated in the synthesis. The findings are compared with the expectations based on the literature, and by comparing the outcomes of the different data collection methods. This results in the identification of critical barriers and required success factors for the

implementation of the NEC into the South African civil engineering industry. This must clarify the problem statement by concluding an answer to the research question. Furthermore, recommendations are suggested in which strategies towards a broader adoption of the NEC are proposed. In addition, improvements are proposed towards procurement and contracting practices.

1.7 Research scope

Because of the comparison between the two contractual developments in the two different countries, the research is partly executed in South Africa and partly in The Netherlands. The scope of the research is narrowed down to civil projects. Civil projects are accounted as civil engineering works primarily concerned with the development, extension, installation, maintenance, removal, renovation, alteration, or dismantling of building and engineering infrastructure as defined by the CIDB (CIDB, 2011). Concerning parties of interest in this research are the employers, contractors and consultants that work with standard construction contract forms, such as the GCC, JBCC, FIDIC and NEC. The interviewees must reflect a good sample of the industry containing all different party types. The contracts investigated into detail in this research are the NEC3 ECC and the UAV-GC 2005.

1.8 Thesis structure

The presentation of the research in this thesis follows a logical sequences as depicted in Figure 1.5. The thesis structure is subsequently explained according to its sequence of chapters and the feedback links between the chapters.

Chapter 1 Introduction

This chapter introduces the problem and explains the associated research design.

Chapter 2 Literature review

An academic literature review is conducted in this chapter to investigate what is known and unknown about the research problem. This includes previous studies on same or similar areas of research and commentaries. Finally, expected outcomes on the research questions are formulated, which are based on the literature findings.

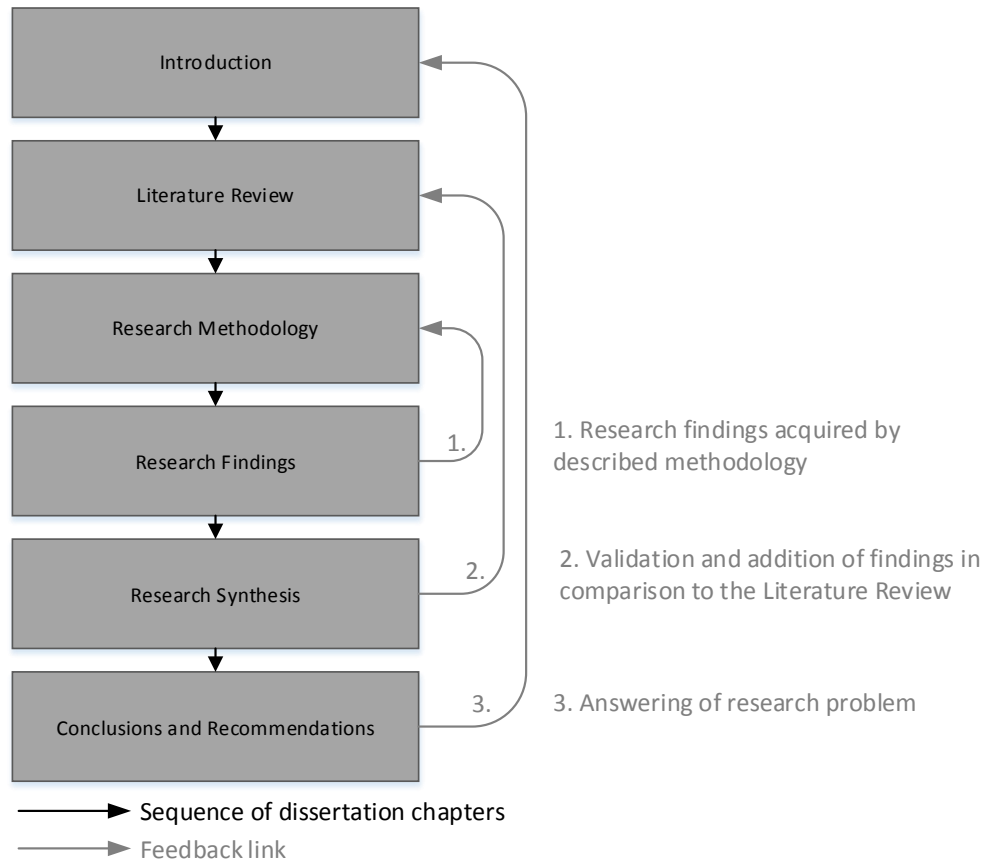


FIGURE 1.5: Logical sequence thesis

Chapter 3 Research methodology

The research methodology is explained in this chapter. The execution of the contractual analysis, expert interviews and short-questionnaire are explained together with the provision of trustworthiness.

Chapter 4 Research findings

The research findings chapter presents the research results. The results are obtained from four different methods and/or source types and these are presented in the following four different sub-chapters:

- 4.1 Contractual analyses and comparison findings

The results from the contractual analyses and comparison are discussed in this sub-chapter.

- 4.2 Expert interview findings from South Africa

The results from the expert interviews in South Africa are discussed in this sub-chapter.

- 4.3 Short-questionnaire results from South Africa

The outcomes from the short-questionnaires in South Africa are discussed in this sub-chapter.

- 4.4 Expert interview findings from The Netherlands

The results from the expert interviews in The Netherlands are discussed in this sub-chapter.

Chapter 5 Research synthesis

In the synthesis chapter the research findings are analysed, discussed and compared to answer the problem statement. The synthesis will furthermore validate the research findings by comparing them with the expectations from literature and by comparing the outcomes of the different methods.

Chapter 6 Conclusions and recommendations

This chapter provides a conclusion of the principal research outcomes. This chapter also provides recommendations for the South African civil engineering industry on the introduction of the NEC and on the topic of procurement and contracting practices. Finally, suggestions for further research are provided.

Chapter 2

Literature Review

This chapter presents a literature study of previous research and commentaries. The study is conducted on the introduction and implementation of standard construction contracts worldwide and specifically in South Africa and The Netherlands. The Literature Review is discussed in eight sub-chapters, as depicted in Figure 2.1. First, the definition and the impacts of standard construction contracts are discussed after which the problems associated with traditional contract forms are explained. Then the opportunity for improvement is discussed by means of innovative contractual mechanisms and more specifically the use of the innovative NEC contract form. Thereafter, the focus changes from a worldwide perspective towards subsequently the South African and Dutch perspective. Lastly, a literature synthesis concludes the expected answers on the research sub-questions based on the literature study findings. In addition, it will identify the shortcomings of the available literature as the motivation for this research. Furthermore, it also provides a comparison between the South African and Dutch situations.

2.1 Definition and impact of a standard construction contract

This first sub-chapter defines a standard construction contract and its implication on a construction project, as depicted in Figure 2.1. Under this heading a standard construction contract, contractual risks and contractual disputes are described.

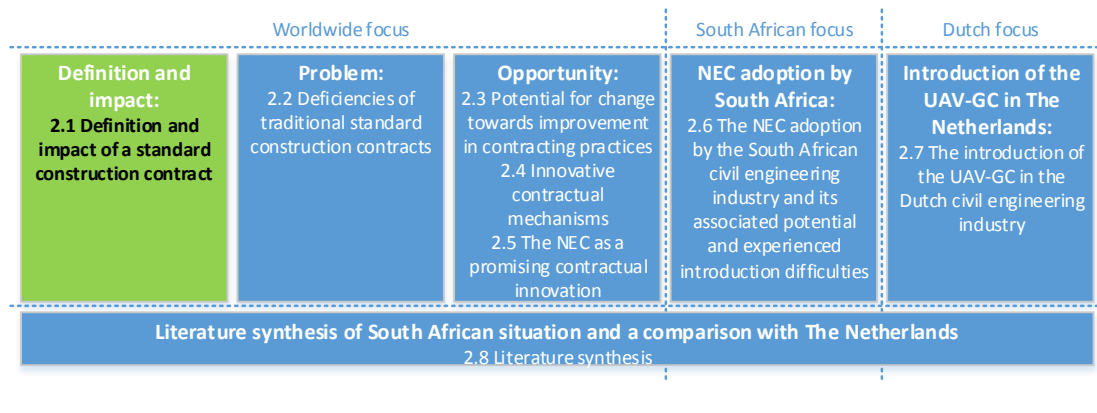


FIGURE 2.1: Overview of Literature Review - Sub-chapter 2.1

2.1.1 Standard construction contract

The complexity of construction projects requires the use of lengthy and carefully written construction contracts to precisely define the contractual arrangements. The standard contract form defines the general conditions of the contract to which the parties must conform to. General conditions of contract are worldwide standardized into many different contract forms, such as the GCC, JBCC, FIDIC, NEC and UAV-GC. The general conditions of contract define the relationships between the parties according to its rights and responsibilities and furthermore spell out the general project rules and commercial terms (Bubshait & Almohawis, 1994). The wide use of local and international standard construction contracts reflect a recognition of the advantages. Two of the main advantages are the ongoing possibility for improvement and the emergence of familiarity. Improvements over a long period of time should lead to more clarity, fairness and efficiency while familiarity will reduce time and effort to prepare and review the contract documents and will reduce bid-price contingencies (Bubshait & Almohawis, 1994).

General conditions of contract play a large role in the successes or failures of a construction project in terms of cost, time, quality, and the satisfaction of the contracting parties. The general conditions therefore require thorough review by both the employer and the contractor as a source of project risk that needs to be assessed (Bubshait & Almohawis, 1994).

2.1.2 Contractual risks

Several aspects need to be considered when evaluating the effect of the general conditions of a standard construction contract on the project performance. The most important aspects are: the anticipation of potential disagreement in the relationship between the contracting parties, the use of language, fairness and the promotion of the achievement of project success in terms of cost, time, quality and safety (Bubshait & Almohawis, 1994). Bubshait & Almohawis (1994) proposed that these aspects be broken down in a checklist of 11 attributes that measure the effect on project performance or on the contrary, in a lacking situation, measure the contractual risks of a standard form of contract. These 11 attributes are:

- Clarity: General conditions are easily understood and free from ambiguities.
- Conciseness: General conditions are concise and do not contain superfluous material.
- Completeness: General conditions are comprehensive containing all relevant aspects.
- Internal consistency: The clauses of the general conditions are consistent with each other.
- External consistency: General conditions are not in contradiction with any other applicable regulations.
- Practicality: Conditions are practical to implement.
- Fairness: General conditions are fair to both the employer and the contractor.
- Effect on cost: General conditions promote the completion of the project within the budget.
- Effect on schedule: General conditions promote the completion of the project within the time duration.
- Effect on quality: General conditions promote the quality of materials and workmanship.
- Effect on safety: General conditions promote the completion of the project without major accident or injury.

Higher contractual risks may enable adversarial relations and disputes to arise and could diminish collaboration and good project management. As a result project objectives such

as cost, time and quality may be under pressure. Most disputes are directly related to the contract and therefore some further explanation of the materialization of disputes is described in the next paragraph.

2.1.3 Construction disputes

Jaffar, Abdul Tharim & Shuib (2011) describe a construction dispute in their review paper as an "argument about an issue concerning project operations, usually resulting from a debate over differences in two or more parties' understanding of situation". Harmon (2003) describes common aspects of a construction project that has effect on a possible inception of a dispute to be: size and duration of the project, contract document, condition changes, communication, resources, financial issues, design, labour and force majeure events.

Cheung & Pang (2013) researched the anatomy of construction disputes. Their research concluded the existence of two different categories of construction disputes, respectively contractual disputes and speculative disputes. Those categories can again be divided into smaller factor groups and further into smaller factors according to Figure 2.2. As shown in Figure 2.2, contract incompleteness plays an important role in both the contractual as the speculative disputes. From Figure 2.2 can be concluded that, to prevent construction disputes, the project environment must be focussed on a fair allocation and effective management of risks, stimulation of good collaboration, prevention of the four factors of contract incompleteness, reduction of the opportunity for opportunistic behaviour and the stimulation of a team effort by creating shared objectives to prevent affective conflicts. An important tool to create a project environment that is focussed on these factors is the standard construction contract (Bubshait & Almohawis, 1994).

Although it is known what attributes a standard construction contract must have to effect successful project outcomes and what some of the consequences are if these attributes are not present the traditional standard construction contracts still contain several deficiencies. Consequently projects are often subject to disputes and non-optimal project performances. These deficiencies within traditional standard contracts are substantiated in the next sub-chapter.

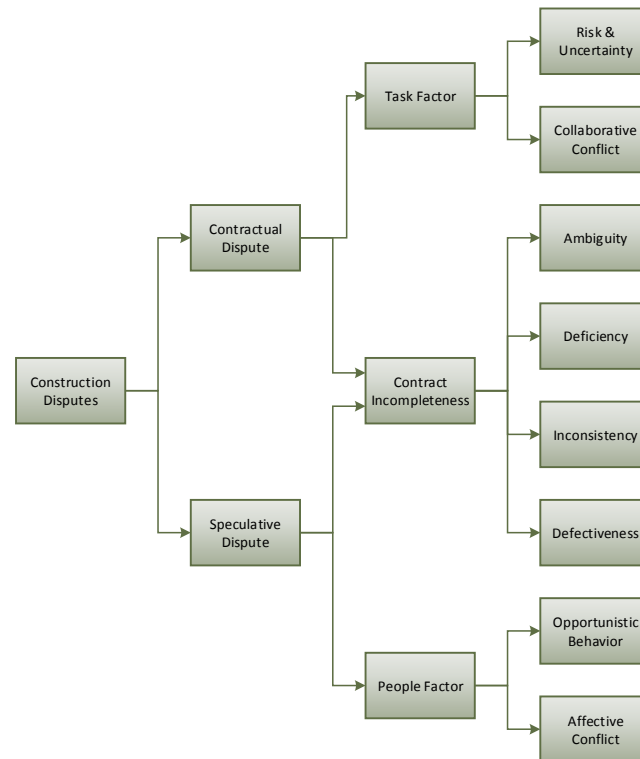


FIGURE 2.2: Construction dispute anatomy (Cheung & Pang, 2013)

2.2 Deficiencies of traditional standard construction contracts

There is much academic literature regarding traditional contract forms and its deficiencies. After a short introduction that defines a traditional contract form, the deficiencies are subsequently explained. This sub-chapter explains the problem with traditional contracts, as depicted in Figure 2.3.

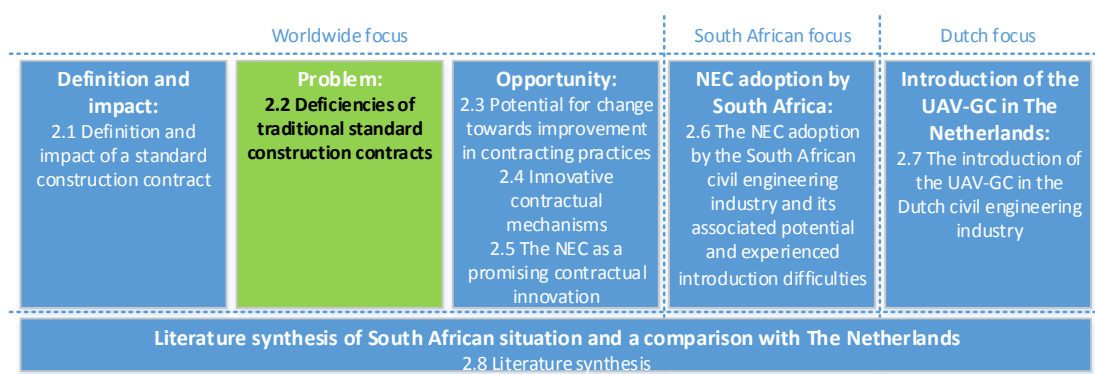


FIGURE 2.3: Overview of Literature Review - Sub-chapter 2.2

2.2.1 Traditional standard construction contract

Traditional standard construction contracts are based on the traditional legal relationships between a contractor and an employer, depicted in Figure 2.4. In the traditional process the employer first enters into a contract with a designer or consultant for the design under a professional services agreement after which the employer enters into a construction contract with a contractor for the execution of the design (Chao-Duivis, Koning & Ubink, 2013:51).

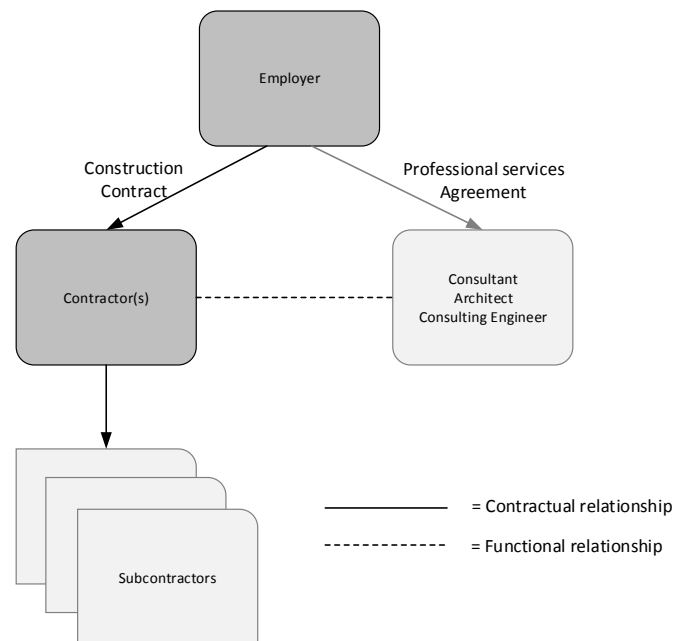


FIGURE 2.4: Traditional contractual relations (Chao-Duivis *et al.*, 2013:51)

A traditional standard construction contract is furthermore considered to be one of a solely transactional nature where relational aspects are limited (Dubois & Gadde, 2000; Thompson, Cox & Anderson, 1998). Another attribute of traditional standard construction contracts is the use of precise legal language. However this has created unquestionable content within a first draft, as revisions were incorporated the language became increasingly complicated and ambiguous. Consequently, more and more revisions became necessary to repair the loopholes that existed. Because the loopholes became exploited has led to a climate of dispute and argument (Wright & Fergusson, 2009).

The problems associated with the mainly transactional attributes and the difficult legal drafting style of traditional standard construction contracts are explained in the following subsequent (sub-)paragraphs:

- The creation of adversarial relations and behaviour
 - Transactional instead of relational contracting attributes
 - Principal-Agent theory
 - Contractual gamesmanship
- Lack of clarity
- Lack of flexibility
- Lacking engenderment of project management

2.2.2 The creation of adversarial relations and behaviour

Over the years the construction industry has developed adversarial relationships with an associated lack of co-operation, ineffective communication, strive for the maximization of self-interest and lack of trust (Chan, Chan, Chiang, Tang, Chan & Ho, 2004). It is assumed in many academic literature that the traditional standard construction contracts create the presence of an adversarial environment instead of providing an incentive to collaborate on project changes and to avoid disputes (e.g. Thompson *et al.*, 2000, Chan *et al.*, 2010b and Harmon, 2003). Several causes for the creation of adversarial relations by traditional contract forms can be found from literature.

It is reasoned that traditional contract forms still have difficulties to embrace change by trying to specify every possible eventuality, what results in a retrospective worst-case scenario contract (Chan *et al.*, 2010b). Consequently, employers often amend traditional standard contracts to seek for a higher degree of certainty of time, cost and quality (Chan *et al.*, 2010b). Usually this leads to inappropriate allocations of risks between the parties, with an onerous risk allocation on the contractor. Furthermore, Rooke, Seymour & Fellows (2003) state that this onerous transfer of risks to the contractor in combination with the existing unilateral domination of price competition in tenders has led to a claim culture in the construction industry. The claim culture has become accepted and consequently opportunism has become a common practice thereof, which further develops adversarial relations and lacking trust between project parties. In addition,

there are two supplementary theories that describe the causes within traditional standard contracts that create adversarial relations. Both the transactional contracting style and the principal-agent relationship within a traditional contract form are assumed to be the main causes (Walker & Davis, 1999). Especially the combination of the two is of high influence and are subsequently described.

Transactional contracting attributes instead of relational

The complexity, uncertainty and multidisciplinary aspects of construction projects require a high level of collaboration to manage the project and its changes to an optimal performance. A traditional contracting approach treats the construction transaction discreet and formal and requirements for collaboration between the contracting parties are limited (Walker & Davis, 1999). In contradiction to the collaborative requirements, the transactional aspects tend to enable adversarial relationships based on ineffective communication, a lack of cooperation and limited trust.

Walker & Davis (1999) summarized several relational aspects, such as:

- Communication is extensive and both formal and informal
- The contract involves extended mutual planning
- The success of the contract is entirely dependent on further co-operation in both performance and planning
- There is sharing of both benefits and burdens

The lack of relational attributes is seen as an important deficiency in embracing the inevitable changes in construction projects.

Principal-Agent theory

A transactional approach isn't necessarily adversarial. However, if contracting parties are assumed to behave in a Principal-Agent model the possibilities for conflict are especially significant under a transactional contracting approach (Walker & Davis, 1999). Walker & Davis (1999) presume that contractual relationships based on a Principal-Agent theory creates a struggle for individual benefit maximization instead of mutual benefits. The cause for this lies in the degree of transactional dependence of Agent on Principal and vice versa. If one party is more dependent on the other, then the greater the possibility is that the one is starting to exploit the other. In this way, one party is acting opportunistic as the other party is locked into the relationship.

Therefore the consequence of adversarial relations is often opportunistic behaviour. When opportunistic behaviour is based on the contractual practices this is often mentioned as contractual gamesmanship. The next sub-paragraph explains the contractual gamesmanship practices and associated attitudes.

Contractual Gamesmanship

Opportunistic behaviour often evolves when contingencies have to be resolved. Traditional standard construction contracts therefore try to cover all the possible contingencies to prevent contractual gamesmanship. However, Walker & Davis (1999:22) stated that "contracts are inevitably incomplete since the unpredictability of the future makes it virtually impossible to write a contract covering every eventuality relevant to the obligations of the parties. Neither to specify enforceable penalties for every instance of non-fulfilment". Uncovered or ambiguous contingencies are inevitably going to arise. Then, as a consequence of adversarial relations, the contracting parties will possibly behave opportunistic by taking advantage of asymmetrical information and uncertainty to benefit themselves over the other.

The described existence of contractual gamesmanship has led to a claim culture. Rooke *et al.*(2003) investigated the attitudes of contractors and employers in a claim culture. The contractor considers a claim strategy as a justifiable mechanism for incomplete design work in a competitive environment and the employer has a contradicting opinion that claim strategies are devious methods of generating profit without production (Rooke *et al.*, 2003). Those adversarial attitudes and the created claim culture that has become a common practice resulted in a construction environment infected by disputes.

2.2.3 Lack of clarity

The study by Rameezdeen & Rajapakse (2007) reveals that there is a strong relationship between readability and contract interpretation. The study found that the easiness of reading the clauses creates a high degree of commonality in interpretation by different readers. Therefore Rameezdeen & Rajapakse (2007) concluded that the clarity of a contract is lacking if the contract has a low degree of commonality because of difficult language.

There are two different studies conducted to test the readability of the FIDIC (International Federation of Consulting Engineers), which is one of the most well-known and

used international standard construction contract and considered to be a traditional one. The first research was conducted by Bunni (1986:8) which revealed that 86 % of the sentences could only be understood by people with an IQ of more than 130, which is equivalent to only 4 % of the population.

Another research was conducted in 2007 by Rameezdeen & Rajapakse (2007) which concluded that the language of the FIDIC contract is still very difficult, and it requires a postgraduate level of knowledge to interpret. According to those two investigations the language is of a difficult kind and therefore according to the study of Rameezdeen & Rajapakse (2007) has a high possibility of not providing commonality and clarity.

This is in accordance with the research by Broome & Hayes (1997) who conducted a survey under distinguished legal commentators, courts, The Plain English campaign, practitioners and others from whom they got the response from all that the existing conditions of traditional standard contracts do not achieve clarity. There was even a complete absence of anyone who was praising it. Broome & Hayes (1997) also investigated why traditional standard contracts were lacking in clarity and identified three main causes, which are subsequently described as:

- **Origin**

The origin of the standard contract is a contract document written by lawyers that were not specialized in construction. Instead the original document is drafted by lawyers with little or no experience of the background and needs of a construction project. Therefore the origin of the document reflects a lack in knowledge of the practical or commercial problems and situations on a construction site (Broome & Hayes, 1997).

- **Age**

Much of the language and phrases within the traditional forms of contract are still based on old and preceding contracts that are for example 100 years old. Therefore, although the industry and its structure and technology have dramatically changed over the last decades, the defined relationships between organizations are still based, albeit with many modifications, on those up to 100 years ago (Broome & Hayes, 1997).

- **Development by committee**

Standard construction contracts have been increasingly developed and revised by

committees in the last decades. According to Broome & Hayes (1997) committee developments have however not always led to improvements in clarity for mainly three reasons:

– *Partisanship*

A committee approach often created partisanship instead of a consensus. Partisanship shows itself in improvements within the contract that are inserted to gain advantage over the other party and to promote the status and role of their respective profession (Broome & Hayes 1997).

– *Lack of direction*

Although the development of the traditional standard contract shows an intention to achieve a certain objective it is presumed that it is hardly something else and more specific than a general objective to improve the operation of the form. Basic principles are not taken into account while revising a traditional standard form of contract and therefore the developments lack in direction (Broome & Hayes 1997).

– *Amendment*

Users often heavily amend and supplement the traditional standard contract forms due to the unacceptance with the committee consensus. Often the original conditions are restored partly or completely which return the industry back to its former situation (Broome & Hayes 1997).

The lack of clarity creates different interpretations of the clauses within the contract and obstructs the smooth performance of a construction project (Rameezdeen & Rajapakse, 2007). The resulting ambiguity is furthermore identified as one of the causes for construction disputes.

2.2.4 Lack of flexibility

Traditional standard construction contracts often lack flexibility in contract strategy. A traditional contract form is often not suitable for all different construction disciplines, different levels of contractor design, the various different procurement strategies and different payment mechanisms (Frehse, 2013:12&26). Moreover, traditional contract forms do not form part of a family of contract documents which are drafted around a modular

structure to easily assemble a 'best fit' procurement and in which a similar structure and terminology promotes back-to-back provisions to provide process integration and contractual cover (Watermeyer, 2012). The traditional forms however, often mainly provide for the lump sum and bill of quantities payment mechanisms (Frehse, 2013:13). Furthermore are the risk allocations in traditional contract forms also inflexible. The risks in traditional forms are precisely described and allocated. As a result, they are not able to tailor risk allocations to suit particular project circumstances without amending the contract (Frehse, 2013:27).

2.2.5 Lacking engenderment of project management

Traditional standard construction contracts also often don't promote good project management. The main causes are that they don't align project objectives by providing enough incentives and that they don't stimulate the contractual parties to perform good project management in a collaborative way. A main consequence is that especially the change management system within a project is ineffective and leads to overspending, delay and disputes (Sun & Oza, 2006). The next two sub-paragraphs discuss more explicitly the main causes and consequences of the lack of good project management practices.

Lack of incentives and stimulation on good project management and collaboration

The influential Egan Report in 1998, named *Rethinking Construction* (Egan, 1998), advocated that all parties in the project team must share successes in line with the value they add to the employer and that employers therefore should not take all the benefits. To enable cost savings through good project management a proper incentive arrangement must be in place to share the savings between the project team members according to fair and reasonable returns. The purpose of a construction contract must be to create such a cooperative system that has common objectives among the contracting parties through properly incentivizing the contractors for their performance (Turner & Simister, 2001). However, traditional standard construction contracts tend to be unable to achieve this (Chan, Chan, Lam, Yeung & Chan, 2011). Consequently an environment with a lack of collaboration between the parties in the project team is created which leads to risks and changes being ineffectively managed, in a reactive way instead

of a collaborative and proactive approach. A traditional standard contract furthermore doesn't enforce any requirements for a proactive management of risks and changes by means of prescribed risk management procedures.

Ineffective change management system

The construction industry becomes increasingly complex and has an increasing multi-disciplinary level within its projects. As a result, construction projects contain higher uncertainties and risks and consequently are more often subjected to change. Changes in a construction project refer to modification or alteration to specification, time or cost (Sun & Oza, 2006). This however also includes the variations generated by the employer and the changes that are inflicted by risks that are required to be managed by the employer. Therefore, project delays, overspending and disputes are not always the fault of the project team but are also often caused by the employer. Cheung & Pang (2013) describe that a common deficiency in traditional contract forms is that the rules for a substantial change to the project are not clearly described, which often leads to a dispute. To prevent this cause for a dispute, the contract should therefore give a clear guidance for project change and should provide a collaborative change management approach. Changes can be caused by both parties and can negatively affect both parties in the contract. However, because traditional standard contracts are of a transactional nature that attempts to specify the roles, responsibilities and the allocation of risks in all possible eventualities, there is little room for negotiation. Consequently changes to the project are not well embraced. A traditional standard contract is therefore only prepared for worst-case scenarios (Chan, *et al.*, 2010b).

This is reflected in the research conducted by Lee & Zou (2009) who compared the construction industry against other industries on its change management practices. They concluded that construction projects less frequently have changes evaluated against the project business drivers and success criteria than projects in other industries. Furthermore, construction projects perform worse on the lessons learned from change management and on evaluating the causes and impacts of changes on project cost and schedule performance after project completion.

In addition, Lee & Zou (2009) concluded that employers and contractors have different views on dealing with project changes. Therefore it is of importance to have a formal and precisely described change management system in place in the project. From these findings it can be concluded that the construction industry has to improve the change

management system which is described by traditional contract forms.

Table 2.1 shows a concluding overview, described by Chan *et al.*(2010b), which summarizes the attributes and consequences of the deficiencies of traditional contract forms.

TABLE 2.1: Traditional contract (Chan, *et al.*, 2010b)

Attributes of traditional standard contracts	Consequences of traditional standard contracts
Enables contractual gamesmanship	Uncertainty of outcome
Lack of clarity	Adversarial attitudes
Lack of flexibility	Conflicts
Does not incentivize good project management	Claims
	Arbitration
	Legal costs
	Wasteful practices

The potential for improvement of the traditional forms of contract is subsequently explained.

2.3 Potential for change towards improving practices

Because of the stated deficiencies a need for a change away from the traditional approach of contracting seems clear. The potential improvements are subsequently described in this sub-chapter, as depicted in Figure 2.5.

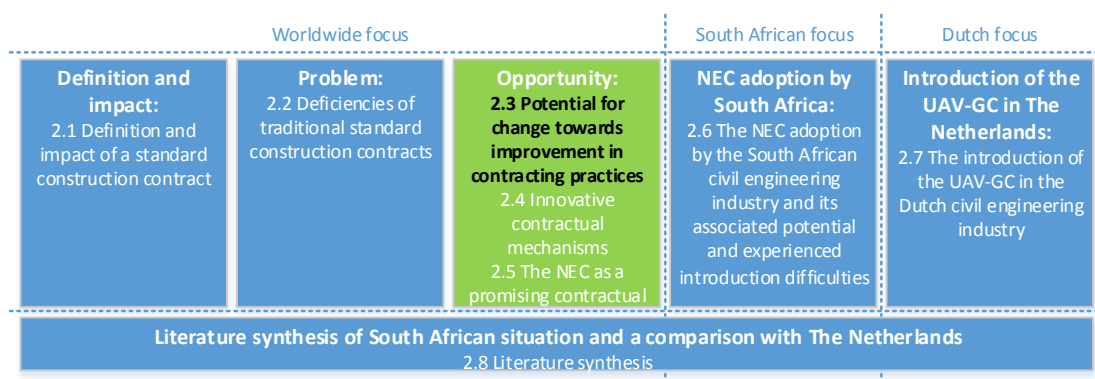


FIGURE 2.5: Overview of Literature Review - Sub-chapter 2.3

Relational contracting attributes are a potential improvement to the deficiencies of a transactional contracting approach. According to Walker & Davis (1999) a relational approach to contracting must be based on mutual trust, interpersonal attachment, commitment to specific partners, altruism and co-operative problem solving. Walker & Davis (1999) furthermore describe a necessary change of the current approach towards preventing problems. Parties should not so much discuss beforehand how to resolve each particular contingency but should agree on the collaborative procedure of resolving future contingencies. An open approach to solve the problem through reasoned negotiation is proposed as a first step in a relational approach. A relational approach to contracting must potentially result in a more collaborative attitude towards the project and will potentially diminish any adversarial relationships and behaviour. A contract should therefore not just be a legal protection when things go wrong but should be a guide of how to jointly and cooperatively manage the project to achieve the best project results (Thompson *et al.*, 2000).

In addition to the potential for relational contracting Table 2.2 shows an overview of some more potential improvements towards a traditional contract form, as identified by Chan *et al.* (2010b).

TABLE 2.2: Improved contract (Chan, *et al.*, 2010b)

Potential attributes of improved contract	Potential consequences of improved contract
Commonality	Reduced conflict/disputes
Certainty of outcome	Improved delivery of service
Added value	Improved quality control
Win-win situations	Improved management of change
Improved management	Culture change
	Improved dispute resolution
	Management tool

According to the research by Broome & Hayes (1997) there are no arguments for a status quo or a further use of traditional standard contracts other than familiarity and legal precedence. Leading reports as 'Constructing the Team' from Latham (1994) and 'Rethinking Construction' from Egan (1998) have led to new developments in contracting styles, which can be called the principles of modern contracting and are discussed in the next paragraph.

2.3.1 Contracting principles for an effective form of contract

In 1994 Sir Latham wrote 'Constructing the Team', also known as the Latham report, which reviewed the British procurement and contractual arrangements in the construction industry. Sir Latham was assigned by the British government and industry organisations to identify industry inefficiencies and to recommend solutions to tackle issues that obstruct industry growth as a whole. The report gained industrial and governmental support in the UK.

The Latham Report (1994) identified the construction industry as adversarial, ineffective, fragmented, incapable of delivering for its employers and lacking in respect to its employees. Latham (1994) furthermore recommended to increase efficiency by openness, co-operation, trust, honesty, commitment and mutual understanding among team members.

More specifically towards the general conditions of construction contracts, Latham (1994) recommended 13 principles of modern contracting to achieve the most effective construction contract:

1. Easily understandable language
2. Clear distribution of duties between the parties to deal fairly with each other
3. The roles of administrator, project manager and adjudicator are separated
4. Teamwork as a duty including shared financial motivation to create a win-win scenario
5. An interrelated family of contracts suitable for all procurements
6. Flexibility to allocate risks to the party best able to manage, estimate and carry the risk
7. Avoidance of unnecessary variations and price necessary variations in advance
8. Flexibility in choice of payment method
9. Clearly defined payment periods
10. Provision of secure trust fund routes for payment
11. Provision for advanced mobilization payments
12. Provision of incentives for highly successful project performances
13. Provision of quick dispute resolution

In his research, Latham (1994) strongly criticised the then existing standard forms of contract in the UK, the Joint Contract Tribunal (JCT) and Institution of Civil Engineers (ICE) forms, and the means by which they were produced. These contracts Latham referred to can be seen as traditional standard forms of contract. These traditional contracts are according to Latham (1994) not effective, unable to solve adversarial problems and therefore often heavily amended. In addition, Latham (1994) assessed these contracts not to conform to the modern principles of contracting. The contractual innovation, by the means of the NEC, however received his approval for being in accordance with all modern principles of contracting. The problems with traditional contracts are shown worldwide and accordingly to the report by Latham, gained worldwide attention and acknowledgement.

2.4 Innovative contractual mechanisms

In accordance with the potential for improvement and the modern contracting principles some innovative contractual mechanisms were introduced as part of some standard construction contracts the last two decades. In this sub-chapter the main innovative mechanisms are discussed, depicted in Figure 2.6.

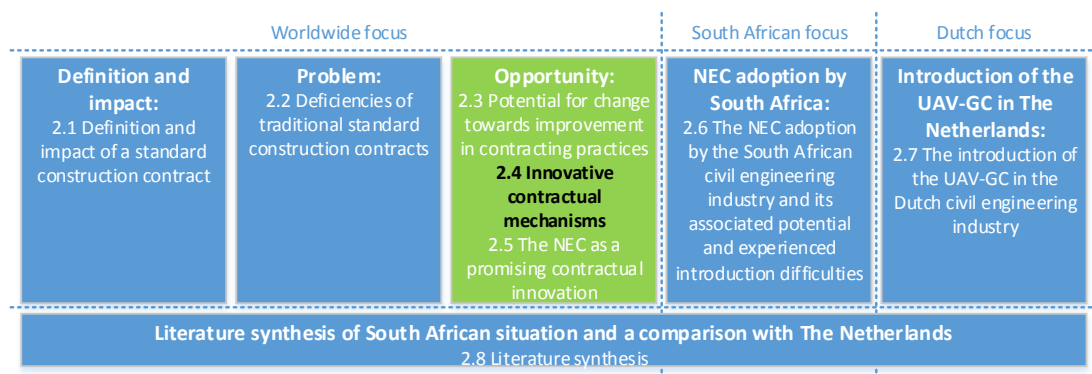


FIGURE 2.6: Overview of Literature Review - Sub-chapter 2.4

Some of the innovative contractual mechanisms that worldwide increasingly are applied the last two decades are subsequently discussed.

Relationship contracting

Relationship contracting is defined by The Australian Constructors Association (ACA, 1999) as "a process to establish and manage the relationships between the parties that

aims to remove all barriers, encourage maximum contribution and allow all parties to achieve success". There are two different approaches towards relationship contracting that differ in the intensity of the relation between the two contracting parties, namely partnering and alliancing.

Target contract

Target contracting is a pricing strategy that puts an incentive on performance. The contractor gets incentivized for any savings made against the target cost and on the contrary will be penalized for any overspending against the target cost due to his own mismanagement or negligence according to a pre-agreed share ratio (Chan, Chan, Lam & Wong, 2010a).

Enforced collaborative and proactive change management

Change management requires nowadays more attention and specification than usual in traditional contract forms. According to the modern principles of contracting it is therefore required that a proactive change management system according to a collaborative, clear and consistent method and procedure be defined and prescribed by a standard construction form. The contract should therefore give a clear guidance for project change and should emphasize a collaborative project and risk management approach through requirements for (Sun & Oza, 2006):

- Early warnings
- Regular risk reduction meetings
- Pre-assessment and pre-agreement of change
- The assignment of the mitigations of the change impacts to the party best able to handle
- Change assessments as a package of time and money instead of the traditional separation of extension of time and variations

Integrated contract

Another worldwide development that is noticeable from the last two decades is the procurement of Design & Construct type of projects that require a design responsibility by the contractor. As a consequence standard construction contracts were required to develop a specific form or were required to contain the flexibility to provide for this type of procurements. Projects including contractor design responsibilities are often contracted

through an integrated contract type, which is different from the traditional project organization. Because more responsibilities and its associated risks are transferred to the contractor this contract type forces the contractor to better manage the project and its risks. When achieving highly successful project performances through better risk and change management he will achieve higher profits and therefore will get incentivized to work collaboratively and to improve his performances.

These developments are in more detail discussed in Appendix A. The NEC includes all the innovative mechanisms previously discussed and is amongst other noticeable innovations seen as a promising improvement towards the current mainly traditional contracting practices. This will be further discussed in the next sub-chapter.

2.5 The NEC as a promising contractual innovation

The NEC was developed in 1993 in Britain as a family of standard construction contracts. The NEC is a collaborative innovation that moves away from the traditional forms of contract. It facilitates the implementation of sound project management principles and promotes partnering which leads to a more collaborative approach in project management. Furthermore is the NEC a clear and simple document that is easy to understand. It is an international contract that can be used in any location.

It is claimed that the implementation of the NEC3 internationally results in major benefits for projects in terms of improved time, cost and quality outcomes (NEC3, 2013b). This sub-chapter, as depicted in Figure 2.7, discusses the findings from literature on the topics: innovations, conformity with the modern principles of contracting and the benefits and disadvantages of the NEC.

2.5.1 Objectives of the NEC and its related innovations

The NEC is assumed to meet the current and near future needs of an engineering and construction form of contract. The design of the NEC is developed according to three main objectives in comparison to traditional forms of construction contracts. The three main objectives of the NEC are (NEC3, 2013b:1):

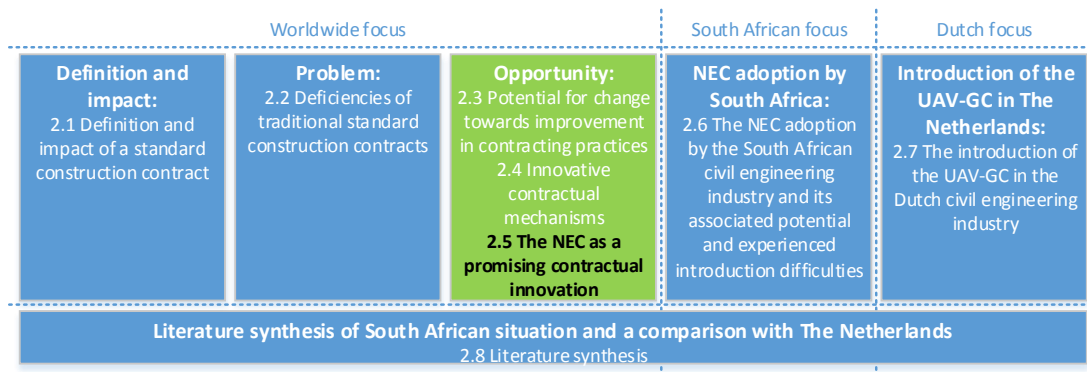


FIGURE 2.7: Overview of Literature Review - Sub-chapter 2.5

- **Flexibility**

The NEC achieves flexibility in the following ways (NEC3, 2013b:1):

- The NEC can be used for any traditional discipline, such as civil, mechanical, electrical and building work
- The NEC can accommodate any level of design responsibility by the contractor
- The NEC can provide all the current options for types of contract, such as competitive tender, target contracts, cost reimbursable contracts and management contracts
- The NEC is an international contract that can be used worldwide (although only in English)
- The NEC has a modular system of 'bolt on' optional clauses through which the contract can be tailored to meet the requirements of the project (Broome & Hayes, 1997)

- **Clarity and simplicity**

The NEC achieves clarity and simplicity in the following ways (Broome & Hayes, 1997):

- By using simple and common language and avoiding legal jargon
- By avoiding to paraphrase existing law
- By using identical phrases where possible
- By excluding contract specific data so that there is no need to change, delete or add to the core conditions of contract

- By clearly and precisely defined duties and responsibilities, using engineering terminology common to all disciplines wherever possible
- By settling for clarity above fairness in minor matters which would involve complicated text
- By omitting matters which are more effectively covered in the technical specification
- By avoiding cross-references
- By treating procedures as logical complete processes checked against flow charts
- By creating a family of contracts with interlinked procedures

- **Stimulus to good project management**

The NEC stimulates good project management according to two principles (NEC3, 2013b:3):

- Foresight applied collaboratively which mitigates problems and shrinks risks
- Clear division of function and responsibility helps accountability and motivates people to play their part

The NEC becomes a project management tool that stimulates and obligates collaborative management. Some core project management procedures are included within the general conditions of the NEC, such as risk, change and programme management. It is furthermore essential when using a NEC contract that the programme is detailed, accurate and up-to-date (Frehse, 2013:101).

The general conditions of the NEC stimulate good project management according to the following obligated tools (Frehse, 2013:27):

- The inclusion of an effective change management system
- Prompt agreement of the time and cost impacts of change
- Early warning procedures followed by risk reduction meetings
- Continuing management of risks including a risk register
- Prompt resolution of disputes

2.5.2 Conformity of the NEC with the principles of modern contracting

Lord (2008) investigated the NEC against Latham's (1994) 13 requirements for a modern contract, as summarized in paragraph 2.3.1. Consequently, Lord (2008) investigated the following 13 topics within the NEC:

- Teamwork and win-win solutions
- Integrated package of documents
- Simple language and guidance notes
- Role separation
- Risk allocation
- Variations
- Mechanisms for assessing interim payments
- Payments
- Trust funds
- Speedy dispute resolution
- Incentives
- Advanced mobilisation

Lord (2008) concluded that in the NEC all 13 researched topics conform to the 13 principles of an effective form of contract as proposed by Latham (1994).

2.5.3 NEC benefits from international literature

There is much international academic literature to be found that investigated the benefits of the NEC. The main findings from three of the most often cited articles are subsequently described.

The research by Broome & Hayes (1997) found four main benefits over traditional forms as a result of the NEC's simplicity and clarity. Those findings are:

- The contract makes people more responsible for their actions taken

- Risk allocations become better visible and people are therefore encouraged to take the appropriate action by reducing or eliminating its probability and impact of occurring
- Site level employees are becoming more aware of risks and its allocation
- It leads to less arguments whether the contractor is entitled to money or extra time as an event occurs

In the research by Wright & Fergusson (2008) a case study is conducted between two similar projects of which one was conducted under the traditional FIDIC and the other under the NEC. It was found that the NEC ECC has delivered better project management, contract clarity and contractual relationships. The NEC ECC provides for a more forward-looking and proactive environment. As a consequence the project costs and time were better planned to realise the best project outcomes. The use of a target contract however required some additional time and cost for administration. Another finding was the unexpected benefit of added safety to the project by the NEC ECC.

The third reference, by Thompson *et al.* (2000), concluded that the NEC has proved to be an improvement in effective communication and better relationships. As a result the management of disputes is improved and disputes are effectively reduced by the use of the NEC.

2.5.4 Disadvantages NEC

Disadvantages of the NEC are hard to find within (academic) literature. The only disadvantages of the NEC that are found, are described by the lawyer Boulding (2006) on a seminar about the NEC application progress in 2006, and are the following:

- Although the language is known for its simplicity and clarity, the use of narrative, descriptive present tense causes concern to legal advisers who have to interpret its effect.
- Due to the emphasis on promoting good project management practice, the project manager has an extremely demanding role which demands an intense use of resources. In addition, the role of the project manager has a certain amount of uncertainty relating to areas where his duty of impartiality applies.

- The wide range of NEC option choices can be criticised as being confusing to those unfamiliar to the NEC Suite.
- The legal effect of the 'spirit of mutual trust and cooperation' provision remains uncertain.
- The use of the risk register in the NEC can lead to concerns that it may be skewed in the contractor's favour because it obliges the project manager to cooperate to the contractor's advantage.

2.6 NEC adoption by the South African civil engineering industry and its associated potential and experienced introduction difficulties

This sub-chapter discusses the current situation on the use and implementation practices of standard construction contracts in the South African civil engineering industry, as depicted in Figure 2.8.

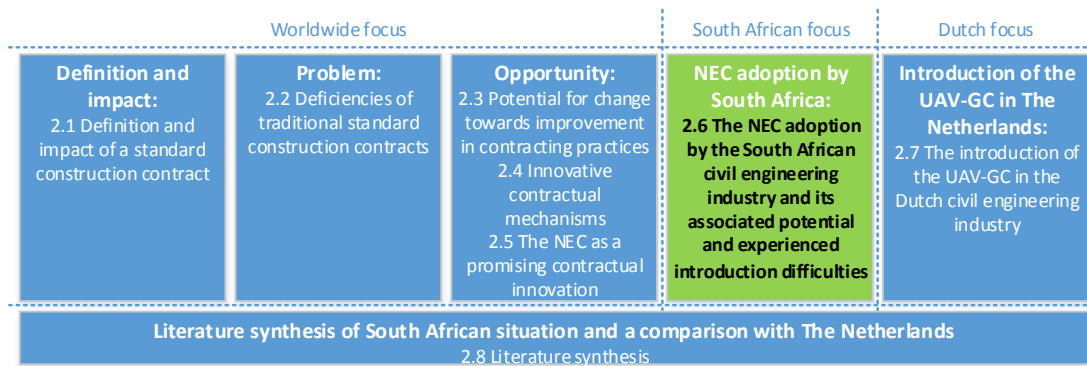


FIGURE 2.8: Overview of Literature Review - Sub-chapter 2.6

Similar to worldwide tendencies, the South African civil engineering industry is proven to be infected by contractual deficiencies leading to adversarial behaviour and its according problems (Visser & Joubert, 2008; Mbachu & Nkado, 2007; Jerling, 2009). This sub-chapter first describes the standard construction contracts that are adopted by South Africa. Then, the South African contracting deficiencies that are identified by completed research are discussed. Finally, the South African potential for contractual innovation in

the form of the NEC is discussed and some of its introduction difficulties are identified from literature.

2.6.1 Adopted standard construction contracts in South Africa

In May 2010 the Construction Industry Development Board (CIDB) published the current South African 'Standard for Uniformity in Construction Procurement'. This CIDB (2010:1) standard "establishes requirements and/or guidance for procurement within the construction industry which are aimed at bringing about standardization and uniformity in construction procurement documentation, practices and procedures". For South African public contracts the standard of the CIDB (2010:16) prescribes for construction projects that:

The contract data in respect of main contracts must reference one of the following standard industry forms of contract unless the publishers of such forms of contract indicate that such a form of contract is not suited for the intended application:

- For an engineering and construction works contract:
 - GCC: General Conditions of Contract for Construction Works
 - FIDIC: Conditions of Contract for Construction, Conditions of Contract for Plant and Design-Build, Conditions of Contract for FIDIC EPC/Turnkey Projects, Conditions of Contract for Design, Build and Operate Projects or Short Form of Contract
 - JBCC: JBCC series 2000 Principal Building Agreement or Minor Works Agreement
 - NEC: NEC3 Engineering and Construction Contract

For a short explanation about the different forms, see Appendix B.

2.6.2 Usage percentages of standard contract forms in South Africa

Marx (2013) investigated also the use of the different contract forms within the different construction sectors. From the 2998 completed projects in 2011, which were in the CIDB database, their contractors were invited for the survey. Survey forms were received back for 1006 projects reflecting a response rate of 33,6%. From the 1006 project responses, with 338 projects, 37% had a civil works project type. Projects of the private sector (36%), public corporations (23%), provincial departments (14%) and metropolitan councils (14%) were best represented in the survey. The results are shown in Table 2.3.

TABLE 2.3: South African construction contract type in 2011 (Marx, 2013)

Project Type	% Contract Document Type usage for each Project Type					Total
Residential Building	11	-	81	8	-	100
Non-residential Building	9	3	78	2	8	100
Civil Works	81	2	4	11	2	100
Mechanical Works	64	4	14	18	-	100
Electrical Works	34	28	19	14	5	100
Special Works	55	-	45	-	-	100
Contract Document Type	GCC	NEC	JBCC	FIDIC	OTHER	
% Projects with Contract Document significantly amended	23	25	29	51	7	

The focus of this research lies on the civil industry. Table 2.3, shows that 81% of civil projects use the GCC, 2% the NEC, 4% the JBCC, 11% the FIDIC and 2% another form. A new survey-research from the CIDB in 2013 (CIDB, 2014) within 886 projects shows, in Figure 1.1 of the introduction chapter, the use of contract forms per employer type in the construction industry as a whole. Only a summary has been published and more information about the survey is not available. However, a tendency that is shown from the results is a possible move from the GCC towards the FIDIC. The NEC is still much limited in its use. It can be concluded that the GCC and FIDIC now dominate the market and are the preferred option of employers. This corresponds also with the research by Frehse (2013: 96), who found that the NEC is hardly if ever used in the municipal environment of the Western Cape. The research even showed that the majority of the employers in the municipal environment of the Western Cape had very little or no knowledge of the NEC.

The findings from literature show many problems according to traditional standard construction contracts, such as the GCC and FIDIC. On the other hand, based on the international academic literature and its expressed positive experiences, the innovation of the NEC seems promising. Despite the assumed benefits, after 20 years, the NEC still experiences a difficult introduction into the South African construction industry.

2.6.3 Deficiencies in contract management environment

The significant use and therefore preference of the GCC in civil projects (81 %) might suggest that the worldwide identified contractual problems and adversarial relations don't exist with the traditional GCC. Therefore this might suggest why employers are

satisfied with the GCC and consequently don't have the need for a change towards the NEC. However, if we look specifically at the South African situation there have been several investigations conducted on the risks and constraining factors for success in construction projects that show otherwise. All investigations have in common that contractual issues play an important role in the outcomes. The South African contractual deficiencies concluded from those investigations are discussed in the following paragraphs.

Risk assessment modelling for the South African construction industry

One of the investigations that show contractual deficiencies for the South African construction industry, was conducted by Visser & Joubert (2008). They proposed a construction risk framework that contains the top 10 highest construction risk exposures in South Africa based on former research and a literature study. To test the framework research was conducted to assess all the construction risk variables and to identify the top 10 risk variables. By comparing them, as shown in Table 2.4, they concluded that the top 10 risk variables correspond to only three of the ten main risks from the framework, namely shortage of skills, tendering & contractual exposures, and financial fluctuations & cost overruns on long-term projects.

Tendering and contractual exposures are therefore seen as some of the main risks in the South African construction industry with specifically failure to execute contracts effectively, loss of corporate intelligence and contractual risks from the standard contract conditions as some risk variables that are underlying factors.

TABLE 2.4: Risk assessment modelling in South African construction industry (Visser & Joubert, 2008)

Rank	Proposed framework (Table 2)	Research results (Table 4)
1	Shortage of key skills (human capital)	Loss of key staff
2	Shortage of critical raw materials	Poaching of key staff
3	Availability & access to key plant	Failure to execute contracts effectively
4	Tendering & contract exposures	Inadequate staff competencies/skills
5	Identification, reporting & actioning of project non-conformances	Loss of corporate intelligence: staff poaching, restructuring
6	Poor business risk management	Contractual risk: standard contract conditions
7	Project management issues	Unfavourable changes in foreign exchange/interest rates
8	Poor data management	Failure of contracted party to comply with contracts – supply chain failure
9	Financial fluctuations & cost overruns on long term projects	Failure of key contractor
10	Government & legislation issues	Failure of a key client

A disconcerting finding from their research is that more than half of the companies they surveyed had no formal risk management policies and procedures implemented in their construction projects. The majority does analyse and report the incidences of risk

events to their boards. Therefore a reactive rather than a proactive management on risk is assumed to be the common practice. The research furthermore highlighted the gap between the establishment of risk management policies and procedures and the usage and enforcement thereof in practice (Visser & Joubert, 2008).

This could be one of the reasons why contractual risks are so high in construction projects. If there is no proper risk management, consequently the contractual risks possibly also don't get assessed properly. As a result the contracting parties might not be completely aware of the risks they carry under certain contract conditions and which will only surface during the project execution. Furthermore, this could also increase the failure to execute contracts effectively because many risks evolve or/and are not managed effectively. Consequently, the contract is often required as a worst-case scenario to solve conflict situations.

Factors constraining successful building project implementation in South Africa

Mbachu & Nkado (2007) investigated the factors constraining successful construction projects. Their research approach divided the potential constraining factors in two different categories each with different constituent factors:

- Controllable (internal) factors
 - Project characteristics
 - Consultants' and contractors' influences
 - Client organisational influences
- Uncontrollable (external) factors
 - Socio-cultural issues
 - Unforeseen circumstances
 - Economic and global dynamics
 - Governmental/statutory controls

On the scale from Not Risky (NR), Not So Risky (NSO), Somewhat Risky (SR), Risky (R) to Very Risky (VR), the following top three risks were perceived in their research (Mbachu & Nkado, 2007):

- Risky (R):
 1. Consultants' and contractors' influences (acts of omission or commission)

- Somewhat Risky (SR):
 2. Client organisational influences
 3. Project characteristics

It is interesting to see that the three controllable factors are the three most risky factors. Apparently the risks are not controlled well, which is often regulated by the construction contract. The two interesting constituent factors for contractual issues are consultants' and contractors' influences and client organisational influences. They have several underlying factors that are applicable or influential to contractual issues and those are hereafter extracted from the complete list of underlying factors.

Some of the underlying factors of the Risky (R) consultants' and contractors' influences, are assessed as follows (Mbachu & Nkado, 2007):

- Risky (R)
 - Quality of services and attitudes
- Somewhat Risky (SR)
 - Disputes & adversarial relations
 - Poorly defined and understood roles & responsibilities
 - Fee cutting and contractual claims
 - Contractual obligations
 - Fragmentation of services

Some of the underlying factors of the Somewhat Risky (SR) client organisational influences, are assessed as follows (Mbachu & Nkado, 2007):

- Risky (R)
 - Poor scope definition, timing & frequency of changes
 - Attitudes, drives, goals & future expectations
- Somewhat Risky (SR)
 - Wrong choice of procurement strategy
 - Type of tendering & contractual arrangements
 - Contractual obligations

- Past project experience & project management ability
- Fragmentation of services

From those outcomes it can be concluded that the actions of the contracting parties itself cause the biggest risk for constraints to achieve successful construction projects. However the service clients, such as the contractor, seem to be the highest factor of constraint towards successful projects. Furthermore, the underlying factors of those two constituent factors contain many perceived risks that are contractual related. Apparently the used standard construction contracts in South Africa don't manage to reduce contractual risks. This is also supported by the previous research from Visser & Joubert (2008) where contractual risks proved to be one of the three main construction risks.

Construction risks generated by employers from the perspective of South African contractors

In the third reference, Jerling (2009:106) identified construction risks generated by employers from the perspective of South African contractors. Results showed that contractual matters are perceived by the contractors as the most prevalent risk group. It was found that many similar risk items within the general risk groups could be grouped into specific sub-groups. Those sub-groups, that represented employer generated risks, are ranked in the order of importance as follows (Jerling, 2009:208):

1. Lack of employer team design & project management skills
2. Contractual risks contained in contract documents
3. Project risks that inhibit the contractors' ability to perform
4. Risk factors specific to employer such as past performance
5. Organisational factors, particular to the employer that causes risks
6. Financial risks originating from the employer

The top five risk items relating to employer generated risk were found to be (Jerling, 2009:208):

1. Design/construction details supplied late
2. The project size and timing presenting extraordinary risk to contractor who will have difficulty to deliver project on time
3. The construction contract significantly favours the employer's interests

4. Too many variations to standard conditions of contract are used
5. Employer not able to manage change & approvals and make timely decisions

Also this research demonstrates the prevalence of contractual risks in construction projects. This research demonstrates that employers try to protect themselves by amending the contract often in their favour. Furthermore the contract doesn't lead to compliance with timely actions and decisions by the employer.

Similarities between the three investigations

Contractual aspects seem to be highly prevalent in the assessment of construction risks and constraints for successful construction projects in South Africa. Furthermore, extracted from those investigations, it is assumed that employers generate high contractual risks in construction projects and on the other hand the practices of service providers, such as contractors, are constraining successful construction projects. However, the constraints to project success caused by contractors can possibly be aggravated by the fact that contractual risks within the project can impact the contractor's ability to deliver a successful project. In conclusion there is an urgent need for change in contracting and a high potential for improvement, possibly by the adoption of the innovative NEC.

The differences between the GCC and NEC are described in the next paragraphs.

2.6.4 Improvements of the NEC for South Africa

The need for a change away from the use of mainly the traditional GCC towards the use of the NEC is hereafter explained based on two former investigations. In addition some present NEC experiences are described.

Potential for a change towards the NEC in accordance with identified problems of the GCC

Some investigations have been already conducted that identified deficiencies of the GCC. In the research by Klingenberg (2014), changes in the latest two editions of the GCC (2004 and 2010) and its related impacts are compared. The research showed the following problems (Klingenberg, 2014:123):

- The GCC 2010 claimed to be improved on its suitability for all construction disciplines. The research however showed no improvement on its applicability.

- The research found that both GCC editions are most suitable for unit price strategies, such as the use of a bill of quantities or schedule of rates. The lump sum pricing strategy are not particularly suitable to be applied with either edition.
- The GCC 2010 states that this edition improved its suitability for other procurement strategies, such as design and build. However, the GCC is still mainly applicable for a design by the employer strategy. Furthermore, other procurement strategies such as design and build require a lump sum pricing strategy. As mentioned earlier, the GCC is not particularly suited for this pricing strategy.
- Klingenberg (2014:123) concluded that the consequences of the changes made to the GCC are only marginal and are furthermore offset because of the common alterations to the contract in the interest of employers. It is furthermore concluded that this means that the contract may still be one with adversarial undertones and that an understanding of mutual interdependency is still not achieved.

These described problems could be improved by the use of the NEC. Another research, conducted by Frehse (2013:96-102), concluded in addition several other points of criticism and opportunities for improvement towards the GCC 2010 in comparison to the NEC3. These findings are however mainly based on a contractual analysis performed by him and extracted from interviews with employers from a municipal environment who were mainly experienced with the GCC and not with the NEC. Therefore a few NEC experts were consulted as an addition to the research. Resulting opportunities for improvement that were found by Frehse (2013:96-102) are:

- Ease of understanding and application of the NEC3
- Suitability of the NEC3 for the use within all disciplines and across the whole supply chain and procurement spectrum
- The engenderment of good project management, e.g. by obligating risk management in the NEC3
- Provision of mechanisms obligating collaboration by the NEC3
- An overwhelming preference from practice for a single procedure that addresses time and cost impacts together to assess change, which is included in the NEC3
- The NEC3 provides a simpler, fairer and more formal approach for compensation which is directly linked to the programme and is based on actual cost plus

- Programmes will be more likely to be detailed to be compliant with the NEC3 requirements
- The NEC3 offers benefits to government, including municipalities, because of the stimulation of good governance, transparency and provision of a detailed audit trail

Watermeyer (2014) also compared the different common contract forms of use in South Africa against a number of different aspects, depicted in Table 2.5. The results show that the NEC, in contrary to the other contracts, contains all investigated aspects. In addition, the NEC has an excellent quality on collaborative working and on the prevention of disputes and its associated delays and disruptions, which is in contrary to the other contracts who have a poor to moderate quality on these aspects.

TABLE 2.5: Standard construction contract comparison (Watermeyer, 2014)

Criteria		FIDIC	GCC 2010	JBCC 2000	NEC3
1	Correlation / fit with respect to Society of Construction and Law's Delay and Disruption Protocol (2002)	Moderate	Poor	Poor	Excellent
2	Potential for collaborative working	Moderate	Poor	Poor	Excellent
3	Target contract option for application in framework contracts, collaborative working and early contractor involvement	No	No	No	Yes
4	May be used for both engineering infrastructure and building projects	Yes	Yes	No	Yes
5	The main contractor may be required to assume responsibility for the design or the works or the finalisation of the design	Yes (yellow and silver)	Yes	No	Yes
6	The main contractor may be required to operate as a management contractor	Yes (silver)	No	No	Yes
7	Cost based pricing strategies, including target cost contracts	No	No	No	Yes
8	Back to back subcontracts	Yes	No	Yes	Yes
9	Short forms of contract suitable for use where risks are low and there is no requirement for sophisticated management techniques	Yes	None	Same management requirements as for principal contract but no subcontracts	Yes
10	An open book approach to the cost of change	No	No	No	Yes
11	Pricing structures that align payments to results and reflect a more balanced sharing of performance risk	No	No	No	Yes

All three investigations show deficiencies of the GCC and the last two investigations also noted the possibilities for improvement in contracting practices, by means of the NEC.

Current NEC implementation experiences in South Africa

In the literature there is reporting of NEC application in South Africa. Two such reports are discussed subsequently.

Frehse (2012) reported about experience of South African Transnet projects using the NEC. From a reported 2000 projects only 70 matters proceeded into adjudication with only 3 ruled against Transnet (the employer). The report states that within the 2000 projects not a single event was found not to be covered by the listed compensation events in the NEC. Therefore, in the opinion of the quoted specialist the compensation events of the NEC cover possible eventualities well. The opinion can however not be considered as scientific evidence.

Watermeyer (2014) also described a major South African project experience with the NEC. One where The University of the Witwatersrand in 2008 established a Capital Projects Program (CPP) to direct a project portfolio exceeding R1 billion by 2012. The NEC contracting system was chosen in order to stimulate a culture shift towards collaboration, efficiency and greater certainty, as indicated in Table 2.6.

TABLE 2.6: Culture shift stimulated by the NEC (Watermeyer, 2014)

Form	To
Master-servant relationship of adversity	Collaboration towards shared goals
Fragmentation of design and construct	Integration of design and construct
Allow risks to take their course	Active risk management and mitigation
Meetings focused on past - what has been done, who is responsible, claims. etc.	Meetings focused on "How can we finish project within time and budget available?"
Develop the project in response to a stakeholder wish list	Deliver the optimal project within the budget available
"Pay as you go" delivery culture	Discipline of continuous budget control
Constructability and cost model determined by design team and Quantity Surveyor <u>only</u>	Constructability and cost model developed with contractor's insights
Short-term " <i>hit-and-run</i> " relationships focused on one-sided gain	Long-term relationships focused on maximising efficiency and shared value

The use of the NEC resulted in the completion of R 1.5 billion of works within six years. The overall cost overrun was less than 5%, whilst it included scope changes

during implementation to accommodate late changes to the design. Projects were generally completed on time or ahead of time. According to Watermeyer (2014) those are remarkable achievements for South Africa and achieved through a combination of:

- Proactive project management
- The application of the NEC3 contracting system
- The adoption of the develop and construct and design by employer contracting strategies with early contractor involvement
- The use of appropriate procurement strategies including framework agreements which enabled long term relationships to be developed
- The use of priced based and target contracts with activity schedules
- The culture change that underpinned the programme

Although successes of the NEC are to be found in literature, there are still barriers for many employers to adopt the NEC into practice. Some examples from literature are subsequently discussed.

2.6.5 Barriers for NEC implementation in South Africa extracted from literature

The research by Frehse (2013:96) found that employers of municipal civil projects within the Western Cape province have limited or no knowledge of the NEC. Insufficient knowledge is a direct barrier that prevents the NEC from being applied. Therefore the awareness of the NEC must be improved and training is required to learn the NEC procedures and practices. Another barrier may be the additional administrative requirements due to the NEC procedures. However these administrative procedures could also be seen as important requirements of good project management necessary in a construction project (Frehse, 2013:102). Frehse (2013:96) also found that there is no particular requirement by employers in municipalities for a form of contract that is drafted in simple English. Whilst the drafting style of the NEC3 is one of the main innovations of the contract, it wouldn't be a primary motivation for Employers to adopt the NEC. This view decreases the opportunity for improvement by the NEC as assessed by employers. Since the interviewed employers had no or little knowledge of the NEC they are may not be

aware of the benefits of simplicity in a contract and should become more aware of this by education and shared experiences.

Watermeyer (2014) also shared his opinion about factors that inhibit the adoption of strategies other than the traditional pre-planned approach. This can also be linked to factors that inhibit the adoption of the NEC since that also is a move away from the traditional approach. Some of the following factors were mentioned by Watermeyer (2014):

- Most South African universities teach contracts in a transactional manner based on a single South African form of contract and on a design by employer contracting strategy with a bill of quantities.
- The resistance of built environment professionals to move away from the traditional approach.
- Project and programme managers are not innovative enough to be prepared to change the culture in order to improve project outcomes.
- Responsible professionals for conceptualising and executing procurement processes have poor procurement skills.

2.6.6 Recommendations for a successful NEC implementation

For a successful implementation of the NEC the following recommendations are found from a case study in New Zealand (Wright & Fergusson, 2009):

- Provide increased training for project teams and project management contractors.
- Increase the awareness of the benefits of the NEC.
- Promote wider future use of the NEC in the engineering and construction industry.
- Actively promote the joint working approach of NEC and foster the collaboration by co-locating future project teams in site offices. The benefits will be better communications and faster development of a close working relationship between the parties, with little or no extra cost involved.

Watermeyer (2014) made an explicit recommendation for South African universities to teach on contracting principles and the range of all strategies that are embedded

in the different forms of contract instead of on traditional and transactional focused procurement (Watermeyer, 2014).

2.7 The introduction of the UAV-GC in the Dutch civil engineering industry

This sub-chapter describes the Dutch contracting environment and its developments within the civil industry, as depicted in Figure 2.9. At first, the commonly used standard construction contracts are described. Then the contracting problems and deficiencies are discussed that are identified from completed research. Finally, the introduction of the Dutch contractual innovation in the form of the UAV-GC is discussed.

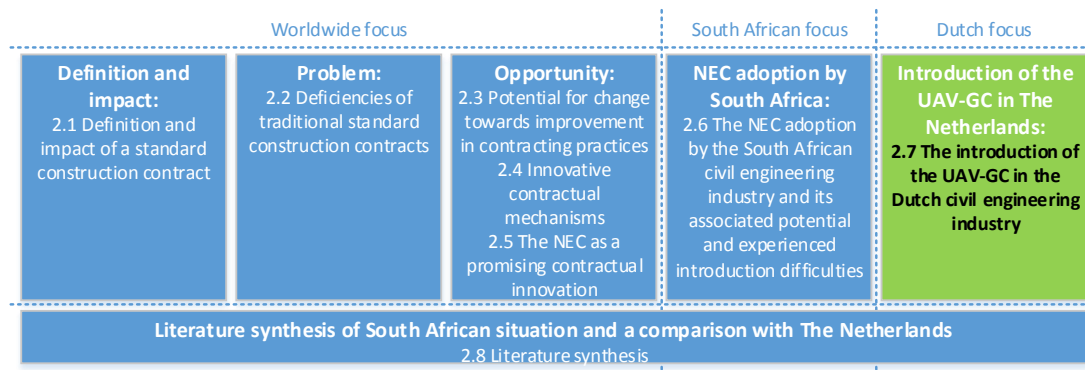


FIGURE 2.9: Overview of Literature Review - Sub-chapter 2.7

2.7.1 Adopted standard construction contracts in The Netherlands

The often used standard construction contracts in the Netherlands are mainly the UAV 2012 and UAV-GC. Both contracts are subsequently described.

UAV

The Uniform Administrative Conditions for the Execution of Works and Technical Installation Works 2012 (UAV 2012) is another common used standard construction contract in The Netherlands (Chao-Duivis *et al.*, 2013:25). The general terms and conditions are based on the traditional legal relationship between the contractor and employer. In the traditional legal relationship the employer first enters into a standard contract between employer and consultant, under The New Rules 2011, for the design of the project.

Thereafter the employer enters into a construction contract, under the UAV 2012, with a contractor to execute that design (Chao-Duivis *et al.*, 2013:51).

UAV-GC

The UAV-GC is a Dutch standard form for integrated contracts that was implemented in 2005, after being tested in a 5 year pilot period. The pilot period was used to monitor, evaluate and improve the contract. In an integrated contract the design and execution are in the hands of a single contracting party as employed by the employer. An integrated type of contract does not necessarily mean that the contracting party performs both the design and execution in-house. The contracting party can bring in a designer or contractor as a sub-contracting party according to the expertise required. The sub-contract for a contractor would consist of the UAV 2012 and a sub-contract for a designer would consist of The New Rules 2011 (Chao-Duivis *et al.*, 2013:99).

The projects under this contract consist of design and construct, design and build and turnkey type of projects. Because of the increasing use of those types of contracts in The Netherlands, a requirement for a better suited standard construction contract existed. For this reason the UAV-GC was created. The UAV-GC is particularly used for infrastructure projects but increasingly used in non-residential buildings projects (Chao-Duivis *et al.*, 2013:100). Chao-Duivis *et al.* (2013:100) mention that there has not been much case law up to 2013. They are of the opinion that this is related to the use of an 'employer-contracting party' legal relationship under the UAV-GC, which results in smoother running relationships.

2.7.2 Procurement strategies in Dutch construction projects

The literature review by Rijt, Hompes & Santema (2010) summarized the adopted contracting strategies by Dutch employers in 2006 as depicted in Table 2.7. This still shows a preference for the traditional procurement method. However 11 % of the infrastructural work was based on an integrated contract 1 year after the published tested version of the UAV-GC (2006). There is no percentage found for periods later than 2006. The results were acquired from research by the Economisch Instituut voor de Bouw (EIB) by Jansen & Sijpersma (2006). This research is however not freely accessible and the research respondents and data collection couldn't be retrieved for this literature study.

However, the EIB is a well-known and reliable institute led by qualified researchers. The data should therefore be trustworthy.

TABLE 2.7: Dutch construction contracting strategies in 2006
(Jansen & Sijpersma, 2006)

	Traditional	Construction team	Design & Construct	Turn Key	PPS	Total
Utility	73%	18%	5%	2%	2%	100%
Infrastructural work	81%	8%	9%	2%	0%	100%
Specialized	76%	17%	4%	1%	2%	100%
Electro technical	69%	8%	5%	13%	5%	100%
Other installations	61%	19%	5%	3%	11%	100%
Total	71%	16%	5%	3%	4%	100%

2.7.3 Deficiencies in contract management environment

The Netherlands has a difficult history regarding the contract environment in the construction industry because of a major collusion scandal. Currently, the heavy competition on price is a consequence of the construction collusion and seen as one of the main bottlenecks in the industry. Furthermore a lack of communication and information sharing is seen as a main reason for failure costs in construction projects. The construction collusion, current bottlenecks and reasons for failure costs in industry are further discussed in the next paragraphs.

Construction collusion

The existence of opportunistic behaviour in the construction industry also turned out to be taking place in the Netherlands, although in a very unethical form. In 2002, a Parliamentary Committee proved that the whole sector participated in unethically opportunistic behaviour such as bid rigging, collusion and corruption (Rijt *et al.*, 2010). More specifically the illegal practices ranged from fraud, unjustified subsidies and license issuance to real bribery and money or favours to individual politicians or higher-ranking public servants. As a result contractors were able to undercut the market and to create monopolies which forced prices up (Van den Heuvel, 2005).

As a reaction, the Parliamentary Committee proposed stricter rules for managing state-corporate relationships, better control on network abuses, the introduction of minimum standards for public contracting and by putting its trust in the cleansing capacity of competition (Van den Heuvel, 2005). Consequently, the construction industry adopted

a natural defensive approach by focusing on control and by preventing potential problems on accountability, legitimacy and reputation (Boes & Dorée, 2007).

The Dutch construction collusion was a black episode within the industry. Trust and future interactions between public sector employers and contractors were severely impacted (Rijt *et al.*, 2010). However, Dorée (2004) concluded that a continued tougher reliance on lowest bid prices may not contribute to the reform of the Dutch construction industry. Accordingly, current bottlenecks and reasons for failure after the implementation of the Parliamentary Committee proposals are discussed in the next paragraphs.

Bottlenecks in the Dutch civil engineering sector

From the literature review conducted by Rijt *et al.* (2010), heavy price competition is seen as the main bottleneck (Table 2.8) in the civil engineering sector. The heavy 'lowest-bid' competition is a logical effect that was institutionalized by the Parliamentary Committee after the construction collusion. However, currently there is much discussion in The Netherlands on how to tender on different criteria than only price (Rijt *et al.*, 2010).

The other bottlenecks, which are administrative burden, delivery systems policy and rules and regulations (see Table 2.8), can be also contractual and legal related.

TABLE 2.8: Bottlenecks Dutch civil engineering sector in 2006
(Jansen & Sijpersma, 2006)

		Mentioned by companies %
1	Heavy competition on price	80
2	Administrative burden	69
3	High labor costs	63
4	Delivery systems policy	63
5	Rules & regulation	59

Reasons for failure

Rijt *et al.* (2010) also described, from an investigation by USP Marketing Consultancy (2007), the main reasons for failures within projects in the Dutch construction industry, shown in Table 2.9. Failures are described as all costs that are unnecessarily made. Failures are therefore incurred due to inefficiencies in the building process, errors and rework. The results come from a survey conducted in 2007 with 430 responses from clients, architects/engineers or contractors. Communication and information transfer, design feasibility and quality issues seem to be the most important failures. Contractual

causes are not as relevant as in South African literature. However the lack of communication and information sharing and late information could be better managed by a standard contract form. Furthermore the delivering of quality should have a higher priority in a team effort.

TABLE 2.9: Reasons for failure in the Dutch construction industry
(USP Marketing Consultancy, 2007)

	Total	Architect & Engineering	Contractors (General & Sub)	Clients
Lack of communication and information transfer	21%	20%	26%	12%
During design phase inadequate attention for feasibility	20%	19%	22%	19%
Delivering quality to end user is not the highest priority	10%	15%	5%	14%
Requirements list unsatisfactory: lot of changes needed	9%	13%	7%	9%
No application of experience previous projects	6%	4%	7%	7%
Tender model not aimed at integral process procedure	5%	6%	4%	6%
Appointments not followed	5%	3%	6%	6%
Information behind on schedule	4%	4%	6%	2%
No synchronization between architecture & installation	4%	6%	3%	3%
Licenses not on time	4%	3%	2%	7%
Contract unclear and incomplete	2%	0%	2%	2%
Lack of logistic communication during realization	1%	1%	1%	2%
Other, namely	3%	3%	3%	2%
Don't know	7%	5%	7%	10%
Total	100%	100%	100%	100%

Failures are assumed to be high in Dutch construction projects. There is a growing awareness started that more innovative and effective ways have to be adopted to restore trust and bilateral relationships between constructors and their employers (Rijt *et al.*, 2010). A resulting main contractual innovation, the UAV-GC, is discussed in the next paragraph.

2.7.4 Innovations of the UAV-GC

The UAV-GC can be seen as a contractual innovation because it moves away from the traditional legal relationships. It replaces the construction contract and independent contract with the designer by just one integrated construction contract. As a result the contracted party has, besides the execution of the project, also a level of design responsibilities. It allocates more risks towards the contracted party but if managed

well creates an opportunity for more profit. The employer consequently has a more direct and open communication structure by contracting with only one party. Hereafter this development is discussed in more depth in the next paragraphs.

Contractual developments

At the end of the nineties new public management strategies in The Netherlands resulted in more tasks and responsibilities distributed to the private sector. Executive governmental departments, such as Rijkswaterstaat (part of the Dutch ministry of infrastructure and the environment), were transformed into agencies. By transferring tasks to contractors, the departments are expected to deliver a facility quicker and at lower cost because of the incentivized opportunity for them to act innovatively. Moreover, private parties are expected to provide private funding and to operate facilities more efficiently (Lenferink, 2013:129). As a result, many European countries move towards integrated contracts for infrastructure projects.

Originally Rijkswaterstaat worked out projects in detail with a specification including technical design, material calculations and construction time. Contractors subsequently prepared their bids and the lowest bid was awarded the construction contract. At completion a new maintenance contract, which is again specified in detail, is tendered among contractors. This traditional process is depicted in scenario 1 of Figure 2.10.

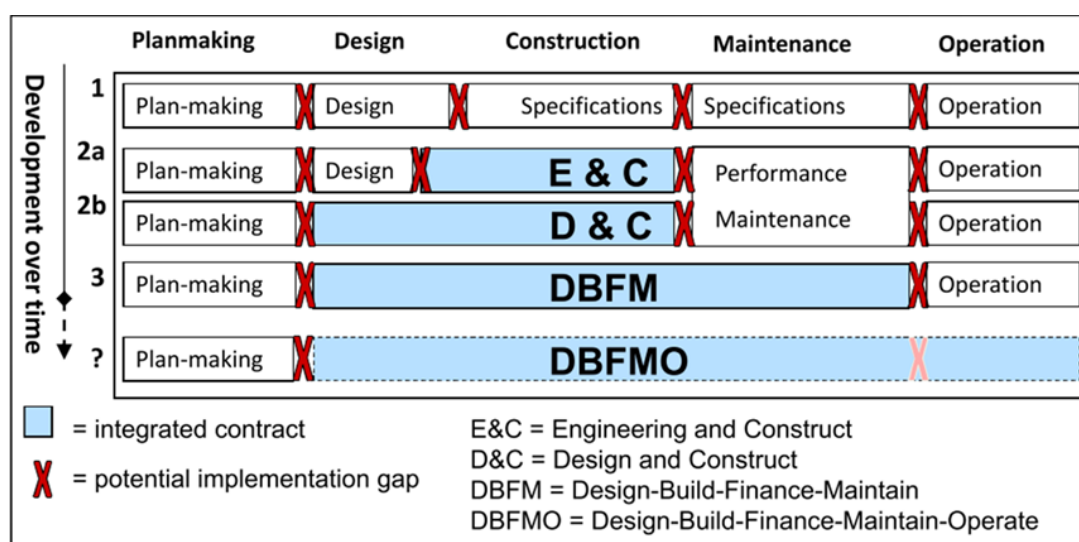


FIGURE 2.10: Development of integrated contracts in the Dutch infrastructure project lifecycles (Lenferink, 2013:128)

The contractual integration development started with maintenance contracts based on performance requirements instead of specified products and processes on tender. In the meantime Engineering and Construct (E&C) contracts were introduced where the contractor is responsible for technical design specifications (scenario 2a of Figure 2.10). Because of positive experience with E&C an expansion of the contractor's responsibilities led to a Design and Construct (D&C) contract (scenario 2b in Figure 2.10). In a D&C contract the employer requests only certain outputs to be delivered based on its required demands. In 2008 Rijkswaterstaat implemented D&C contracts as their standard form of contracting (Lenferink, 2013:129). The next step in the integration of stages in infrastructure projects is a Design-Build-Finance-Maintain (DBFM) contract, depicted in scenario 3 of Figure 2.10. DBFM combines design and construction tasks with performance maintenance over a longer contract period. For complex projects at a national level in the Netherlands, the DBFM is currently the standard procurement method and is increasingly applied (Lenferink, 2013:129). Local authorities however are still more reserved in the use of integrated contracts (Boes & Dorée, 2007).

Objective of the UAV-GC and its innovations

The UAV-GC defines a flexible framework for specifying the design and implementation responsibilities of both the employer and the contractor in an integrated contract including design and execution whether combined with maintenance responsibilities or not.

As a result the UAV-GC claims to be an innovative contract that overcomes fragmentation within the teams and processes over the different lifecycle stages. In this way it overcomes implementation gaps within the lifecycle of a construction project by integrating them as shown in scenario 2a, 2b and 3 of Figure 2.10.

Conformity of the UAV-GC with the principles of modern contracting

The innovation of the UAV-GC is mainly focused on the integration of the project team and processes around the product throughout the whole lifecycle to improve the construction industry, as described in the Egan Report (Egan, 1998). As a result there is a move away from the traditional legal relationships, and the employer is provided with more flexibility in allocating design responsibilities.

However, the UAV-GC does not conform to many of the Latham (1994) principles for modern contracting. The UAV-GC is still a contract with strict allocations of risks

instead of the flexibility to assign them to the party best able to manage them (Meulebeek, 2012). In addition, Roosjen (2013:73) found that parties within an integrated contract under the UAV-GC still sometimes experience ambiguity in the content. Roosjen (2013:73) identified an example of a project where parties had a different interpretation of the change procedures. Furthermore, Roosjen (2013:73) noticed that integrated contracts under the UAV-GC are still transactional focused and lack in relational aspects to stimulate cooperation. Although there is a duty for the employer to cooperate and a duty for the contractor to inform in the UAV-GC, these are limited and clearly allocated to a few situations in which they are applicable (Chao-Duivis *et al.*, 2013). Consequently the UAV-GC still has many attributes that are known to create adversarial relations. In addition, the UAV-GC is also not a family of contracts that creates flexibility in the choice of pricing strategies and in different procurement strategies.

The UAV-GC therefore is, apart from the legal relationships, still mainly based on traditional aspects and not in compliance with the principles of modern contracting. However the UAV-GC leaves much space for project-specific additions and specifications. Therefore, although it does not conform to many modern contracting principles, it does possess in many cases the freedom to do so by adding additional regulations.

2.7.5 Possible barriers for UAV-GC implementation extracted from literature

Where national public authorities shifted almost completely to the use of integrated contracts, local public authorities are more resistant to the change. The local public authorities are unwilling to implement outsourcing strategies and most organizations therefore continue to show a preference for a traditional contract form based on specifications and drawings (Boes & Dorée, 2007). Given the current problems with traditional contract forms this is rather odd according to Boes & Dorée (2007), who identified a lack of focus on quality to be a main issue in a construction project under the traditional contract form, UAV. Unilateral price competitions sometimes result in a focus away from quality and therefore forces the employer into labor intensive control mechanisms to achieve an acceptable product. In a tender evaluation for an integrated contract more aspects, than a solely price-based competition, will be evaluated because of the design responsibilities of the contractor and the associated quality related aspects (Boes & Dorée, 2007).

The main reasons for not using integrated contracts in civil projects, given by its public employers, are an apparent lack of knowledge and experience, advantages that are not obvious and high procurement costs (Boes & Dorée, 2007). On a positive note, Boes & Dorée, (2007) found local public authorities to believe that the market has sufficient expertise and knowledge to be able to implement integrated contracts. However, local public authorities are still traditional thinkers and less flexible with regard to the use of new contract forms (Boes & Dorée, 2007).

2.7.6 Recommendations for a successful UAV-GC implementation

Boes & Dorée (2007) made the following recommendations for broader adoption and implementation of integrated contract forms under the UAV-GC:

- There is an urgent need for leadership at the local level to address important issues of outsourcing strategy, the division of responsibilities and co-operation between organisations to push positive change in procurement strategies. This should result in an increased willingness to use integrated forms of contract, a greater division of responsibilities, less labour intensive control mechanisms and more flexible approaches to procurement.
- Public clients should in the future act more proactively towards new developments and changes to regulations. This requires the development of additional skills and competencies needed to successfully handle new contract forms.

2.8 Literature synthesis

This literature synthesis is the last section of this chapter as depicted in Figure 2.11. This sub-chapter initially answers the research questions using information from the literature study. The findings are used later to validate the findings from the research. Lastly, a comparison with the Dutch introduction findings of the UAV-GC is provided.

2.8.1 Expected answers to the research questions of the NEC3 ECC introduction in South Africa based on the literature findings

The outcome from the literature review is subsequently paired with the research questions. The research questions are answered based on the literature findings. Where there

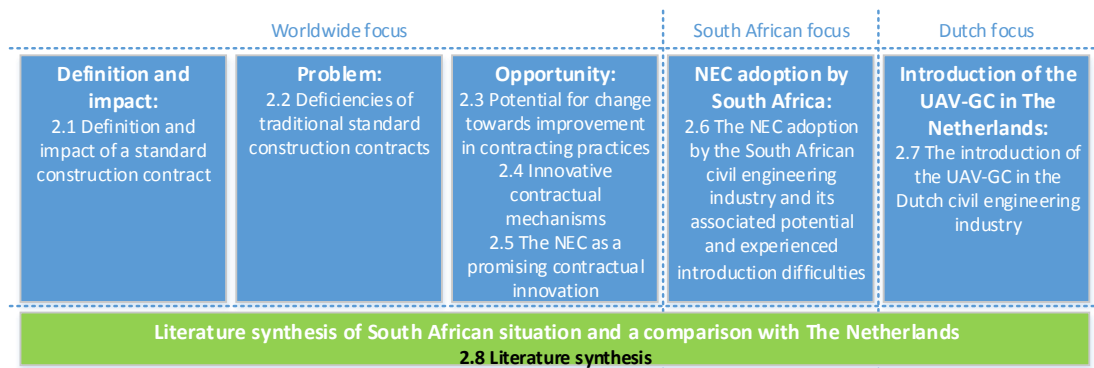


FIGURE 2.11: Overview of Literature Review - Sub-chapter 2.8

are shortcomings this will be pointed out as the motivation for further investigation in this research.

Should the NEC be broader adopted by the South African civil engineering industry?

Because of the many contractual related problems in the South African construction industry it is found that an improvement in procurement and contract management is required. More specifically towards the problems associated with the FIDIC document internationally and with the GCC in South Africa. it is found that the commonly used standard forms of contract should be improved or changed. Especially the NEC is found to be an improvement from the use of the GCC, FIDIC and JBCC. However, based on the quantitative data that is found from literature, the NEC is hardly used in projects throughout the South African construction industry and more specifically in the civil engineering industry. Therefore it seems that the NEC should be broader adopted by the South African civil engineering industry. This has not yet been specifically addressed by academic research and is therefore investigated by this research.

What are the advantages of the NEC3 ECC?

From international as well as South African literature many advantages of the NEC are found. The following main advantages are found:

- Ease of understanding and application
- Flexibility
- The engenderment of good project, programme and risk management
- Included mechanisms obligating collaboration

- Simpler, fairer and better regulated procedures for compensation (in which cost compensations and time extension are assessed together)
- Provision of a transparent and detailed audit trail
- People are more responsible for their actions taken
- Risk allocations and contractual procedures are clearer
- Changes assessed on a forecast basis to better plan ahead to realise the best project outcomes
- Added safety to the project (unexpected benefit found in a New Zealand case study)
- Improvement in effective communication
- Better relationships between contractual parties
- Improved dispute management
- Disputes get effectively reduced

The advantages however have not yet been broadly investigated in South Africa by professionals that are experienced with the NEC. Therefore NEC experiences from the South African practice are extended by this research. It is expected that the research findings will identify advantages that are also identified from literature.

What are the disadvantages of the NEC3 ECC?

Disadvantages of the NEC are hard to find within (academic) literature. The only disadvantages that are found is the opinion of a British construction lawyer shared on a congress. He found possible disadvantages of the NEC to be:

- The use of simple and clear language and the use of narrative, descriptive present tense causes of concern to legal advisers who have to interpret its effect
- The project manager has an extremely demanding role which demands an intense use of resources
- The role of the project manager has a certain amount of uncertainty relating to areas where his duty of impartiality applies
- The wide range of NEC option choices can be confusing to those unfamiliar to the NEC Suite
- The legal effect of the 'spirit of mutual trust and cooperation' provision remains uncertain

- The risk register may be skewed in the contractor's favour because it obliges the project manager to cooperate to the contractor's advantage

The disadvantages of the NEC have not been investigated within South Africa and are therefore addressed in this research. There is no construction lawyer amongst the interviewees in this research but only NEC experienced people from construction practices. Therefore it is not immediately expected that similar disadvantages will come up in this research. However, similar to the findings from academic literature it is expected that not many disadvantages are to be identified by this research.

What are the critical barriers for the implementation of the NEC3 ECC in South African civil projects?

Barriers for an implementation of the NEC3 ECC in a construction project have not yet been academically investigated and are therefore identified in this research. However, some barriers are extracted from a South African source with a different focus and from the opinion shared by one NEC experienced individual in South Africa. This led to the following identified barriers from the literature study:

- Limited or no knowledge of the NEC
- Additional administrative requirements
- Only traditional South African forms of contract, such as the GCC and JBCC are taught at universities
- Only the transactional design by employer with bill of quantities procurement strategy is taught at universities
- Resistance to change away from traditional approach by employers
- Employers are not innovative enough to change the culture in order to improve project outcomes
- Poor procurement skills at employers

The research findings are expected to show similar outcomes as those barriers identified in the literature study. However, since the barriers for a NEC implementation haven't been investigated yet additional barriers are expected to be identified by this research.

What are the required success factors for a broader adoption and successful implementation of the NEC3 ECC in South African civil projects?

Success factors for the implementation of the NEC3 ECC in construction projects have not yet been academically investigated and are therefore identified in this research. However, some success factors are identified from international literature and from the opinion shared by one NEC experienced individual in South Africa. This led to the following identified success factors from the literature study:

- Provide training
- Increase the awareness of the benefits of the NEC
- Promote wider future use of the NEC in the engineering and construction industry
- Actively promote the joint working approach of the NEC and foster the collaboration
- South African universities must teach on contracting principles and the range of all strategies that are embedded in the different forms of contract including the NEC

The research findings are expected to show similar outcomes as those success factors identified in the literature study. However, since the success factors for a NEC implementation aren't investigated yet additional success factors are expected to be identified by this research.

2.8.2 Comparison between the South African and Dutch contractual developments

Lastly, contractual problems and developments in South Africa are compared with those in The Netherlands. First the contractual problems and subsequently the contractual innovations of the NEC and UAV-GC are compared. Then, the described barriers for adoption and success factors for implementation in respectively South Africa and The Netherlands are compared.

Contractual problems

Some of the biggest problems in the South African construction industry are contractual risks. General conditions of contract are found to be often unclear, ambiguous, amended,

favouring one certain party and containing poorly defined contractual obligations. This consequently often leads to the failure to execute contracts effectively and the arising of contractual disputes. Furthermore, relational issues such as adversarial problems and service quality attitudes are other often noticed problems. Moreover, it is found that the employer often chooses the wrong procurement strategy.

In The Netherlands, contractual risks and issues with the general conditions are not seen as some of the main problems in the construction industry. Instead strict governmental regulations and imposed administrative burdens as a reaction to a history with collusion in the industry is seen as the main problem for the industry. However, relational problems are also mentioned as one of the bigger problems in the Dutch construction industry together with issues such as a lack of information transfer, communication and focus on quality to the end user.

Therefore, contractual problems seem not to be shared amongst the South African and Dutch construction industries in a similar intensity. However, relational problems show similarities amongst the two countries.

Contractual innovations: NEC vs. UAV-GC

The NEC in South Africa is an all-embracing innovation that covers the whole spectrum of procurement and pricing strategies in a newly created family of contracts. The NEC is conform to all the modern principles of contracting and is based on flexibility of contracting strategy choices and a relational focus that emphasised good project management.

The literature on the benefits of the NEC is mainly positive. In addition, some examples of application of the NEC in South Africa have good project outcomes. However, broad industry adoption seems not yet to be achieved in South Africa.

The Dutch UAV-GC on the other hand is a contractual innovation just based on a different procurement method that integrates the lifecycle, processes and teams. The UAV-GC is however still of a transactional nature and does not conform to many of the principles of modern contracting. The UAV-GC does not provide for relational contracting and the flexibility for the full spectrum of procurement, pricing and other contracting strategy choices.

The need for the creation of the UAV-GC existed because of positive experiences from practice with integrated procurement strategies, such as design and construct. As a

result a newly created integrated contract, although based on the previous main standard contract, was created to better correspond with the contractual requirements of those new procurement methods. Especially on national level the UAV-GC is broadly adopted. Local authorities are still more reserved in the application of the UAV-GC.

Barriers for adoption and success factors for implementation

Similar barriers for the adoption of a new contract form are found in both South Africa and The Netherlands. These are a lack of knowledge about the contract, lack of experience with the new contract and a resistance to change away from traditional thinking by the employer. The main difference is that it is assumed that in the Netherlands the industry has sufficient knowledge to implement the new contract form and procurement type and therefore shouldn't be a barrier. In contrast it is found that South Africa has a lack of skills amongst employers to procure a new contract other than their usual approach and this must be seen as a barrier. In The Netherlands benefits that are not clear and the high procurement costs are mentioned as barriers for the adoption of the UAV-GC.

One similar required success factor for a broader adoption of a new contract form is found in both South Africa and The Netherlands. This is required to develop additional skills and competencies by the training of employees.

Chapter 3

Research Methodology

The Literature Review in chapter 2 identified some items for further investigation, which are the motives for this research. This chapter provides a description of the research methodology and the primary data collection. In addition, it confirms the validity of the research.

3.1 Methodology: Explanatory and exploratory research

The research methodology consists of an explanatory and exploratory part. At first, an explanatory research analyses secondary data, such as literature and standard construction contracts, to describe the current situation of relationships and variables according to contractual problems, developments and innovations. Secondly, an exploratory research identifies key variables that have not yet been academically defined but are discovered by this research, such as the critical barriers and required success factors for the introduction of the NEC in South Africa. In addition, the differences and similarities on its contractual developments between two countries are being explored and defined. The research phases and methodology are discussed in the next paragraphs.

3.1.1 Phases in the research

The research is designed according to four different research phases. This paragraph describes the execution of these phases.

Phase 1: Literature review

The data collection in this phase only contains secondary data that is mainly obtained from academic articles and other reliable sources.

Phase 2: Contractual innovations and industry perspective*Contractual analyses*

This phase first provides a comparison between the NEC and UAV-GC. The analysis is conducted through a textual analysis of the general conditions of the contracts. The comparison considers their innovative aspects and in specific the procedures for project management principles within contracting. The contractual analysis forms the basis for a better understanding of the contractual environment and innovations in respectively South Africa and The Netherlands. In addition it provides data input for the research synthesis, to validate the findings from the Literature Review.

Expert interviews

In this phase insight is gained from the collection of primary data through expert interviews. From the expert interviews the existing problems and the potential for improvement by the contractual innovations are considered from an industry perspective. The potential for the NEC as an improvement of the contracting practices in South African construction projects is in addition quantitatively assessed by a short-questionnaire at the end of each interview. Furthermore, the industry barriers and required factors for a broader adoption of the NEC in the industry are identified from the expert interviews.

Phase 3: Project experiences perspective*Expert interviews*

The third phase investigates the current experience and achievements using a NEC or UAV-GC through expert interviews. The focus is here on the impact of the contract at the execution of the project. The second and third phase contain an overlap since the information is extracted from the same expert interviews, but for clarity purposes the research is structured in this way.

Phase 4: Synthesis, conclusions and recommendations

Lastly, in the concluding phase the contractual analyses, the interview findings and short questionnaires outcomes are analysed and compared in the research synthesis. In support of the analysis a comparison is conducted between the South African and Dutch situations. The analysis furthermore tests the research outcomes against the literature

findings. Conclusions are then drawn and recommendations are formulated to achieve the research objective.

3.2 Primary data collection: Qualitative and quantitative

The primary data was gathered from several different expert sources over a period of three months. The data was collected qualitatively by interviews and quantitatively by a short-questionnaire. The short-questionnaire contains 13 statements about the NEC which must be valued according to a Likert-scale. The interview method is further described in the next paragraphs.

3.2.1 Method: Expert Interviews

Interviews are chosen because they are a strong tool to explore and identify barriers and success factors within a defined scope. Moreover they allow the interviewer and interviewee to further elaborate into a more detailed question or response. In this manner, the interviews create an understanding of a social phenomenon such as the adoption of a standard contract by an industry.

Therefore, expert interviews are chosen as the collection method because it gives a more in-depth industry perspective than for example a case study or survey. A case study would be too project-focused to explore barriers and success factors in an industry perspective. On the other hand, a survey lacks in the possibility to further explore for unknown barriers and success factors. Furthermore, it doesn't deliver the best in-depth understanding of the outcomes because of the merely quantitative results without an explanation of the context.

The South African interviews are partly semi-structured and partly structured. The semi-structured interviews encourage an informal and in-depth conversation that covers certain themes and questions. The structured short-questionnaire has the objective to test some statements that compare the NEC with the traditional contracts. In this manner, qualitative advantages of the NEC are provided with a quantitative substantiation to compare and validate the findings.

Because there is less emphasis on the comparison between the Dutch contracts, a short-questionnaire is not conducted in the Dutch expert interviews. The Dutch interviews are therefore fully semi-structured and maintain a different protocol than that used for the South African interviews. The different interview protocols are discussed in the next paragraph.

3.2.2 Interview protocol

The South African interview protocol is discussed in this paragraph. The semi-structured interview questions are presented in Appendix C. The Dutch interview protocol is fully discussed in Appendix C.

Purpose of interview

The interview is conducted to understand the difficult introduction of the NEC in South Africa. To create this understanding the interview investigates if a broader adoption of the NEC would be beneficial for South Africa, why the NEC is hardly adopted and how the NEC could achieve a broader adoption.

Interview procedure

- For an interview 90 minutes are reserved with the interviewee, however it is tried to be kept within 60 minutes.
- After the first acquaintance, but before the interview starts, the interview procedure is clarified and the interview ethics are discussed with the interviewee.
- The interview is semi-structured. The interviewee is free to further elaborate on topics and the interviewer is free to ask follow-up questions to proceed into more depth.
- After the interview a transcription is sent to the interviewee for validation and confirmation.

Content during interview

- Current experienced contractual problems in South African civil projects
- The current extend of the NEC adoption and implementation in South African civil projects

- Experiences and achievements from civil projects in South Africa that applied the NEC
- Is a broader adoption of the NEC seen as an improvement for South Africa
- Advantages of the NEC
- Disadvantages of the NEC
- Critical barriers for the implementation of the NEC3 in South African civil projects
- Required success factors for an implementation of the NEC3 in South African civil projects
- Short-questionnaire to test NEC experiences in comparison to the other traditional contract forms

Result from interview

After the interviews are transcribed, validated and confirmed, the principal findings are summarized and categorized into an overview table. The findings in the summary table are categorized according to the main issues stated as bullet points in the previously discussed 'content during the interview' paragraph. The summarized findings serve as the data input for the validation and the comparisons in the research synthesis.

Result from short-questionnaire

All the results on the short-questionnaire statements are averaged into one Likert-mean outcome. The averaged Likert-outcomes on the statements are used to validate the qualitative found advantages of the NEC. They can however not be seen as an academic outcome because of the limited number of responses.

3.2.3 Interview sample

The South African interview sample is composed of the three main parties involved in the contracting practices of civil projects. Those three parties are the employer, the contractor and the consultant. To ascertain academic quality interviewees are approached who have at least more than 10 years of experience, but preferably more than 20 years, and have a high function to be accounted as knowledgeable and influential. The sample is furthermore composed to reflect the higher and less complex projects, which make use of a standard construction contract. Therefore parties that work with bigger or/and smaller projects are approached and included in the sample. In this manner the research

creates a view on the civil engineering industry in its entirety. The conclusions drawn from this research are consequently focused on the contracting practices of the entire South African civil engineering industry.

Random governmental bodies and companies were approached in the search for knowledgeable employers, contractors and consultants who have experience with the NEC and at least one other contract form, such as the GCC, JBCC or FIDIC. The aim was to find 3 to 4 reliable interviewees of all three actor types to try to collect repetitive data and therefore validated research findings. The search for people with NEC experience and who were willing to make time for an interview was of a difficult nature. Some contacts from the supervisor of the research were used in the search for more people with NEC experiences. This led to 3 interviewees of both an employer and a consultant, and which both created repetitive outcomes. However, only one contractor with NEC experience was found to be willing to participate. Therefore the contractors' perspective didn't create repetitive findings and is therefore in this research less emphasised. Consequently, the outcome of the contractors' point of view requires further research and validation. The eventual total interview sample consists of the 7 persons stated in Table 3.1. The names of the interviewees can be found in Table D.1 in Appendix D.

TABLE 3.1: South African interview sample

Actor type	Government/ Company	Function	Experience (NEC)	Project sizes
Employer	WITS University - Campus planning and development	Senior project manager (Former Eskom PM)	20 years (20 years)	Large
Employer	Department of Transport and Public Works of the Western Cape	Programme manager - General Infrastructure	28 years (2 years)	Large / Small
Employer	Saldana Bay IDZ licensing company	Lead - Infrastructure planning and environment	28 years (6 years)	Large
Contractor	Murray & Dickson (CE8)	Director	36 years (5 years)	Large / Small
Consultant	RoyalHaskoningDHV	Principal Buildings	10 years (1 year)	Large / Small
Consultant	Storey Eng (Pty) Limited	Director	31 years (4 years)	Small
Expert / Consultant	Infrastructure Options	Director (Former SAICE president)	34 years (17 years)	Large

The Dutch part of the research is for comparison purposes to gain from external Dutch insights. For this purpose less interviews are conducted than in the South African part. The Dutch interview sample is composed of three different actor types: one of the biggest employers that uses the UAV-GC, an engineering consultancy specialized in project and

contract management, and the institute that is the developer and current administrator of the UAV-GC. Some of their most experienced UAV-GC employees are interviewed. They can provide good insights for the comparison and recommendation purposes of the Dutch research part. The eventual interview sample consists of the 3 persons stated in Table 3.2. The names of the interviewees can be found in Table D.2 in Appendix D.

TABLE 3.2: Dutch interview sample

Actor type	Government/ Company	Function	Experience (UAV-GC)
Employer	Ingenieursbureau Amsterdam	Advisor (Integrated Contracts, Systems Engineering, Risk Management) (UAV-GC expert)	5 years (4 years)
Consultant	Brink Groep	Senior Project Manager (Current PM in NEC project - International Criminal Court The Hague)	28 years (+ NEC)
Developer / Administrator	CROW (knowledge institute)	Project Manager (UAV-GC) (Co-developer and current administrator of the UAV-GC)	36 years (14 years)

3.3 Trustworthiness

Academic research must guarantee trustworthiness. The research outcome must be accurate and must provide a consistent outcome according to respectively its validity and reliability. These are discussed in the next paragraphs.

3.3.1 Validity

Research validity is striving for the truth. However qualitative research is of an interpretative kind, striving for validity means that the interpretation of the results accurately represent the phenomena to which it refers (Hammersley, 1990:57). To accomplish validity in qualitative research it is therefore important to adopt triangulation and respondent validation.

Triangulation

The approach of triangulation is implemented in the research to improve the validity. Triangulation creates a more detailed and balanced picture of the situation by creating a true fix on the situation through combining different ways of looking at it (Silverman, 2010:277). According to O'Donoghue & Punch (2003:78) this is achieved by a "method of cross-checking data from multiple sources to search for regularities in the research

data". This research establishes a methodological triangulation, in which the data is collected through several different methods (Denzin, 1978). The different methods in this research are a literature study, a contractual analysis, expert interviews and short-questionnaires.

Respondent validation

Respondent validation is an accuracy check of the processed data and the according findings from a conducted interview with the respective respondent (Silverman, 2010:278). Summarizing and restating the information obtained to the respondent, by means of an interview transcript, allows them to critically analyse the findings and to comment on them. When the respondent affirms the accuracy and completeness, the information is valid. In this way incorrect data and incorrect interpretation of data will be mitigated. Instead findings that are authentic, original and reliable are achieved.

3.3.2 Reliability

Reliability refers to the degree of consistency of research results in case of repetition of the research. To create reliability it is therefore important to accurately document the research procedures and consistently commit to the use of the same categories and well-defined phenomena (Silverman, 2010:290). This is done by the use of interview protocols, categorization of the research items and the creation of an audit trail.

Audit trail

A research database is created where all the research data is stored. The acquired literature or the references, contact information and communication, interview records, validated transcripts and the thesis document are all stored in the database. In this manner a detailed audit trail is created and the research could be repeated towards a consistent outcome.

Chapter 4

Research Findings

The findings of the research are presented in this chapter. The chapter is divided into four sub-chapters in which findings from different data collections are presented. The four sub-chapters are:

- Contractual analyses and comparison findings
- Expert interview findings in South Africa
- Short-questionnaire findings in South Africa
- Expert interview findings in The Netherlands

The four different findings sources are subsequently described.

4.1 Contractual analyses and comparison findings

In this sub-chapter the content of the NEC and the Dutch UAV-GC contracts are analysed and compared. The analyses and comparison form the basis for the understanding of the two different contracting environments. First the NEC3 ECC is described and then the UAV-GC 2005, after which a comparison is made. The analyses will be structured according to the following subjects:

- 1. NEC3 (ECC) / 2. UAV-GC 2005
 - Family of contracts
 - Contractual arrangements
 - Required contract documents
 - Structure of the general conditions of the contract
 - Arrangement for contractor's design responsibilities
 - Project management principles
 - * Risk management
 - * Programme management
 - * Change management
 - * Quality control management
 - * Dispute management
 - * Partnering
- 3. Comparison between NEC3 ECC and UAV-GC 2005
 - Flexibility and standardization
 - Clarity and simplicity
 - Stimulation of good project management
 - Relational contracting

4.1.1 NEC3 (ECC)

The NEC is an international contract that can be used in any location. It facilitates the implementation of project management principles. The NEC comes with associated guidance notes and flow charts that explain the procedures that need to be followed and by whom, throughout the lifecycle of the project. This sub-chapter subsequently discusses the NEC3 family of contracts, the structure of the NEC3 ECC and the included project management principles in the NEC3 ECC, as depicted in Figure 4.1.



FIGURE 4.1: Contractual analysis of the NEC3 ECC

4.1.1.1 The NEC3 family of contracts

Unlike the GCC and JBCC, the NEC3 is structured as a family of contracts which maintain an integrated working approach to procurement. The NEC3 family contains a suit of contracts that can be used in a diverse range of works, services and supply. Consequently, to achieve high flexibility in procurement delivery over the whole lifecycle of a project, the NEC3 family consists of 12 different contracts. The focus of this contractual analysis is hereafter on the Engineering and Construction Contract (NEC3 ECC).

4.1.1.2 Contractual arrangements in NEC3 ECC

The NEC3 ECC is intended as the contract between the employer and the contractor for the construction of a project. To manage the project, in a NEC3 environment, the employer appoints a project manager and supervisor. The employer and contractor together appoint an adjudicator. Designers can be appointed by both the employer and by the contractor, dependent on the chosen design responsibilities. The contractor is the one who appoints the subcontractors and suppliers. This leads to a project organization as depicted in Figure 4.2.

The NEC sets out the responsibilities and roles for:

- The Employer
- The Project Manager
- The Supervisor
- The Contractor

- Subcontractors
- The Adjudicator

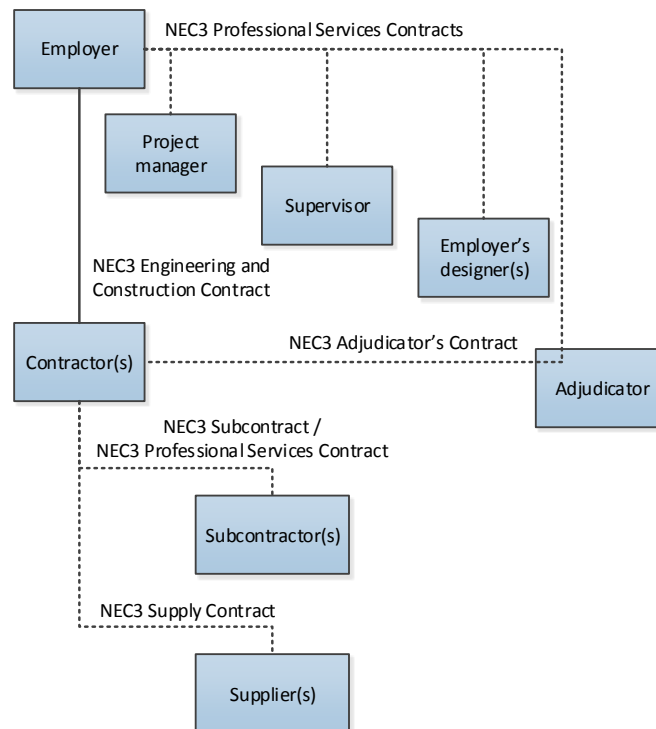


FIGURE 4.2: NEC3 system

Separate functions of Employer's designer and contractor's designer are assumed but not mentioned in the contract (NEC3, 2013b:8). In traditional contracts, such as the JBCC and GCC, respectively the principal agent or engineer is both the project manager and the supervisor and also has some adjudicator responsibilities. The NEC3 ECC clearly divides these responsibilities towards a project manager, supervisor and adjudicator function on the project. The three functions are described below.

Project manager

The project manager is appointed by the employer, either from his own staff or from outside. The project manager manages the contract on behalf of the employer with the intention of achieving the employer's objectives for the completed project. The project manager has considerable authority in the ECC reflected by clause 27.3 (NEC3, 2013b:10):

"The Contractor obeys an instruction which is in accordance with this contract and is given to him by the Project Manager or the Supervisor."

It is assumed that the project manager has the employer's authority to carry out the actions and make the decisions required of him. (NEC3, 2013b:10).

Supervisor

The supervisor is appointed by the employer, either from his own staff or from outside. His role is to check that the works are constructed in accordance with the contract. It is the responsibility of the supervisor to issue the defects certificate, which signifies most of the obligations of the parties (NEC3, 2013b:11).

Adjudicator

The adjudicator is jointly appointed to settle any disputes that arise between the parties.

4.1.1.3 Required contract documents under the NEC3 ECC

The complete construction contract, when using an NE3 ECC arrangement, includes the following documents:

- The NEC3 ECC
 - The core clauses
 - The main option clauses
 - The dispute resolution clauses
 - The secondary option clauses
 - The shorter or full schedule of cost components (not applicable to main option F)
 - The contract data formats
- The works information
- The site information
- Documents resulting from chosen secondary options

Other documents that may be included are:

- The contractor's tender programme as the accepted programme
- An activity schedule or bill of quantities

4.1.1.4 Structure of the general conditions of the NEC3 ECC

The NEC3 ECC is structured according to six different components, which are subsequently discussed.

Core clauses

The core clauses are described in eight different sections, namely:

1. General
2. The Contractor's main responsibilities
3. Time
4. Testing and defects
5. Payment
6. Compensation events
7. Risks and insurance
8. Termination

Main option clauses

The main options provide a choice between six different payment mechanisms. The main option clauses describe the arrangement for payment and associated risk allocations for each different option. The main options are subsequently described:

Option A: Priced Contract with Activity Schedule

Option A prices activities lump sum, based on an activity schedule. The sum of the priced activities will be the total contract sum. The contractor is paid in accordance with the completed activities. The activities from the activity schedule are linked to the time bars on the programme, which are both prepared by the contractor to suit his planned method of execution. The contractor bears the pricing risk and the employer bears the risk of compensation events.

Option B: Priced Contract with Bill of Quantities

Option B prices a schedule of items with quantities. The items are priced with the tender rates of the contractor. The sum of the multiplication of all the priced items with their quantities will be the total contract sum. The contractor bears the pricing risk and the employer bears the quantity risk and the risks of the compensation events.

Options C and D: Target Contracts (C: with Activity Schedule or D: with Bill of Quantities)

In target cost contracts the risks are shared between the employer and contractor according to a 'pain-gain' ratio. The liabilities of cost overruns, but also of cost savings, in comparison to the target cost are shared based on an agreed ratio. Option C and D are similar to option A and B but as a difference have a target cost mechanism built into the contract. Target cost contracts are especially useful when the project contains high risks. The target cost mechanism stimulates the parties to better manage the risks in a more collaborative way because of the risk sharing.

Option E: Cost Reimbursable Contract

Option E provides for a pricing strategy that pays the contractor his actual costs plus a fee. This contract type is useful when a quick start of the execution of the project is required without the scope of the works to be adequately defined. In this contract type the employer bears all the cost-related risks.

Option F: Management Contract

The management contract under option F is used when a main contractor subcontracts all or most of the work towards subcontractors. The main contractor acts as a management contractor who is paid the defined costs plus a fee.

The dispute resolution option clauses

It is compulsory in the NEC3 ECC to choose a dispute resolution option as a part of the contract. Both options contain adjudication as the method of resolution. The two options are:

Option W1

This is the standard NEC dispute resolution option. In each NEC project an independent adjudicator is jointly appointed beforehand by the NEC3 Adjudicator contract. The use of the adjudicator should only be used after attempts at negotiation and mediation or conciliation. Arbitration or litigation should only be used as an ultimate means for final resolution.

Option W2

This option is only applicable in the UK and therefore not relevant to South Africa.

Secondary option clauses

The NEC3 ECC provides a choice to add secondary option clauses to the compulsory core clauses and chosen main option clauses. This provides the employer with significant flexibility in compiling a construction contract that best suits the circumstances of the project. The standardized flexibility of the NEC3 ECC therefore ensures that the original contract terms don't need to be amended to fit specific project circumstances or country circumstances. Special country regulations can be added as an options Z-clause.

The possible secondary option clauses to choose from, are:

- Option X1: Price Adjustment for Inflation (used only with Option A, B, C, and D)
- Option X2: Changes in the Law
- Option X3: Multiple Currencies (used only with Options A and B)
- Option X4: Parent Company Guarantee
- Option X5: Sectional Completion
- Option X6: Bonus for Early Completion
- Option X7: Delay Damages
- Option X8: Collateral Warranty Agreements (not applicable for the ECC)
- Option X9: Transfer of Rights (not applicable for the ECC)
- Option X10: Employer's Agent (not applicable for the ECC)
- Option X11: Termination by the Employer (not applicable for the ECC)
- Option X12: Partnering
- Option X13: Performance Bond
- Option X14: Advance Payment to the Contractor
- Option X15: Limiting the Contractor's design to reasonable skill and care
- Option X16: Retention (not used with Option F)
- Option X17: Low Performance Damages
- Option X18: Limitations of Liability
- Option X19: Task Order (not applicable for the ECC)
- Option X20: Key Performance Indicators (not used with Option X12)
- Options Y 1,2 and 3: Only UK, not applicable to South Africa
- Option Z: Additional Conditions of Contract

Schedule of cost components

The schedule of cost components (SCC) is part of the contract when option C, D or E is used. The schedule of cost components:

- Defines the cost components for which the contractor will be directly reimbursed
- Defines the cost components which are included in an assessment of changed costs arising from a compensation event.

The shorter schedule of cost components (SSCC) is part of the contract when option A or B is used. The SSCC is used to define the cost components only when assessing a compensation event (NEC3, 2013b:124).

Contract data formats

The contract data is to provide data as required by the conditions of contract specific to the particular NEC contract form. There are two standard formats, part one and part two. Part one needs to be completed by the employer and part two by the contractor.

4.1.1.5 Arrangement for contractor's design responsibility

The NEC provides for a possible involvement of the contractor in the design responsibilities. NEC3 ECC clause 21.1 describes that the works information must state the contractor's design responsibilities. He must according to clause 21.2 furthermore submit the particulars to the project manager for acceptance as required by the works information. A reason for not accepting is that the design does not comply with the works information or the applicable law. According to clause 22.1 is the employer allowed to use and copy the design for any purpose connected with construction, use, alteration or demolition of the works unless otherwise stated in the works information. Clause 27.1 states that the contractor must obtain approval of his design from others where necessary (NEC3, 2013a:8). The exact NEC3 ECC sub-clauses are cited in Appendix G. When the contractor doesn't have the required design skills in-house for his design responsibilities, he is allowed to subcontract others. The flexibility of the NEC provides for the use of a NEC3 professional service (short) contract as a subcontract for the contractor to appoint designers. The NEC3 professional service (short) contract can therefore be used by both the employer and the contractor to appoint a designer.

4.1.1.6 Project management principles in the NEC3 ECC

The focus of this part of the contractual analysis is on the implications of the use of a NEC3 ECC in the execution of construction projects. An innovative aspect of the NEC in comparison with the more traditional contracts that are used in South Africa, such as the GCC, JBCC and the FIDIC, is the higher level of prescribed project management standards that are required by contract. The following project management principles in the NEC3 ECC are subsequently discussed:

- Risk management
- Programme management
- Change management
- Quality control management
- Dispute management
- Partnering

All mentioned clauses in this paragraph are derived from the NEC3 ECC (NEC3, 2013a). The sub-clauses which are referred to in this paragraph are cited in Appendix G.

Risk management

The NEC3 ECC allocates the risks and prescribes some required risk management procedures. Firstly, the way of risk allocation between the employer and contractor is discussed and secondly the required risk management procedures. The risk management procedures that the NEC3 ECC prescribes are the requirements for a risk register, an early warning system and risk reduction meetings.

Risk allocation

The risk allocation in the NEC3 ECC is discussed in chapter 8, 'Risks and Insurances'. The risk allocations are divided in:

- Clause 80. The employer's risks

Clause 80.1 states six different situations, which contain several sub-situations, in which the employer is responsible to bear a certain risk and its indemnifications.

Furthermore, the compensation events described in clause 60.1 can also be seen as an employer's risk for increasing costs. The 19 different described compensation events

entitle the contractor on indemnification of his extra costs and time extension for his delay that were caused by the employer. These include the indemnification of the employer's risks described in clause 80.1. The listed compensation events contain therefore all situations that can lead to extra costs for the employer.

- Clause 81. The contractor's risks

Clause 81.1 describes that: "From the starting date until the Defects Certificate has been issued, the risks which are not carried by the Employer are carried by the Contractor". The strict procedures and associated time limits of the NEC3 ECC are an extra risk for the contractor. Not complying with the contract may for example cause the contractor to miss compensation and therefore profit.

Overall, the risk allocations are simply described in clause 80 and 81 with a clear division between the employer's risks and the contractor's risks. Furthermore, the possible compensation events are clearly stated in one place, in clause 60.1.

Up-to-date risk register

The Contract Data Part 1 of the NEC3 ECC contains the aspect "The following matters will be included in the Risk Register:" to be filled in by the employer. In this manner the contract requires a risk register from the start. Thereafter the NEC3 ECC requires the project manager and contractor to collaboratively maintain the risk register during the project. The risk register is defined in clause 11.2 (14) as the list of risks included in the contract data and the risks that resulted from early warnings. The list of risks must include a description of the risk and the actions which are to be taken to avoid or reduce the risk. Clause 16.1 and 16.4 describe that the project manager is responsible to enter early warning notices in the risk register, to revise the risk register, to record the decisions made at a risk reduction meeting and to issue a revised risk register to the contractor. If a decision at the risk reduction meeting leads to changes to the works information, the project manager must issue these changes to the contractor at the same time as the revised risk register.

Early warning system

The NEC3 ECC includes a compulsory early warning system into its contractual procedures. According to clause 16.1 an early warning must be given by the contractor or project manager as soon as either becomes aware of any matter which could:

- Increase the total of the prices
- Delay completion
- Delay meeting a key date
- Impair the performances of the works in use

The contractor can also warn the project manager early of any matter which could increase his total costs.

Risk reduction meetings

Based on clause 16.2, both the project manager and the contractor may instruct the other to attend a risk reduction meeting. Risk reduction meetings can also be used after an early warning to resolve any problem. Clause 16.3 describes the responsibilities of the parties who are attending the risk reduction meeting. They are required to co-operate in proposing solutions to avoid or reduce the registered risks and searching for the solution which would bring advantage to all of those who would be affected. Furthermore has to be decided on the action to be taken and who will be responsible for executing the action. Lastly, the meeting must conclude which risks can be removed from the risk register.

Because of the clear description of a basic risk management system within the contract the NEC3 ECC guarantees the awareness and management of risks. Furthermore the NEC3 ECC gives a clear overview of the risk allocations, which are simply described and easy to understand.

Programme management

The NEC3 ECC describes in detail in clause 31 the requirements for the programme to be accepted. Clause 32 states what needs to be done within a revised programme to become an accepted revision. The NEC3 ECC provides through clause 50.3 the possibility for the employer to retain 25% of the price from his payments of work done to date until a programme is submitted that is according to the contract requirements. In the Contract Data Part 1 of the NEC3 ECC, which is filled in by the employer, the maximum interval period needs to be stated for the contractor to submit his revised programmes.

Because of the detailed described programme requirements, strict time intervals for revision and resulting penalties the NEC3 ECC is a stimulator for on-going programme management in the project.

Change management

Both variations and claims are settled in the NEC3 ECC through compensation events. The NEC3 ECC describes, in the sixth chapter 'Compensation Events', all the different situations which a compensation procedure applies to and it sets out the procedure how to handle, quote, assess and implement the compensation events. The 'Compensation Events' chapter is divided in the following five main clauses, which contain several sub-clauses:

60. Compensation events
61. Notifying compensation events
62. Quotations for compensation events
63. Assessing compensation events
64. The Project Manager's assessment
65. Implementing compensation events

The analysis of these five change management system clauses is described in Appendix E. From this analysis can be concluded that the rules and procedures for compensation events are clear and described in one place, only in chapter 6 of the contract, on a step-by-step procedural basis according to clause 60 to 65. The procedure of a compensation event assesses the associated cost compensation and time extension together based on the forecasted consequences to the accepted programme and the associated total price of the project. The procedures are strict and easy to understand and therefore avoid grey areas in the contract as much as possible. Furthermore the clauses include the stimulation of a collaborative search for solutions and a prompt execution of a compensation event and its assessments.

Quality control management

The quality control procedures are set up and described in the works information. The NEC3 ECC describes testing and defects in chapter 4. These are the general rules for testing and inspections done by either the contractor or supervisor and the general rules in the case of possible defects. The NEC3 ECC has a project organization with a supervisor and he is therefore the manager of the quality control process. In the end he is responsible for the approval of the delivered quality by issuing the defects certificate.

Dispute management

A dispute in the NEC is referred to and decided by an impartial independent adjudicator. The party who refers a dispute to the adjudicator provides him also with the information that is to be considered. The notification of disputes, the provision of its information and the decision by the adjudicator are subject to strict procedures and time limits to arrange for the prompt solution of a problem. The adjudicator must always communicate openly to all concerned parties and has to make his decision in the same way as a compensation event is assessed in the NEC. In the meantime that the dispute is considered the project manager and supervisor must proceed as if the decision has not been disputed. The adjudicator has under clause W1.3 (5) the opportunity to instruct four different actions. The adjudicator has the opportunity to revise his decision in the case of a mistake or ambiguity only within two weeks of the decision. The decision of the adjudicator can be referred to the chosen tribunal within the strictly set procedures and time limits. Otherwise the adjudicator's decision is binding.

The disputes are dealt with quickly and efficiently with the intention that they are not left to cause any ill will amongst the parties. The NEC3 ECC tries to emphasize it as an efficient method for referring honestly held differences, between parties working together in a spirit of mutual trust and co-operation, to a third party to decide (NEC3, 2013b:12).

Partnering

It has already been noticed in the risk management and change management paragraphs that the NEC includes collaboration in the procedures of handling risks and changes. Risks are to be reduced or avoided collaboratively by early warnings and risk meetings. In the case of handling risks and changes, the employer and contractor are expected to search together for possible solutions and the best approach. This already leads to a more relational approach than in the traditional contract forms.

In addition to this the NEC3 ECC also prescribes clause 10.1, which states that the employer, contractor, project manager and supervisor shall act according to the contract in a spirit of mutual trust and co-operation. In this way the parties already undertake a collaborative intention by signing the NEC3 ECC. The NEC3 ECC also provides for a secondary option to include a partnering agreement to the contract. The partnering agreement contains a Schedule of Partners in which Key Performance Indicators and

associated payments are defined and all the objectives of partners other than the employer are defined. The partners work together to achieve the client's objectives and the objectives of each partner. If a partner becomes aware of any matter that could affect the achievement of another partner's objective an early warning must be given. The partnering agreement describes some definitions, actions to be taken, some rules on how to work together and the use of incentives. Some of these critical partnering clauses are stated in appendix G. The partnering clauses must stimulate the creation of a team effort by sharing and trying to achieve each other's objectives.

The NEC clearly tries to emphasize good project management practices and tries to create an environment of collaboration that must lead to better project outcomes. The NEC3 ECC achieves this due to the clarity of strict risk allocations and time limits, the emphasis on collaborative risk management, the prompt and quick resolution of problems and the stimulation of a team effort. In addition the clear and strict change management procedures, which are based on a detailed and on-going programme management, create proper substantiated change assessments on time and cost. The change management therefore becomes less sensitive to conflicts.

However, the emphasis on good project management practices by the NEC does require more intense project management. More time needs to be allocated to the contractual mechanisms such as the early warnings, notifications and risk meetings. Therefore a rise of the administration costs is to be expected.

4.1.2 UAV-GC 2005

As the input for the comparison between the NEC and the UAV-GC innovations, the UAV-GC 2005 is also analysed, as depicted in 4.3.



FIGURE 4.3: Contractual analysis of the UAV-GC 2005

The UAV-GC 2005 contains a model agreement with corresponding uniform administrative conditions suited as a contract that integrates design, execution and if desired, maintenance responsibilities towards a single party. This is known as an integrated contract. The UAV-GC is an innovative procurement strategy that provides the opportunity for innovative solutions through early contractor involvement and better collaboration between designer and contractor. Design & Build, Design & Construct and Turnkey are some examples of project types that use an integrated contract form. The creation of the UAV-GC has been invoked by the civil sector but is, by its publisher, also assumed to be applicable to structural projects.

The contractual analysis of the UAV-GC 2005 subsequently discusses the structure of the UAV-GC 2005 and its facilitated project management principles. The outcomes of the contractual analysis can be consulted in Appendix F. These outcomes are used for the comparison with the NEC, which is provided in the next section.

4.1.3 Comparison between the NEC3 ECC and the UAV-GC 2005

Now that the NEC3 ECC and the UAV-GC 2005 have been presented separately, this sub-chapter compares the two contracts on their innovative aspects, as depicted in Figure 4.4. This comparison provides an understanding of the contractual similarities and differences between the introductions of these contracts within their civil engineering environments. The flexibility and standardization, clarity and simplicity, stimulation of good project management and relational contracting are subsequently compared. Finally, a conclusion about the level of innovation within both contracts is concluded.



FIGURE 4.4: Comparison between the NEC3 ECC and the UAV-GC 2005

Flexibility and Standardization

There is a significant difference between the flexibility of the NEC3 ECC and the UAV-GC 2005. The NEC3 ECC is part of a family of different procurement options and

suitable for use within almost any procurement strategy. On the other hand the UAV-GC 2005 is limited in its flexibility on different procurement strategies. Apart from the procurement strategy, the UAV-GC 2005 delivers flexibility through the possibility of arrangements to be enforced external of its general conditions, such as an acknowledgment plan, quality assurance and control plan and risk and programme management plans. Arrangements as these must with an UAV-GC 2005 be project-specifically described as an extra requirement whereas the NEC3 ECC has most of these arrangements standard included in its documents. Therefore the standardization of the NEC3 ECC is higher than for the UAV-GC 2005 and this should lead to more uniformity in the industry.

Clarity and simplicity

The language of the NEC3 ECC is found to be simple. The sentences were relatively short and uses many synoptic bullet points and no referencing to other clauses. Reading and understanding the NEC3 ECC is therefore experienced as easy and the content allowed for only one interpretation and therefore seems unambiguous. In addition, the procedures and responsibilities are found to be described clearly in the NEC3 ECC and were therefore easy to understand.

In comparison with the NEC3 ECC, the UAV-GC 2005 contains longer sentences, less bullet points and a high amount of referencing to other clauses and external documents. Furthermore it is made up of clauses to describe eventualities instead of procedures. The UAV-GC 2005 is found to be more difficult to read and to understand. Hence is less clear. As an example, the NEC3 ECC clearly describes the employer's risks for extra compensation in one section by the 19 possible compensation events. Everything outside of these risks are the contractor's risks. This creates a strict and clear risk allocation and doesn't leave space for grey areas. All the risk allocations in the UAV-GC 2005 are scattered throughout the document and discussed per eventuality. This provides less clarity. Furthermore not all eventualities can be described in a contract, so there might be occasions where the risk is not allocated and may lead to conflict whereas the NEC3 ECC assigns the risk of any eventuality that is not described by the contract towards the contractor. This creates strictness, clarity, openness and must prevent conflicts because the strict allocations are easily understood and are been agreed upon upfront.

Stimulation of good project management

Many project management principles are found to be facilitated by the NEC3 ECC. It enforces good project management principles such as risk management, programme

management, prompt change and conflict management and a relational approach. In contrast, the UAV-GC 2005 excludes these project management requirements and it is therefore the responsibility of the employer to enforce these requirements externally of the UAV-GC 2005. In this manner it is not standardized amongst the industry and therefore leads to less uniformity and resulting efficiency than with a NEC3 ECC.

Variations are dealt with in the NEC3 ECC based on the programme as an inherent tool to assess the forecasted time extension and extra costs consequences together. All required procedural responses are subject to strict time limits and any variation should therefore be dealt with promptly and quickly. In this way the project should be better controlled on its schedule and budget by creating a better up-to-date and more accurate awareness of the project performances. The UAV-GC 2005 on the other hand doesn't prescribe the same procedures based on project management principles with strict time limits for response. In the UAV-GC 2005 cost compensation and time extension are dealt with separately in the assessment of variations. The cost compensation is based on a quotation of substantiated extra costs and not the increase of the total price of the project as a consequence of the variation, as is the case with the NEC3 ECC. Furthermore, because the UAV-GC 2005 doesn't describe strict time limits the duration of settling the consequences of variations can take long and may lead to delays and cost overruns. This doesn't lead to awareness about the accurate project performances.

Project management principles such as risk, programme and change management are found to be prescribed in more detail by the NEC3 ECC. They are furthermore better stimulated because of the enforced strict time limits for response and strictly prescribed procedures.

Relational contracting

The NEC3 ECC aims to create a team effort by stimulating collaboration through contractual mechanisms such as partnering, a target contract and a collaborative approach to risk management. This aspect is found to be limited in the UAV-GC 2005. The UAV-GC 2005 still seems to be of a transactional nature.

4.1.3.1 Concluding level of innovation

Based on the analysis of the UAV-GC 2005, it seems to be merely an innovation to provide for a new procurement strategy that contains an early contractor involvement

and the inclusion of the contractor's design responsibilities. There aren't many innovative aspects found on the content and procedures within the general conditions of the contract. The contract is perceived by this analysis to be of a transactional nature. From these findings, the UAV-GC 2005 seems to show more similarities to the GCC than the NEC. The NEC3 ECC however professes to be an innovation on the content, its procedures and the philosophy of how the parties have to operate under the contract. This can be seen as a shift away from the traditional approach.

4.2 Expert interview findings from South Africa

The findings from the expert interviews in South Africa are described in this sub-chapter, as depicted in Figure 4.5.



FIGURE 4.5: South African expert interviews

The names and companies of the South African interviewees are stated in Appendix D. The transcripts of all interviews are available from the author and are supplied on memory disk together with this thesis. The function and experiences of the interviewees are further explained in the transcripts. From the transcripts, the main findings are categorized and summarized per interviewee into tables presented in appendix H. From these tables the overall research findings were categorized and summarized. The overall findings are described in this sub-chapter. Statements by the interviewees are referenced by putting the surname in between brackets at the end of the sentence. The findings for the South African civil industry are discussed according to:

- Contractual problems experienced
- Extent of the NEC adoption
- NEC experiences and achievements
- Broader adoption desired based on opinions from NEC experienced people

- Advantages of the NEC
- Disadvantages of the NEC
- Critical barriers for the implementation of the NEC3
- Required success factors for an implementation of the NEC3

4.2.1 Current contractual problems in South African civil projects

Contractual problems that have been mentioned several times by the different interviewees are:

- The lack of knowledge and understanding of contracts within the industry
- Deficiencies of the GCC and the JBCC
- The existence of adversarial relationships
- The escalation of problems into complex and long lasting conflicts
- Over-specification of the general conditions of contract
- Other singular identified contractual problems

These problems are now discussed.

The lack of knowledge and understanding of contracts within the industry

Most of the interviewees mentioned a lack of knowledge about construction contracts as one of the main contractual problems in the civil industry (Van Rensburg, Watermeyer, Vanden Eynde, Murray, Storey, Zandvoort). This lack of knowledge ranges from a general lack of knowledge within the industry towards specific items for the (small) contractors, the employers and the architects. Employers were mentioned to have a lack of knowledge about contracting, which is more focused on the procurement strategy (Watermeyer). Furthermore, the lack of knowledge is often identified as a lack of understanding of the contract and the differences between the commonly used contracts (Vanden Eynde, Storey). It was also commented that the contracts are often not read and are only consulted when necessary (Vanden Eynde). Reasons mentioned for the lack of knowledge are a combination of: a shortage of skilled engineers, a lack of knowledge-transfer in the industry and a high workload (Zandvoort). Consequently, this leads to many employees who are never taught an understanding and comparison of the different contracts.

Deficiencies of the GCC and JBCC

Several deficiencies of the GCC and JBCC were mentioned by the interviewees to the question on general contractual problems, irrespective of the used standard contract form, within the industry. The mentioned deficiencies are:

- The traditional approach within the GCC doesn't lead to value for money (Marais)
- The GCC is set-up to evoke conflict through the claims procedure (Marais)
- The GCC is unfair towards contractors on the valuation of variation orders (Marais)
- Delays and disruptions are hard to control with the JBCC and GCC (Watermeyer)
- The GCC is complex, difficult, not clear and contains many irrelevant aspects (Storey)
- The GCC makes contracting practices unnecessarily difficult (Storey)

The existence of adversarial relationships

Two of the seven interviewees mentioned the existence of adversarial relationships as a problem in the industry (Vanden Eynde, Murray). However most interviewees mentioned the creation of co-operation as an advantage of the NEC. This could imply that the industry isn't currently as co-operative as desired and might also be related to the existence of adversarial relationships.

The escalation of problems into complex and long lasting conflicts

The escalation of problems is often mentioned by the interviewees in combination with the GCC and sometimes JBCC (Marais, Watermeyer, Murray, Storey). It is mentioned that those contracts don't deal with problems promptly and escalate in complex conflicts with a long aftermath (Storey, Murray). Consequently, delays and disruptions are hard to control (Watermeyer). The set-up of the claims procedures, in the case of the GCC, are mentioned to be a big cause for problems to escalate (Marais).

Over-specification of the general conditions of contract

The over-specification of contract conditions was mentioned by a few interviewees (Van Rensburg, Storey). This was described as the addition of clauses to protect the employer in more specific eventualities. This is seen by these interviewees as an ineffective custom in South Africa. In addition, this confirms some remarks of interviewees that recommended employers to avoid the use of additional Z-clauses in the NEC, whilst this is a common practice in South Africa (Van Rensburg, Storey, Zandvoort).

Other singular identified contractual problems

Other singular identified contractual problems are:

- Lack of sufficient English proficiency in industry for contracting practices which sometimes leads to misunderstandings and wrong assumptions resulting in problems (Zandvoort)
- Lacking contract management as part of an overall lack in project management (Zandvoort)
- Projects often are not properly designed upfront and invoke contractual problems (Watermeyer)
- An industry shouldn't have too many different contract forms and only two forms would be sufficient (Watermeyer)
- Employers or consultants often have problems properly integrating the works information with the standard construction contract (Van Rensburg)

4.2.2 The current extent of the NEC adoption by the South African civil engineering industry

The NEC was unanimously reported by the interviewees not to be broadly adopted by the South African civil engineering industry. The bigger government-owned corporation Eskom was generally mentioned as a regular user of the NEC. Many also remarked that other large client bodies also use the NEC but that it is not widely adopted within the industry as a whole. The private sector and the smaller projects almost don't use the NEC at all (Vanden Eynde, Storey). In government the NEC use is also still limited (Van Rensburg). It is also mentioned that there probably won't be many consultants advising for the NEC as the preferred contract (Vanden Eynde). However remarks are made that the NEC adoption is starting to pick up now, amongst other aspects because the government is rebuilding its capabilities (Watermeyer, Vanden Eynde, Zandvoort). Another interviewee made a critical comment that he finds many projects that adopted the NEC are still not applied in the right NEC philosophy (Marais). Furthermore are the NEC options with activity schedule and target contract still found to be far away from adoption (Marais, Storey).

4.2.3 Experience and achievements from civil projects in South Africa

From the experience of the interviewees all of them are positive about the NEC use and find the NEC to lead to better project outcomes. The NEC is furthermore to be found legally applicable to South Africa and is assumed to be a mature contract (Van Rensburg, Zandvoort). Moreover it is often mentioned that the NEC is easy to learn and that migrating to the NEC is therefore an easy and quick process (Van Rensburg, Watermeyer). It is mentioned by all interviewees that either the architects, contractors, professionals or consultants are reluctant towards an NEC adoption because of the unfamiliarity and extra administration. However, these remarks were always followed by the comment that people become positive about the NEC as soon as they become familiar with it.

4.2.4 Is a broader adoption of the NEC seen as an improvement for South Africa by NEC experienced people

The outcome of the expert interviews shows a clear and unanimous opinion that the NEC is seen as an improvement within the South African civil engineering industry and that a broader adoption would be beneficial. One interviewee added the comment that an improvement to some of the current applications of the NEC would be required and beneficial (Marais). Another interviewee mentioned that although the general consensus assumes that the NEC is particularly useful within big complex projects, he is of the opinion that the NEC is particularly beneficial for the smaller construction projects in South Africa (Storey). He finds the simplicity and clarity of the NEC a big benefit for smaller contractors to create understanding. Furthermore he mentioned that the project management level particularly in smaller projects is lacking and that the NEC forces a proper level of project management onto the contractor. Because most of the contracting in the civil engineering industry is executed on smaller projects there is also much benefit to gain from the NEC at that level. Another interviewee added the comment that in his opinion the NEC is unquestionably the contract of the future (Zandvoort).

4.2.5 Advantages of the NEC

All of the different interviewees stated numerous advantages for the use of the NEC within construction projects. Many advantages expressed by the interviewees contained overlap or reflected the same type of advantage. The following main advantages are noticed:

- The NEC enforces good sound project management
- The NEC promotes team efforts by forcing co-operation
- The NEC is simple and clear and therefore creates a better understanding
- The flexibility of the NEC makes it a useful tool for applying the best suitable project-specific procurement strategy
- The employer is better protected by the compensation event procedures
- Other singular identified advantages

The main advantages of the NEC are subsequently discussed.

The NEC enforces good sound project management

All of the interviewees mentioned the enforcement of good sound project management by the NEC or an aspect thereof, as an advantage of the NEC. The main advantage of good sound project management can be further divided into several sub-categories of project management.

Project management in general

- The NEC applies modern principles of project management (Marais)
- The NEC helps to better control and achieve the project outcomes (Watermeyer, Vanden Eynde)
- The NEC get things done more effectively (Murray)
- The NEC controls delays and disruptions (Marais, Van Rensburg, Watermeyer, Vanden Eynde, Murray)
- The forced execution of project management by the NEC is a good solution to the problems with the lacking project management quality within many South African construction projects (Zandvoort)

Risk management

- The NEC enforces a proper execution of risk management (Marais, Van Rensburg, Storey)
- The clear responsibilities and risk allocations of the NEC prevent conflicts (Murray)
- The NEC resolves problems before it becomes a conflict or dispute through the prompt early warning and risk reduction meeting requirements (Marais, Vanden Eynde, Murray)

Programme management

- The NEC forces a proper execution of programme management (Marais)
- Managing with the programme as such an inherent tool is very beneficial (Van Rensburg)

Cost management

- The NEC keeps better control over the project finances and its performances (Watermeyer, Vanden Eynde, Murray)
- The final account can be settled with the NEC much quicker (Murray)

Change management

- The prompt and effective compensation event system of the NEC prevents conflicts (Marais, Vanden Eynde)
- Compensation events are dealt with quicker and don't have a long aftermath (Murray)
- The NEC leads to fewer claims and the claims are dealt with on a lower management level (Storey)

The NEC promotes team efforts by enforcing co-operation

According to all employer- and contractor-interviewees the NEC helps to build a partnership in which you work co-operatively as a team instead of being opponents (Marais, Van Rensburg, Vanden Eynde, Murray). The interviewee from the contractor furthermore also mentioned that the use of the NEC leads to a more satisfied client, which

is important to his business (Murray). It is also mentioned a few times that the NEC cuts evenly both ways and is therefore not prejudiced towards a party (Van Rensburg, Murray). One employer-interviewee also mentioned that the NEC creates more communication and openness between the parties, which is an important basis for a partnership (Van Rensburg).

An interesting observation is that the advantage of team efforts that arise through co-operation is mentioned by all interviewees from an employer and contractor but not by the consultant-interviewees. This can be explained because the employer and contractor are especially the two parties who are in the adversarial relationship and therefore benefit from a team effort. Only one consultant made a remark on the topic of co-operation in a procedural-specific way by mentioning that the NEC promotes co-operation in problem resolutions (Storey). However, he doesn't go as far as the employers and contractor to mention a team effort or adversarial relations that are prevented.

The NEC is simple and clear and therefore creates a better understanding

The simplicity and clarity of the NEC is often mentioned based on the following three advantages:

- The NEC is simply written and logical to follow (Van Rensburg, Murray, Storey, Zandvoort)
- The NEC is clear and without ambiguity. (Van Rensburg, Murray, Storey)
- Procedures are simply regulated and documented and well mapped out (Storey)

As a consequence of the simplicity it is often mentioned that the NEC is easy to learn and creates a better understanding and ease of use (Van Rensburg, Murray, Storey, Zandvoort). It is furthermore mentioned that the consequences of the simplicity will improve the practices of smaller contractors (Storey). A consequence from the clarity of the NEC that is mentioned is the creation of better awareness of risk allocations and responsibilities, which leads to benefits (Storey).

The flexibility of the NEC makes it a useful tool for applying the best suitable project-specific procurement strategy

The flexibility of the NEC is an often mentioned advantage. The NEC is assumed to be applicable in every different type of construction project, procurement method and

pricing strategy (Marais, Van Rensburg, Watermeyer, Vanden Eynde). As a result the NEC is a useful tool in applying procurement strategy because it fits all strategies.

The employer is better protected by the compensation event procedures

It is mentioned by two of the interviewees from an employer that the employer is better protected under a NEC environment by the use of the compensation event system (Marais, Van Rensburg). It is also mentioned that the NEC covers everything and therefore is a complete and mature contract (Van Rensburg, Storey).

Other singular identified advantages

There are two advantages mentioned only once, which aren't reflecting one of the discussed main advantages. These singular identified advantages are:

- Using the NEC is conducive to devising a better contract document with a better and clearer split in the presentation of contract information (Van Rensburg).
- The interviewee from a contractor remarked that the NEC does not necessarily lead to a higher profit for the contractor but it does create a more certain and better guaranteed profit, which is very valuable for a contractor (Murray).

4.2.6 Disadvantages of the NEC

The only disadvantage mentioned by one interviewee, as a minor one, is the high price of the NEC documentation in comparison to other contracts (Storey). Especially smaller consultant companies won't easily buy the whole suit and therefore aren't able to properly advise on the best procurement strategy since they don't have all options available. In addition, it was mentioned that some contractors work on NEC projects without even possessing an NEC copy (Storey).

At the question about the disadvantages of the NEC, it is mentioned by most interviewees that the NEC does lead to a higher administrative burden (Marais, Van Rensburg, Vanden Eynde, Murray, Storey). However, their remarks were immediately followed by their notion that the higher administrative burden is outweighed by its benefits and therefore cannot be seen as a disadvantage.

Big disadvantages were not found. All interviewees responded that there are no real disadvantages of the NEC.

4.2.7 Critical barriers for the implementation of the NEC3 in South African civil projects

The interviews explored and identified the barriers for adoption of the NEC. The barriers that were mentioned were found to reflect the following main barrier categories:

- A lack of knowledge of the NEC and limited familiarity with its benefits and procedures
- A lack of education and current training courses are found to be ineffective
- Industry resistance towards the adoption of the NEC
- A lack of skills and project management capabilities in industry
- A lack of South African case law on the NEC to test its effectiveness
- Some employers desire a certain amount of grey area in the construction contracts of their projects

The main barriers for the use of the NEC are now discussed.

A lack of knowledge of the NEC and limited familiarity with its benefits and procedures

This knowledge category is the principal barrier, as mentioned by all interviewees. The barrier comes down to a lack of knowledge and understanding of the contract and a lacking awareness of its benefits. This is furthermore accentuated by a limited market penetration by the NEC (Van Rensburg). In addition, the NEC is considered as a big change with different terminology and procedures and therefore requires a different mind-set (Van Rensburg). The interviewees are therefore of the opinion that people prefer to stay within their comfort zones of standard construction contracts (Storey, Vanden Eynde, Murray). It is also mentioned that people don't have or take time to find out about another contract such as the NEC (Storey, Zandvoort). As a result, the lack in knowledge about the NEC persists. In addition it is mentioned that contractors price the unknowns of the NEC into their tenders (Vanden Eynde, Murray). In this way it is assumed that tendering a NEC project could be more expensive.

A lack of education and current training courses are found to be ineffective

It is mentioned by a few interviewees that people from practice are only taught on one

specific South African contract form and not the NEC (Marais, Watermeyer, Zandvoort). This is caused by universities who only teach one South African contract form to their students. In addition, it was mentioned several times that the current NEC training courses are ineffectively taught by lawyers without the proper practical experience to compare the impacts of the different contract forms (Marais, Van Rensburg, Watermeyer). Instead they teach ineffectively on a theoretical clause-by-clause basis. One interviewee added the comment that the current training courses on the NEC are expensive and that a company cannot easily send a whole department to those trainings (Zandvoort).

Industry resistance towards the adoption of the NEC

Several interviewees remarked a resistance from industry that consists because of conflicting interests (Watermeyer, Murray, Storey, Zandvoort). It is often mentioned that SAICE should promote and push the NEC because they have the aim to improve the industry. SAICE is however already the publisher and facilitator of the GCC and would therefore have more interest in promoting and pushing the latest version of the GCC. As a result, the NEC is not well promoted and monitored, and there is not enough focus on providing training courses. Another mentioned remark is more person specific, in which influential persons at companies or governmental bodies are hesitant to decide to adopt the NEC (Van Rensburg, Watermeyer).

A lack of skills and project management capabilities in industry

The lacking skills that are described by several interviewees are associated to the inability of the in-house employees in government, the contractors and quantity surveyors to control and administer activity schedules and target contracts (Marais, Van Rensburg, Vanden Eynde). It is even mentioned that for many contractors the project management principles in the NEC are already too advanced and that the administrative burden is too high for them (Marais). In addition, a more general cause mentioned, is a lack in knowledge transfer and sharing within the industry that leads to lacking procurement and contract management skills of employees.

A lack of South African case law on the NEC to test its effectiveness

South Africa misses case law on the NEC. The NEC is therefore unknown to be effective (Marais, Storey). In addition, big governmental bodies or companies have in-house procedures or standard documentation available that is structured around the GCC.

This standard documentation is probably already legally tested in disputes and those employers are therefore reluctant to move to an untested NEC environment.

Some employers desire a certain amount of grey area in the construction contracts of their projects

It is mentioned by two different consultant-interviewees that some employers desire some grey areas in their contract (Watermeyer, Zandvoort). One of the two consultants mentioned this as a barrier (Zandvoort). It was explained that there were certain tolerances in the contract desired to allow for the smaller changes, without having to compensate the contractor automatically. The strict and clear compensation events of the NEC can therefore be an obstacle to the employers. This is similar to the remark of the other consultant. He mentioned that the tight tolerances of the NEC don't suit a design that is yet not detailed enough from the start of the execution, because immediate compensation consequences can arise (Watermeyer).

4.2.8 Required success factors for an implementation of the NEC3 in South African civil projects

The interviews explored and identified the success factors for the implementation of the NEC. The success factors that were mentioned were found to reflect the following main barrier categories:

- The NEC must be researched, students must be educated and participants from industry must be trained on the NEC
- The NEC must be promoted and pushed by an influential institute, government department and consultant body
- Employers must apply and improve their procurement strategy and will identify the NEC as their best tool
- An understanding of the NEC and its philosophy must be present to achieve a successful implementation of the NEC, a cultural change is necessary
- Other singular identified success factors

The main success factors of the NEC are subsequently discussed.

The NEC must be researched, students must be educated and participants from industry must be trained on the NEC

Several different aspects, mentioned by the interviewees, are associated to the research, education and training of the NEC. These aspects are:

- University education on all contracts must be rolled out (Watermeyer, Vanden Eynde, Murray, Zandvoort)

The education must be in simple terms and with comparisons between the contracts. In addition, the different procurement strategies must be taught. This must include the approaches other than measuring quantities, such as forecasting costs. As a result the NEC will become an important part of the education.

- An institute or university department should research and monitor construction contracts (Zandvoort)

To create substantial awareness of potential contractual improvements and of the differences between the contracts, especially case study research should be conducted. The outcomes must be shared with the industry. (Marais)

- NEC training opportunities should be more effective and practical to create understanding of the NEC, its benefits and what to achieve with it (Marais)
- Employers must be taught what the NEC can do for their procurement strategy (Watermeyer)
- Contractors that are still unfamiliar with the NEC need to be guided and trained throughout the project (Van Rensburg, Watermeyer, Vanden Eynde, Murray)
- Training courses must be more affordable for companies to be able to send a large number of employees to it (Zandvoort)
- Online training courses to train people on the NEC would be useful (Zandvoort)
- People should start reading available literature on the NEC to get familiar with NEC experiences and become aware of the benefits (Storey)

The NEC must be promoted and pushed by an influential institute, government department and consultant body

The interviewees mentioned several different aspects which are associated to the promotion and pushing of the NEC. These aspects are:

- People must become aware that the NEC is not complicated but easy to follow and learn (Vanden Eynde)
- Experts from industry must share their experiences more often, for example on seminars (Van Rensburg, Watermeyer, Storey, Zandvoort)
- NEC benefits and its experiences from industry must be better advertised and shared with the industry (Watermeyer, Murray, Storey)
- SAICE should be the institute that promotes, trains and monitors the NEC use (Murray, Storey, Zandvoort)
- NEC investments are easily earned back on a macro level because of the current high capital waste, government should therefore push the NEC (Zandvoort)
- People must dare to question traditions and especially the employer must drive the change (Marais, Watermeyer, Zandvoort)
- The Department of Public Works would be an important big client body to push the NEC by its use (Murray)
- Many clients rely on the consultant's advice and consultants therefore should advise them to use the NEC more often (Storey)
- The increasing use of framework contracts is a good opportunity for a NEC adoption (Vanden Eynde)
- The availability of a NEC-helpdesk for quick answers would be useful (Murray)

Employers must apply and improve their procurement strategy and will identify the NEC as their best tool

It was mentioned by a few interviewees that employers have much to gain by an improvement in their procurement strategy (Watermeyer, Storey). A better reasoned procurement strategy instead of a single use of procurement by the traditional approach must lead to better value for money. Consequently, the use of the NEC must be based on the procurement strategy since the NEC is the perfect tool to apply it. However, it is remarked by a few interviewees that the implementation of the NEC must be one step at a time (Van Rensburg, Vanden Eynde). The NEC, its philosophy and procedures are often all new concepts for a contractor. It is therefore often too complicated for many contractors to immediately force them onto an activity schedule and target contract, although this would be often the best procurement strategy. The NEC should therefore be gradually adopted.

An understanding of the NEC and its philosophy must be present to achieve a successful implementation of the NEC, a cultural change is necessary

Several different aspects, mentioned by the interviewees, are associated to the understanding of the NEC as an important factor for a successful implementation of the NEC within projects. These aspects are:

- A cultural change is necessary before the NEC will become a useful tool, people must adopt to the NEC philosophy and not try to use it in a GCC way (Watermeyer, Vanden Eynde, Storey)
- The understanding of the application is very important when using the NEC (Vanden Eynde, Murray)
- The NEC requires the employer to be involved (Marais)
- The success of a NEC project depends on trust and the attitudes of the parties to work as a team (Murray)
- Clients must avoid to amend or add things to the NEC (Van Rensburg, Storey, Zandvoort)

Z-clause additions should be kept to a minimum for a successful implementation of the NEC. If something doesn't fit in the NEC there is simply no place for it.

- Make peace with the more labour intensive administration and see the benefits (Van Rensburg)
- A NEC pre-tender meeting and introductory class at the start of a project are beneficial to orientate people on the NEC and to get everybody on board as a team (Van Rensburg, Watermeyer, Vanden Eynde, Murray)

Other singular identified success factors

There are three success factors mentioned only once, which aren't reflecting one of the main success factors. These success factors are:

- The client must provide a complete set of tender documents, especially for a successful target contract (Murray)
- An improved English proficiency in the industry is important to prevent wrong assumptions (Zandvoort)
- South Africa could be better off with only the NEC and FIDIC (Watermeyer)

Because the NEC (modern contracting) and FIDIC (traditional approach) together provide for all the possible procurement strategies, they could be the only contract forms to be used. The use of only two different contract forms are to increase the uniformity in the industry. The two South African forms are lacking in quality compared to the two international forms. They could therefore be removed as one of the, by the CIDB, accepted forms of contract for South Africa.

4.3 Short-questionnaire results from South Africa

The findings from the short-questionnaire research on the advantages of the NEC, are described in this sub-chapter, as depicted in Figure 4.6.



FIGURE 4.6: South African short-questionnaire

At the end of the South African expert interviews, the interviewees were asked to rate 13 statements according to a Likert scale about the advantages of the NEC in comparison to the GCC, JBCC and FIDIC.

The statements started with:

"In comparison to the FIDIC, GCC and JBCC, the use of the NEC in its right philosophy should lead to"

and are thereafter completed by the 13 different endings of the statement, which are depicted in Table 4.2. The interviewees were presented with 6 options to respond to every statement. These 6 options are depicted in Table 4.1 as the 'Possible Likert-responses'. The number corresponds to the textual response.

After all short-questionnaires were completed, the corresponding numbers of the 7 interviewee-responses were averaged into one Likert-mean for each statement. The resulting mean that was found per statement lies within one of the Likert-mean ranges as

depicted in Table 4.1. The ranges of the Likert-means correspond to its textual outcomes as depicted in Table 4.1.

TABLE 4.1: Likert method of use

Possible Likert-responses		Likert-means	
1.	Strongly disagree	1. - 1.8	Strongly disagree
2.	Disagree	1.81 - 2.6	Disagree
3.	Neutral	2.61 - 3.4	Neutral
4.	Agree	3.41 - 4.2	Agree
5.	Strongly agree	4.21 - 5.	Strongly agree
-	No response	-	No responses

This research is strongly based on the assumption from literature that the NEC is an improvement from the other commonly used standard contract forms in the South African construction industry. Because of the reliance on this assumption, it is further investigated within the contractual analysis, expert interviews and in this short-questionnaire. Consequently, the advantages of the NEC can be validated according to a triangulation approach. The short-questionnaire furthermore serves as a quantitative indication to validate the found qualitative advantages. However, because of the limited numbers of responses the short-questionnaire outcome can not be seen as scientific evidence.

The short-questionnaire outcome is presented in Table 4.2 where the average and textual outcomes per tested statement are presented.

TABLE 4.2: Short-questionnaire outcomes

#	Statement	Average	Outcome
1.	Better compensation procedures	4,9	Strongly agree
2.	Better risk management	4,9	Strongly agree
3.	Fairer risk allocations	4,7	Strongly agree
4.	Increase in the level of project management	4,4	Strongly agree
5.	Better contractual relationships (less adversarial behaviour)	4,4	Strongly agree
6.	Better communication between employer and contractor	4,4	Strongly agree
7.	Reduction in arbitration/litigation	4,3	Strongly agree
8.	Increase in projects that stay within budget	4,3	Strongly agree
9.	Reduction in disputes	4,3	Strongly agree
10.	Better incentivizing of contractor's performance	3,9	Agree
11.	Increase in projects that stay within its schedule	3,7	Agree
12.	Increased profits for contractor	3,5	Agree
13.	The full potential of the NEC is currently achieved in South African civil projects.	1,4	Strongly disagree

The overall advantage of the NEC in comparison to the GCC, JBCC and FIDIC are confirmed by the short-questionnaire outcome. This validates the assumption based on the literature. The statement outcomes are highly positive in which all advantage statements are at least agreed upon. The most statements are even strongly agreed upon. The compensation procedures and risk management advantages of the NEC are especially assessed as big benefits. Also the risk allocations, project management, relationships and communication attributes related to the NEC are seen as big advantages over the other contracts. The last statement assesses the potential for the NEC in South Africa. It is found that the full potential of the NEC for South Africa is far from having been achieved. This also validates the limited adoption and desired broader adoption of the NEC within the civil engineering industry of South Africa.

4.4 Expert interview findings from The Netherlands

The findings from the expert interviews that were conducted in The Netherlands on the introduction of the UAV-GC are described in this sub-chapter, as depicted in Figure 4.6.



FIGURE 4.7: Dutch expert interviews

The names and companies of the Dutch interviewees are stated in Appendix D. The transcripts of all interviews are available from the author and are supplied on memory disk together with this thesis. The function and experiences of the interviewees are further explained in the transcripts. The overall findings are described in this sub-chapter. Statements by the interviewees are referenced by putting the surname in between brackets at the end of the sentence. The findings for the Dutch civil industry are discussed according to:

- Contractual problems in Dutch civil projects

- The motive for the creation of the UAV-GC
- Advantages of the UAV-GC
- Disadvantages of the UAV-GC
- The introduction process of the UAV-GC
- Critical barriers for the implementation of the UAV-GC in Dutch civil projects
- Required success factors for the implementation of the UAV-GC in Dutch civil projects

4.4.1 Contractual problems in Dutch civil projects

There were only two general contractual problems within The Netherlands mentioned by the Dutch interviewees. These problems are:

- The current fixed price contracts don't contain any stimulation to collaborate and therefore often lead to adversarial relations (Fondse).
- Governmental professionals in The Netherlands aren't often the people with the best contractual skills. As a result the contractor often manages to avoid, by contract, the responsibility for many problems in a project he was of influence to (Munster).

4.4.2 The motive for the creation of the UAV-GC

The development of an early contractor involvement in projects through assigning design responsibilities towards the contractor, by the means of design and construct type of contracts, required a new set of general conditions of contract. The old standard contract form, UAV, isn't suitable for the assignment of design responsibilities towards a contractor (Suy, Fondse, Munster).

4.4.3 Advantages of the UAV-GC

There are two advantages mentioned that are associated with the use of an UAV-GC contract, which are:

- The UAV-GC benefits from the contractors' knowledge in value engineering the design and by creating a more effective and practical design for the execution (Munster). It furthermore creates a better budget controlled co-operation between the designer and the contractor (Munster).
- The UAV-GC gives the employer more price certainty by transferring more design responsibilities and its associated risks towards the contractor (Fondse, Munster).

4.4.4 Disadvantages of the UAV-GC

The interviewees also identified some disadvantages of the UAV-GC, which are:

- The employer is still of the opinion that with a UAV-GC the contractor still sometimes unfairly manages to avoid responsibility for problems created by him (Munster).
- The UAV-GC is seen as a transactional contract and could lead to adversarial relationships. It doesn't have any relational contracting features (Suy, Fondse, Munster).
- The UAV-GC doesn't necessarily lead to better cost outcomes. Certain design risks are paid for irrespective of occurrence or not (Fondse).
- The UAV-GC doesn't prescribe and therefore doesn't standardize any risk management procedures. Also the prescription of programme and change management procedures could be prescribed in more detail to realize a good standard that leads to uniformity within the industry (Fondse).

4.4.5 The introduction process of the UAV-GC

The UAV-GC was developed in 2000 after the national road agency, Rijkswaterstaat, made a shift in their policy to allocate more design responsibilities towards contractors. The UAV-GC was developed by 25 persons from different actors in the industry and was guided by CROW. The following five years the contract was monitored by CROW in around 180 projects (Suy). Members from the projects were interviewed to monitor experiences and CROW provided training courses to share experiences and to guide the projects. This resulted in the UAV-GC 2005 to be accepted a verified contract form (Suy). Consequently the UAV-GC 2005 achieved a broad adoption, where everybody

is aware of the contract and its implications (Suy, Fondse). The UAV-GC is nowadays broadly used within the national and local authorities (Suy, Fondse). It is mentioned that once people have used the UAV-GC, they become positive about it (Munster). Moreover, the introduction process is now seen as a past process (Suy, Fondse). Concluding from the past process, it was found that especially in the beginning the delivered quality by contractors showed deficiencies because of the lack of experience (Suy, Fondse). This has now been improved (Suy). Eventually, every party invested some money in the UAV-GC development to get experienced with it (Suy). This is seen as part of the process of innovating.

4.4.6 Critical barriers for the implementation of the UAV-GC in Dutch civil projects

From the interviewees the following barriers for an UAV-GC implementation are mentioned:

- Employers find it difficult to trust contractors in their design task responsibilities (Suy, Munster)
- Big organisations have difficulties reforming their organisation towards the new procedures that are required by a UAV-GC use (Munster)
- Architects are not used to collaborate with a contractor to design within a tight budget (Munster)
- Project teams are not able to work within the required new processes of the UAV-GC, instead they still think in products, materials and quantities instead of giving design freedom (Munster)
- Often a lack of procurement strategy at the start of a project results in an over-specification when deciding on the contract form and therefore the UAV-GC is not a useful contract type anymore (Munster)
- Contractors don't know how to apply their design duties within projects, as a result of a lack of experience at the contractors (Fondse, Suy)

4.4.7 Required success factors for the implementation of the UAV-GC in Dutch civil projects

The interviewees identified the following factors for a successful adoption and implementation of the UAV-GC:

- The development of contract management software tools supports the adoption and leads to more uniformity (Suy)
- You need motivated pioneers that take the lead in the development (Suy, Munster, Fondse)

This means big (governmental) employers that adopt the new contract and employees within organizations who support the use by convincing others of the benefits.

- In addition to a certain level of support from the industry the adoption of a new contract requires an institute that actively pushes the development (Suy)

An institute must provide an infrastructure that guides and monitors the implementation and furthermore shares the knowledge and experience with the contract.

- Knowledge sharing by governmental bodies, such as provinces (Munster)

By comparing experiences and approaches lessons are learned and parties can help each other with their problems.

- The development of Systems Engineering, which goes hand in hand with the development of the UAV-GC contract, amplify each other's adoptions (Munster).

Systems Engineering is an increasingly used design methodology in the Dutch civil engineering industry. It structures and controls complex design processes and is used to design according to the design problem, a functional analysis and associated performance requirements throughout the lifecycle. To assign design responsibilities with some design freedom towards a contractor it is necessary to provide him with performance requirements instead of design details. As a result, the UAV-GC contract is often perfectly applicable to the Systems Engineering design methodology used by some employers. In addition the use of a UAV-GC contract requires a Systems Engineering design method. Consequently, the two developments amplify each other (Munster).

4.4.8 NEC benefits for The Netherlands

The interviewee who has also NEC experiences, through an international project that uses the NEC, mentioned that also for The Netherlands the following benefits over an UAV or UAV-GC use can be achieved:

- Stimulation of collaboration prevents the usual adversarial relations
- Prescribing of risk management can lead to less project specific additions and therefore a better uniformity within the industry
- Programme and change management procedures and certain basic principles of project management are better prescribed, this must lead to less project specific additions and therefore a better uniformity within the industry

Chapter 5

Research Synthesis

In this chapter the research findings of the NEC adoption and implementation in South Africa are discussed with reference to their research sub-questions. Thereafter, a comparison with the research findings of the Dutch introduction of the UAV-GC is discussed.

The research findings are evaluated for its validity through:

- A comparison with the expected outcomes of the research sub-questions.

These expected outcomes are based on the literature findings and were previously discussed in the Literature Synthesis in section 2.8.

- A comparison of the contractual analyses, expert interview findings and short-questionnaire outcomes

5.1 NEC adoption and implementation in South Africa

In this section the adoption and implementation of the NEC in South Africa is discussed.

5.1.1 Should the NEC be broader adopted by the South African civil engineering industry?

The NEC adoption in the South African civil engineering industry is found to be limited according to the literature and all interviewees. To recommend measures for a broader

NEC adoption in South Africa, this research is highly dependent on the findings by Frehse (2013), who concluded that the NEC leads to many benefits, especially when compared to the GCC. Also the international literature shows positive NEC experiences (e.g. Broome & Hayes, 1997; Sun & Oza, 2006; Thompson *et al.*, 2000 and Wright & Ferguson, 2009). As was discussed in the Literature Synthesis, it is therefore expected that the NEC should be broader adopted. This expectation however requires validation. According to all interviewees, the NEC should be broader adopted by the civil engineering industry in South Africa. This was also identified in the Literature Synthesis and is therefore validated. Also the 'strongly disagree' outcome from the short-questionnaire, on the statement that the full potential of the NEC has been reached in South Africa, shows the need for a broader adoption.

5.1.2 What are the advantages of the NEC3 ECC?

From international and South African literature several advantages of the NEC are identified. To improve and further validate the former findings by Frehse (2013), this research investigated the advantages of the NEC3 ECC over other optional contract forms in South Africa, such as the GCC, JBCC and FIDIC. The main findings from this research are:

From the contractual analysis it is found that the NEC3 ECC contains a high flexibility and standardization, is clear and simple, stimulates good project management and introduces some relational contracting aspects to stimulate collaboration.

From the expert interviews the following advantages are found:

- The NEC enforces good sound project management
- The NEC promotes team efforts by forcing co-operation
- The NEC is simple and clear and therefore creates a better understanding
- The flexibility of the NEC makes it a useful tool for applying the best suitable project-specific procurement strategy
- The employer is better protected by the compensation event procedures

The short-questionnaire results were only positive about the advantages of the NEC and strongly agree on the five advantages stated in the interviews.

The contractual analysis, expert interview findings and short-questionnaire outcomes show high similarities. These similar outcomes from different methodologies provides the validation of the findings through triangulation. Moreover, these advantages are also identified in the literature review.

5.1.3 What are the disadvantages of the NEC3 ECC?

Similar to the literature findings this research didn't find significant disadvantages of the NEC3. The only disadvantage found was mentioned by one consultant, to be the high price of the NEC3 in comparison to other contract forms. No other disadvantages were mentioned in the expert interviews. This is similar to the expectation based on the literature findings, described in section 2.8.1 of the Literature Synthesis. This validates the findings of the limited disadvantages of the NEC.

5.1.4 What are the critical barriers for the implementation of the NEC3 ECC in South African civil projects?

The barriers for the NEC implementation were not yet academically investigated as far as could be established. Some barriers were however to be expected as seen from the literature findings, described in section 2.8.1 of the Literature Synthesis. Some barriers were extracted from a former research on the NEC with a different focus (Frehse, 2013) and some others were obtained from the shared opinion of a NEC expert in South Africa (Watermeyer, 2014). In the expert interviews both industry- and project-specific barriers were explored, through questions focussing on either the industry or on the contract applications. The different industry and project barriers that were identified are subsequently presented.

Industry perspective

The following critical industry-specific barriers were identified:

- A lack of knowledge of the NEC and limited familiarity with its benefits and procedures
- A lack of education and current training courses
- A lack of procurement strategy skills in the industry

- Industry resistance towards the adoption of the NEC
- A lack of South African case law on the NEC to test its effectiveness

The first three barriers were also identified in section 2.8.1 of the Literature Synthesis. The last two barriers are newly identified barriers not identified from the literature.

Project perspective

The following critical project-specific barriers were identified:

- Some employers desire a certain amount of grey area in the construction contracts of their projects
- A lack of project management and contract management capabilities in construction projects

The first barrier can be associated with "A resistance to move away from the traditional approach by employers", which is one of the barriers that was expected from the literature, and described in section 2.8.1. The last barrier is a newly identified barrier not identified from the literature.

Most of the barriers are therefore validated by the literature study, while the others are findings additional to those identified from the literature study.

5.1.5 What are the required success factors for a broader adoption and successful implementation of the NEC3 ECC in South African civil projects?

Also, the required factors for a successful NEC implementation were not yet academically investigated by others. Some success factors were however to be expected based on the literature findings, described in section 2.8.1 of the Literature Synthesis. Some success factors were extracted from a case study in New Zealand (Wright & Ferguson, 2009) and some others were obtained from a NEC expert in South Africa (Watermeyer, 2014). In the expert interviews both industry- and project-specific success factors were explored. The different industry and project success factors that were identified are subsequently presented.

Industry perspective

The following critical industry-specific success factors were identified:

- The NEC must be researched, students must be educated and participants from industry must be trained on the NEC
- The NEC must be promoted by an influential institute, government department and consultant body

Both success factors were also identified as possible expected outcomes in section 2.8.1 of the Literature Synthesis.

Project perspective

The following critical project-specific success factors were identified:

- Employers must apply and improve their procurement strategy and will identify the NEC as their best tool
- An understanding of the NEC and its philosophy must be present to achieve a successful implementation of the NEC, a cultural change is necessary

Both are newly identified success factors not identified from the literature.

The industry-specific success factors are therefore validated by the literature study, while the project-specific success factors are findings additional to those identified from the literature study.

5.2 Comparison with the UAV-GC introduction in The Netherlands

The comparison with the Dutch contractual environment and the introduction of the new UAV-GC is subsequently described according to:

- Contractual problems
- Contractual innovations: NEC vs. UAV-GC
- Barriers for adoption of a new contract form

- Success factors for implementation of a new contract form

Contractual problems

From the interviews it was found that both in South Africa and in The Netherlands the existence of adversarial relations and a lack of procurement skills of employers are seen as contractual related problems in the industry. The difference is that for South Africa more problems related to standard contract forms were mentioned by interviewees than in The Netherlands. This is in accordance with the literature findings, where it was found that both countries experience relationship problems but contract-quality specific problems were more present in South Africa. Also the Dutch interviewees didn't regard contractual deficiencies amongst the bigger problems in the industry whilst the South African interviewees emphasized the current problems with standard contract forms and the potential for improvement by the NEC.

Although the interviewees in The Netherlands didn't regard contractual deficiencies to be amongst the bigger problems in the industry, an interesting observation was that several disadvantages of the UAV-GC were mentioned. Maybe this can be explained by the findings from the contractual analysis, where the UAV-GC is found to be less innovative and still mainly of a traditional kind. Whilst the South African interviewees have experienced the potential of the innovation of the NEC, they found more deficiencies in the traditional contracts as a problem for the industry and a potential for improvement. On the other hand, the Dutch interviewees are not aware of this innovation and are satisfied with their familiar traditional situation. Therefore the disadvantages of the UAV-GC are not seen as some of the bigger problems in the industry. However, this must be seen in the light of the smaller number of interviewees in The Netherlands.

This lack of knowledge would be further substantiated by the one interviewee in the Netherlands who has NEC experience and who was the only one who raised one contract-quality specific problem of the industry. In addition he mentioned many opportunities for improvement by the use of the NEC in The Netherlands. Consequently it can be argued that people must become aware of innovations and its benefits to see the potential. They should start to question their traditional approach, for example the use of the GCC. This is also in accordance with the lack of awareness of NEC benefits in South Africa.

Contractual innovations: NEC vs. UAV-GC

As expected from literature, the contractual analysis showed that the NEC is a newly

created and all-embracing innovation, while the UAV-GC was still developed based on the former traditional version and is still of a highly transactional nature. The UAV-GC can be seen as an innovation that is based on procurement strategy and not so much the quality of the standard construction contract. Eventually the UAV-GC shows more similarities towards the GCC, but was developed for the use of integrated contracts.

From the findings of this research the adoption of the NEC is still found to be limited in South Africa. The UAV-GC on the other hand is found to be well introduced and broadly adopted. More importantly, it is known by the whole industry including its new procedures and implications. This is similar to the findings from literature in which the NEC adoption experienced more difficulty in South Africa than the UAV-GC in The Netherlands.

Barriers for adoption of a new contract form

Similar barriers were found for the introduction of a new contract in respectively South Africa and the Netherlands. The following three barriers were mentioned in both countries:

- A lack of familiarity with the new procedures

The lack of familiarity with new procedures by both the employer and contractor led in both countries to an initial resistance to move away from the employer's traditional contracting approach. This was also found in the literature study.

- A lack of trust in the contractors' abilities by the employer

In both countries the employer tends to distrust the contractor's capabilities to work according to the new procedures in order to deliver the same quality and project outcomes. The lack of trust is found to be experienced at first exposure of the contractor with the new procedures, but as soon as they become familiar with the procedures the attitude changes. This was not found from the literature study and is therefore a new finding.

- A lack of procurement strategy by employers

The interviews found that there is a lack in procurement strategy by employers from both countries. This partly conflicts with the findings from literature. The Dutch interviewee from an employer mentioned that employers don't maintain procurement strategies at the start of a project and therefore often do not properly apply the UAV-GC. The literature however shows that there is sufficient knowledge amongst Dutch employers to apply the UAV-GC. Although the knowledge to apply the UAV-GC is sufficient not to be a barrier for implementation, the skill of procurement strategy is still lacking and becomes a barrier for the UAV-GC. This is also the case in South Africa.

However, because the lack of procurement skills of Dutch employers partly conflicts with the literature it requires validation by further research. The lack of procurement strategy of South African employers was also found in the literature study.

Required success factors for implementation of a new contract form

There are several lessons to be learned from the more successful introduction of the UAV-GC in The Netherlands. The first one, is the only one that has been mentioned in both countries, and was mentioned by the interviewees in The Netherlands to be of high importance for a successful introduction of a new contract form. The lessons to be learned from the Dutch UAV-GC introduction are:

- Promoting, monitoring and training by an institution and pushing by pioneers is an important factor for success

In The Netherlands the Dutch institute, CROW, is highly involved with the promotion, monitoring and training of the UAV-GC. In addition, the national road agency (Rijkswaterstaat) and the national rail agency (Prorail), were big parties pushing for the use of the UAV-GC. South Africa lacks an institute that focusses on the promotion, monitoring and training of the NEC. Eskom could be seen as a promoter of the NEC but to a much lessor extent than the innovative character of Rijkswaterstaat, which tries to be an innovator for the whole industry and often tries out innovative approaches. This difference can be seen as one of the most important introduction difference between South Africa and the Netherlands.

Other important success factors from The Netherlands, which were not mentioned in the South African part of the research, are:

- Knowledge sharing within the industry

In the Netherlands there are many knowledge sharing opportunities, for example between provinces and between the bigger municipalities. By sharing knowledge and experiences with new methods and innovations, the knowledge and awareness amongst the industry is increased and problems are collaboratively resolved. In the South African part of the research signs of knowledge sharing collaborations were limited. This might be an area for improvement. A lack of knowledge transfer in the industry was even mentioned by one interviewee as a problem of the industry. This could be another important factor for why the implementation of the NEC is difficult.

- A complementary development as an important accelerator of the implementation of a new standard contract form

In The Netherlands it is found that the development of Systems Engineering goes hand in hand with the development of the UAV-GC and works as an accelerator. This could also be relevant for South Africa, where it is found that framework contracts are increasingly applied and that the NEC best suits that contracting strategy. This could be better advertised.

- Software tools for contract management

In The Netherlands software tools are developed to assist with contract management. This improved the ease of application of the contract and creates more uniformity in the industry. Consequently the implementation of the UAV-GC was stimulated. There hasn't been mention of any software tool for contract management in South Africa. Ideally this must be developed for South Africa, or if it is already present, be applied more often to stimulate the ease and uniformity of the NEC implementation.

From the literature study it was found that leadership and co-operation between organisations were required for the implementation of the UAV-GC in The Netherlands. This is partly in accordance with the first two success factors that were found from The Netherlands. They can therefore be seen as validated. The last two success factors were not identified from the literature study.

Chapter 6

Conclusion and Recommendations

This research identified the critical barriers of a NEC adoption in the South African civil engineering industry. Moreover, in order to recommend strategies and measures to achieve a better NEC adoption, required success factors for a NEC implementation were investigated. In addition, beneficial insights for South Africa are gained from the introduction of the UAV-GC in The Netherlands.

Firstly, a literature study was conducted to define the research needs and focus. Both contracts were analysed and compared. These findings were then used to validate the assumed advantages of the NEC by correlating them to the contract content. Subsequently, expert interviews were conducted in which the advantages, disadvantages, barriers for adoption and success factors for implementation of the NEC were explored. Interviews with seven South African experts also contained a short-questionnaire. The short-questionnaire gave a quantitative context as validation for the qualitative advantages. In addition, three interviews with Dutch experts were conducted. In this manner the Dutch UAV-GC introduction experiences were explored. In the research synthesis, findings from the various sources were validated. This is achieved through a comparison of the different methods applied in the study.

It is found from the research that the NEC introduction into an industry can be difficult although potential for its use is promising. The findings on the introduction of the NEC are discussed in this chapter with reference to the research objective. Thereafter,

recommendations are made for strategies and measures for the introduction of the NEC in South Africa. Finally, recommendations are made for further research.

6.1 Conclusion

The research objective is addressed in the following paragraphs by referring to the sub-objectives.

Identification of problems and the associated opportunities for innovation and improvement in the use of standard construction contracts for South African civil projects

The South African civil engineering industry is troubled by problems with its contractual practices. The main issues are lack of skills and understanding of contracting, the presence of adversarial relationships and deficiencies with the South African and traditional standard forms of contract. There is an opportunity for addressing these problems, with the NEC as an innovative standard contract form. The NEC simplifies contracting, stimulates good project management and prevents adversarial relationships because of its clarity and emphasis on collaboration. The NEC is however after 20 years still rarely used in South Africa and therefore this opportunity for improvement is not exploited by the industry. This is in contrast to the finding that the NEC is well suitable for South Africa and seen as a mature contract form.

Investigation if a broader NEC adoption is seen as beneficial for South Africa based on the present NEC experiences

The research showed an unanimous opinion that the NEC is not broadly adopted in the civil engineering industry and should become broader adopted because of its benefits in comparison to the other contract forms. The investigated experiences showed that projects under the NEC result in better project outcomes. Furthermore, it is found that people and parties from practice at first are often reluctant to use the NEC but as soon as they have used the contract, they become positive about using it. They often find that the NEC is an easy contract form to learn, to migrate to and it is also easy to use. Because of the simplicity of the NEC, it is found to be both beneficial in larger and smaller projects and to larger and smaller employers and contractors because it makes the contracting practices better to understand and easier. In addition, also the smaller

contractors are forced by the NEC to apply the necessary minimum amount of risk management and they must apply proper change and project management principles in their projects. This should improve the project management practices in smaller construction projects in South Africa.

Identification of the similarities and differences between the NEC3 ECC and the UAV-GC, its innovations and its introductions in their respective civil engineering industry

The NEC and the UAV-GC are both relatively recently created contract forms. The difference is that the NEC was written as a newly created contract, whereas the UAV-GC is based on the older Dutch contract, the UAV. As a result there are much more innovations to be found in the NEC than in the still mainly transactional and traditional UAV-GC. Where the NEC is focussed on flexibility, the UAV-GC is only focused on the new and innovative procurement strategy that uses integrated contracts. As a result the NEC requires a bigger change in procedures and mind-set while the UAV-GC lies closer to the traditional way of contracting which is common in The Netherlands. This might be a factor why the introduction of the UAV-GC is more successful than the introduction of the NEC in South Africa. The UAV-GC is broadly used, the industry is aware of the UAV-GC and its implications and the introduction process is seen as a completed stage. Another difference that might be an important factor in the introduction is the existence of an institute in The Netherlands, the CROW, that takes ownership for the introduction. The introduction is highly monitored, advertised and training opportunities are arranged by CROW. Furthermore, it is promoted by big national employer-bodies, such as Rijkswaterstaat and Prorail. This is not the case in the South African introduction of the NEC. In contrast to this it is found that there exists a reluctance in the industry to adopt the NEC, because the South African standard contract forms are preferred by influential South African institutes, such as SAICE.

Identification of the critical barriers and success factors for the implementation of the innovative NEC in the established civil engineering contracting environment of South Africa

The main objective of this research is the identification of the critical barriers and required success factors for an NEC implementation in civil construction projects. Since limited academic research has been conducted that focused on this aspect, this research

must explain the difficult introduction of the NEC in South Africa. The findings are supported by the findings from similar Dutch experiences. Moreover, the required success factors are complemented by Dutch experience. The critical barriers and the required success factors are provided below:

Critical barriers

The critical barriers are divided into industry- and project-specific barriers:

- **Industry-specific barriers**

- A lack of knowledge of the NEC and limited familiarity with its benefits and procedures
- A lack of education and current training courses
- A lack of procurement strategy skills in the industry
- Industry resistance towards the adoption of the NEC
- A lack of South African case law on the NEC to test its effectiveness

- **Project-specific barriers**

- Some employers desire a certain amount of grey area in the construction contracts of their projects
- A lack of project management and contract management capabilities in construction projects

Required success factors

To overcome the barriers and to stimulate the use of the NEC the following industry- and project-specific success factors are required:

- **Industry-specific required success factors**

- The NEC must be researched, students must be educated and participants from industry must be trained on the NEC
- The NEC must be promoted by an influential institute, government department and consultant body

- **Project-specific required success factors**

- Employers must apply and improve their procurement strategy and will identify the NEC as their best tool

- An understanding of the NEC and its philosophy must be present to achieve a successful implementation of the NEC, a cultural change is necessary

From the comparison with the more successful introduction of the UAV-GC in The Netherlands, some lessons can be learned from these experiences. These are:

- **Extracted success factors from the Dutch lessons learned**

- Knowledge sharing between the governmental parties in regular meetings is important to guide innovations
- Another development that goes hand in hand with the NEC can be an important stimulator, such as the increasing use of framework contracts that are best suited for use with the NEC
- Software tools for contract management simplify the migration to the NEC and leads to uniformity

6.1.1 Limitations

The conclusions of this research are subject to the following limitations:

- The contractor's point of view is, with only one interview, in this research less emphasised and requires further research and validation.
- The general implications of the response by an industry to any innovation isn't investigated. This will also be of influence. However an introduction period of over 20 years is long and the same introduction period in the United Kingdom seems to be more successful. It is therefore assumed that this cannot be the key barrier any more.
- Because the design of this research required people with NEC experience and knowledge, to also investigate the advantages and required success factors, the barriers are not investigated amongst people without NEC knowledge and experience. Research amongst them would improve the understanding why people didn't hear about the NEC or didn't learn about it. This would also further clarify why employers don't want to try the NEC in projects more often but want to stay with

their traditional contracting methods. These insights could extend the identification of barriers and could provide more context behind the identified barriers in this research.

6.2 Recommendations

Another research objective was to recommend possible improvements in procurement and contract management within the civil engineering environment in South Africa. Many recommendations are extracted from the required success factors for implementing the NEC. The following main recommendations for South Africa are subsequently discussed:

- The industry should not be afraid to question tradition and to initiate the required cultural change towards increasing collaboration
- An influential South African institute should take responsibility for the promotion, monitoring and training of the NEC
- Educate students on the NEC and other contracts based on all possible procurement strategies
- An adoption strategy should be applied for inexperienced NEC parties
- NEC should be used as the stimulator for improvement of South African project management practices in construction projects
- Organize regular knowledge sharing meetings between governmental departments to stimulate and improve innovations
- Employers should improve their procurement practices by applying procurement strategy

The industry should not be afraid to question tradition and to initiate the required cultural change towards increasing collaboration

The civil engineering industry and its participants should question their traditions and customary working approaches in a search for improvement and innovation. A potential for improvement, by means of the NEC, is already available for 20 years but has still not penetrated the industry because it requires a change of culture. The current adversarial thinking must give way to an environment in which construction projects are

executed effectively and efficiently in a collaborative way. The NEC is a clear improvement on these aspects and project participants must learn about the benefits and must acknowledge them.

An influential South African institute should take responsibility for the promotion, monitoring and training of the NEC

Since the NEC is an international contract originating from the United Kingdom it doesn't have a local institute, in contrast to the South African forms of contract, which are intensively administered, monitored, advertised and provided with training for the contract form. This is a large obstruction to the adoption of the NEC. Especially because the players in industry don't become familiar with the contract and the confidence isn't created that the NEC is an improvement also applicable in South Africa. It is therefore recommended that an influential South African institute such as SAICE, which has the goal to improve the civil engineering industry, acknowledges the benefits of the NEC and starts to act as its promoter to obtain a broader adoption of the NEC.

Educate students on the NEC and other contracts based on all possible procurement strategies

Universities should start to teach procurement strategies, instead of mainly on the traditional procurement with a traditional contract form. In this way all the different methods of procurement and pricing strategies are taught. This will show the flexibility of the NEC. Furthermore, this improves the procurement skills of employers to better achieve their project objectives by using the most appropriate procurement strategy for their construction project. Therefore all contract forms must be taught including an increased emphasis on the NEC as an improvement and on its procedures and methods.

An adoption strategy should be applied for inexperienced NEC parties

When adopting the NEC it is useful to apply a strategy to become familiar with the NEC on a 'one step at a time' basis. Immediately using the unfamiliar NEC contract with activity schedule and target contract are three new approaches to learn at once. It is therefore wise to first become familiar with the NEC procedures in a fixed price with bill of quantities contract. When familiar with the NEC procedures the beneficial activity schedule and target contract can be used as contract option.

The employer must also be aware that contractors might not be used to executing under the NEC. It is beneficial to instruct the contractors on the NEC, possibly already

upfront in a tender meeting. This reduces the chance that the contractor will price for the unknowns of the NEC in their tender. In addition, a project team meeting at the start of the project is found to be helpful to create collaborative attitudes and to further explain the implications of the NEC on the project. Inexperienced contractors may require guidance on the NEC during the whole project, this will benefit the team effort and effective project execution.

NEC should be used as the stimulator for improvement of South African project management practices in construction projects

The NEC requires sound risk and programme management practices and prescribes strict time limits for responses. Furthermore, the management of project changes includes better project management principles. As a result, the NEC can be seen as an important innovation for the industry that would improve the project management of construction projects. Also, because the NEC is clear and easy to understand smaller contractors get a better understanding of contracts, risk allocations and responsibilities. Consequently, they can improve their project and risk management practices. The NEC should therefore be advertised for smaller civil engineering projects.

Organize regular knowledge sharing meetings between governmental departments to stimulate and improve innovations

By organizing regular meetings between different governmental bodies within the same sector, such as between provinces, departments of public works or the larger municipalities, knowledge and experience can be shared. This will stimulate and assist innovations by informing and helping each other. In this way new innovations, such as the NEC, become less unfamiliar and shared experiences can push other parties to follow.

Employers should improve their procurement practices by applying procurement strategy

Employers should consider their project objectives and decide how they want to deliver those with all the procurement strategies in mind. There are many different procurement tools and methods other than the traditional approach of a fixed priced contract with the use of a bill of quantities. It is however found that many employers mostly tend to procure on the traditional approach, using their familiar traditional contract form. Consequently, little procurement strategy is applied to fit the project's best contractual

approach. The NEC is a highly flexible contract that fits most procurement strategy options. The NEC is therefore found to be a useful tool to apply procurement strategy.

6.3 Recommendations for further research

To extend and improve the research on the introduction of the NEC in South Africa the following recommendations are made:

- This research focused on the civil engineering industry. Similar results for the construction industry in general are expected, and this should be investigated further.
- In this research only one contractor with NEC experience was found, who was willing to participate in an interview. To improve the contractor's point of view, further research must be conducted.
- Future studies can help to establish greater validity of the findings from this research.
- Case studies should be performed to quantitatively investigate the benefits of the NEC and to investigate the affect on the relationships caused by the use of the NEC.
- An institute or university department should monitor the use of the NEC to determine the effectiveness of the NEC within the South African environment and laws.
- The current NEC training courses should be investigated for their effectiveness and possibility for improvement.
- The current academic curricula should be investigated for their effectiveness of educating procurement strategies and its use of the NEC options therein.

Appendix A

Innovative contractual mechanisms

The following developments of modern contracting are subsequently discussed in more detail:

- Relational contracting
- Target contracts
- Enforced collaborative and proactive change management system
- Integrated contracts

A.1 Relationship contracting

To move away from the unilateral transactional approach of construction contracts, relationship contracting strategies are increasingly adopted within construction projects. Relationship contracting is defined by The Australian Constructors Association (ACA, 1999) as "a process to establish and manage the relationships between the parties that aims to remove all barriers, encourage maximum contribution and allow all parties to achieve success". Relationship contracting would conform to the 4th aspect of the principles for modern contracting, in which Latham (1994) describes teamwork as a duty

including shared financial motivation to create a win-win scenario. The NEC is a contract form that includes relationship contracting in the form of an optional standardized partnering agreement.

There are two different approaches towards relationship contracting that differ in the intensity of the relation between the two contracting parties, namely partnering and alliancing. Partnering and alliancing are subsequently described in the next paragraphs and finally a comparison with the traditional contracting approach is presented.

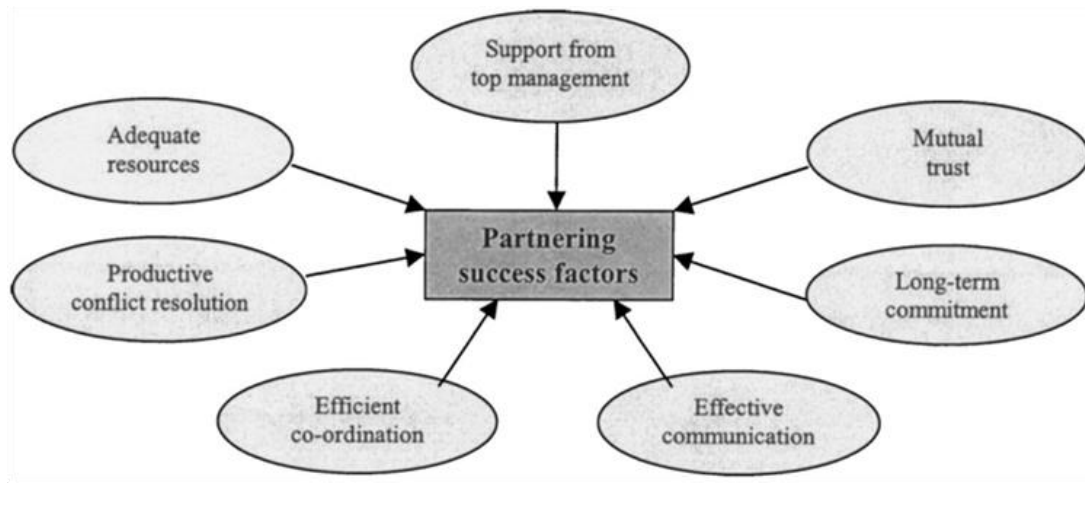
Partnering

Partnering is increasingly adopted in projects after the recommendations of the Latham Report (Latham, 1994) that advocated the development of a team approach to construction. Even further impulse was given by the Egan Report (Egan, 1998) which advocated integrated processes and teams to improve construction practices.

Bresnen & Marshall (2000:230) defined partnering as "a long-term commitment between two or more organizations for the purposes of achieving specific business objectives by maximizing the effectiveness of each participant's resources". This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based on trust, dedication to common goals, and an understanding of each other's individual expectations and values.

MacDonald (2005) described partnering as a commitment to work cooperatively, rather than competitively and adversarial, according to a code of conduct. It is difficult to precisely prescribe partnering and its responsibilities and rights in a contract because of the required flexibility and according trust and attitude principles. Although partnering requires more flexibility of the contractual parties it does however not relax the contracting terms. Therefore the contracting parties enter into an additional partnering agreement charter that is intended to shape a non-adversarial culture to promote a 'win-win' relationship (MacDonald, 2005). The general conditions are however of importance to provide required contractual procedures and responsibilities that are promoting a successful partnership.

Chan *et al.* (2004) identified seven main success factors of partnering, shown in Figure A.1.

FIGURE A.1: Partnering success factors (Chan *et al.*, 2004)

After the identification of the main success factors, the research by Chan *et al.* (2004) identified the ten most important underlying factors for a successful partnership which are:

- Establishment and communication of conflict resolution strategy
- Commitment to win-win attitude
- Regular monitoring of partnering process
- Clear definition of responsibilities
- Mutual trust
- Willingness to eliminate non-value added activities
- Early implementation of partnering process
- Willingness to share resources among project participants
- Ability to generate innovative ideas
- Subcontractor involvement

Fundamental principles such as commitment, trust, sharing risks according to a win-win attitude, respect, teamwork, openness, communication and equality are adopted in a project through partnering to consider the interest of all the contracting parties. According to Moore, Mosley & Slagle (1992) it is the building of trust that helps to avoid problems with the project such as disputes and litigation. The required change in culture, attitude and procedures throughout the supply chain causes a dependence on

each other to achieve project success. Especially complex or long-term projects that are involved with higher-risk contracts will benefit from a partnership approach.

Alliancing

Alliancing is in general similar to partnering and its earlier described principles. However there are a few differences between partnering and alliancing. The key difference is that in alliancing projects the parties will enter into a contract that acts in the best interest of the project (MacDonald, 2005). This differs from partnering since that is a purely voluntary agreement.

MacDonald (2005:4) defines alliance contracting as:

An arrangement where parties enter into an agreement to work cooperatively and to share risk and reward, measured against the performance indicators. The owner and service providers work as a single integrated team to deliver a specific project under a contractual framework where their commercial interests are aligned with actual project objectives.

The key principle in an alliance approach is the recognition that the contractor's profit should be based on his performance and not on the contractor's ability to successfully claim (MacDonald, 2005). Other principles are: defined shared risks, joint sharing of liabilities for project failure, joint sharing of gains and shared goals and costs. An alliance requires an even higher level of trust than a partnership.

Relationship contracting vs. traditional contracting

Black, Akintoye & Fitzgerald (2000) described four key differences between relationship contracting and the traditional approach. The key differences are that relationship contracting has an emphasis on cost rather than on price, a more long term focus rather than a short-term one, preventing defects instead of conducting quality checks, and finally has a single use of resources instead of multiple sourcing. Furthermore, there are also different degrees of relationship contracting, with a basic level of partnering, a full level of partnering and alliancing. MacDonald (2005) identified and compared those different levels of relationship contracting against traditional contracting on its attributes, consequences and expected project outcomes. Table A.1 summarizes the differences between the different contracting approaches.

The relations evolve from competitive in a traditional situation, cooperation in a basic partnership, collaboration in a full partnership towards a coalescence in an alliance.

TABLE A.1: Traditional vs. relationship contracting (MacDonald, 2005)

Level 1 – Traditional	Level 2 – Basic Partnering	Level 3 – Full Partnering	Level 4 – Alliancing
<i>Adversarial Arms-length Contractual</i>	<i>Collaborative Team Oriented</i>	<i>Value added Integrating Team</i>	<i>Synergistic Strategic Partnership</i>
Competition	Cooperation	Collaboration	Coalescence
<ul style="list-style-type: none"> Each side has clearly established responsibilities Client 'monitors and inspects' contractor Little or no trust 	<ul style="list-style-type: none"> Each side knows and commits to the goals of the project and to each other's goals – requires a degree of trust 	<ul style="list-style-type: none"> One integrated team consisting of both client and contractors personnel is created – requires a high degree of trust This team has one set of goals for a successful project Team often creates a separate organisational entity for the life of the project 	<ul style="list-style-type: none"> Elements of shared risk also defined Joint sharing of liabilities for project failure Joint sharing of gains Both sides share their goals and cost – requires extremely high trust
<ul style="list-style-type: none"> Often adversarial Often creates disputes, sometimes litigation 	<ul style="list-style-type: none"> Significant energy in communications and 'win-win' conflict resolution Disputes typically resolved in some degree of compromise and harmony 	<ul style="list-style-type: none"> Accountability is collective among the integrated team Both client and contractor provided senior level 'sponsors' to remove barriers and support the project 	<ul style="list-style-type: none"> Curve on benefits is logarithmic – based on meeting and then exceeding project goals The essence of the relationship is to increase the mutual profitability of both parties Neither at the expense of the other Both at creating new and synergistic solutions
<ul style="list-style-type: none"> Both sides are plagued by schedule slips and cost overruns 	<ul style="list-style-type: none"> Established for early positive intervention Projects often accomplished on schedule and within budget 	<ul style="list-style-type: none"> Typically included some incentive for exceeding project goals 	<ul style="list-style-type: none"> Requires extensive communication, collaboration and organisational commitment and sponsorship Creates the opportunities for major breakthrough

Project outcomes are expected to evolve from a project that is plagued in schedule slips and cost overruns in a traditional situation towards projects that are accomplished on schedule and within budget for a basic partnership, a project that is incentivized for exceeding project goals for a full partnership towards a project where the commercial interests of all contracting parties are fully aligned with the project objectives. However, alliances contain high risks for a major breakdown if things go wrong on the relational aspects between the different parties (MacDonald, 2005).

A.2 Target contract

A target contract is another contractual innovation of the last decades that is becoming increasingly used worldwide. A target contract conforms to three of the modern contracting principles described by Latham (1995). Two of the principles are the 4th aspect of teamwork as a duty including shared financial motivation to create a win-win scenario and the 12th aspect of provision of incentives for highly successful project performances. The NEC is a contract form that contains a target contract option as one of its standardized pricing mechanism options. Therefore the NEC also complies with the 8th aspect of flexibility in choice of payment method by providing for several payment strategies.

Target contracting is a pricing strategy that puts an incentive on performance. The contractor gets incentivized for any savings made against the target cost and on the contrary will be penalized for any overspending against the target cost due to his own mismanagement or negligence according to a pre-agreed share ratio (Chan, Chan, Lam & Wong, 2010a). Chan *et al.* (2011) describe that the contractor in a target contract must get paid according to the actual cost for the work done during the contract stage. Meanwhile, the initial target cost will be adjusted during the execution to allow for any changes to the original specification. When the final total cost of the construction project differs from the final target cost, the difference is shared between the employer and the contractor based on a pre-determined gain- share/pain-share ratio as stated in the contract.

Although the incentive for good performance by contractors is higher in target contracts than in fixed price contracts, the transactions costs that are required to monitor the performance are also higher. However, variations are easier to process because of the administrative procedures that are in place to monitor performance. Furthermore, the administrative procedures require an open book accounting approach which gives rise to transparency of costs and leads to openness. This promotes a higher degree of cooperation than is apparent in most price-based contracts and provides a solid foundation for partnering approaches (Watermeyer, 2009). Target contracts can still lead to disputes but a contractor will not pursue variations to increase its profit anymore because it is motivated to save costs which can be achieved in a target contract more easily by saving

costs (Turner, 2004). Ultimately this mechanism must lead to collaboration between employer and contractor since it is in both their interests to save cost.

Chan, *et al.* (2010a) identified five significant factors required for successfully implementing a target contract in a construction project:

- Reasonable share of cost saving with fair allocation of risks
- Cultivation of partnering spirit
- Right selection of project team
- Well-defined scope of work in employer's project brief
- Early involvement of contractor in design development

Chan *et al.* (2011) identified the top five risk factors of target contracting to be:

1. Change in scope of work
2. Insufficient design completion during tender invitation
3. Unforeseeable design development risks at tender stage
4. Errors and omissions in tender document
5. Exchange rate variations

A.3 Enforced collaborative and proactive change management system

Change management requires nowadays more attention and specification than usual in traditional contract forms. According to the modern principles of contracting it is therefore required that a proactive change management system according to a collaborative, clear and consistent method and procedure be defined and prescribed by a standard construction form. This is based on four different aspects of a modern contract described by Latham (1995). The 2th, 4th, 6th and 7th principles of modern contracting require an enforced collaborative and proactive change management system based on:

- Clear distribution of duties between the parties to deal fairly with each other

- Teamwork as a duty (including shared financial motivation to create a win-win scenario)
- Flexibility to allocate risks to the party best able to manage, estimate and carry the risk
- Avoidance of unnecessary variations and price necessary variations in advance

The contract should therefore give a clear guidance for project change and should emphasize a collaborative project and risk management approach through requirements for (Sun & Oza, 2006):

- Early warnings
- Regular risk reduction meetings
- Pre-assessment and pre-agreement of change
- The assignment of the mitigations of the change impacts to the party best able to handle
- Change assessments as a package of time and money instead of the traditional separation of extension of time and variations

In the next four paragraphs, project change causes, project change impacts, project change management and project change assessment are more specifically discussed.

Project change causes

Construction projects are subject to many factors that can trigger a project change because of external, organisational and project level pressures. Some of the most common specific change causes include (Sun & Oza, 2006):

- Climate conditions
- Site and ground conditions
- Employer-initiated variations
- Contractors' faults
- Design changes, errors and omissions
- Communication failures
- Project team and personnel changes

Some of the change causes are within the control of the project team and others are not. Project changes within control require proper management. However, even if a project change is beyond the control of the project team, it is of high importance to identify potential or occurred changes at the earliest opportunity to be able to anticipate or react in the most effective way.

Project change impacts

Most project changes negatively impact the project through an interruption of the work flow and a further increase in the uncertainty of the outcome (Sun & Oza, 2006). The most common impacts are (Sun & Oza, 2006):

- Cost and time overruns
- Rework
- Loss of productivity
- Claims and disputes
- Negative impact on staff morale

Many damaging changes of construction projects are caused by the lack of systematic review and early identification of project risks (Sun & Meng, 2009). Proactive change management in a project is therefore of high importance and will be discussed in the next paragraph.

Project change management

According to Sun *et al.* (2006) there is a lack of standards for project change management procedures and methods. Instead of an adopted formal change management system in construction projects, project teams currently cope with project changes on an ad hoc basis which lead to changes that are poorly managed (Sun, Fleming, Senaratne, Motawa & Yeoh, 2006). Change management must have the objective to prevent unnecessary changes and mitigate the negative impacts of necessary changes. Since changes in construction projects are unavoidable, change management does not aim to eliminate any project change. However, it is of high importance that changes are well managed following a collaborative, proactive, formal and consistent system to promote a balanced change culture, to recognize change at its earliest stage, to better evaluate and implement change and to continuously improve from the lessons learned (Sun *et al.*, 2006). To prevent and minimize the negative impacts of project change the contract should

therefore give a clear guidance to project changes and should emphasize on a collaborative change management approach with room for negotiation to find the best solution. Furthermore, for different project changes a different party might be most effective to mitigate the negative impacts of the change. Therefore a collaborative change management system should be adopted to assign the best approach to the right party based on foresight and proactive action instead of the traditional reactive approach (Sun & Oza, 2006).

Project change assessment

The assessment of project changes is often a source of uncertainty because of many different assessment procedures at different eventualities and because of the retrospective approach to change that can lead to uncertainty in the project outcome for the employer (Frehse, 2013:99). Therefore claims should not be based on retrospective assessments through proven additional costs based on records and variations should not be re-measurable. Furthermore, the adjustments to time-related items will currently often only be known at completion. The project change management system should therefore be based on pre-assessment and pre-agreement of all time and cost impacts, following a clear and consistent method based on the accepted programme. In this way the project's knock-on effects are assessed at the time of the change event which provides immediate certainty (Frehse, 2013:63). The contractor provides quotations for the valuation of any change beforehand and if possible for different alternatives that address the problem. The project manager is then capable of selecting the best alternative that best serves the interests of the employer, based on criteria such as lowest cost, least delay or best finished quality or any combination. The contractor carries the potential risk or reward if his forecast of the cost impact is wrong, and the employer has a firm commitment (NEC3, 2013b:4). This change system intends to:

Project change impacts

Most project changes negatively impact the project through an interruption of the work flow and a further increase in the uncertainty of the outcome (Sun & Oza, 2006). The most common general impacts are (Sun & Oza, 2006):

- Stimulate foresight
- Enable the employer to make rational decisions about changes to the work with reasonable certainty of their cost and time implications

- Put a risk on the contractor which is tolerable and which motivates him to manage the new situation efficiently

A.4 Integrated contract

Another worldwide development that is noticeable from the last two decades is the procurement of Design & Construct type of projects that require a design responsibility by the contractor. As a consequence standard construction contracts were required to develop a specific form or were required to contain the flexibility to provide for this type of procurements. Projects including contractor design responsibilities are often contracted through an integrated contract type, which is different from the traditional project organization. This contractual innovation conforms to the 4th and 12th Latham (1995) principles for modern contracting, which require teamwork in a win-win environment and an incentive for highly successful project performances. Because more responsibilities and its associated risks are transferred to the contractor this contract type forces the contractor to better manage the project and its risks. When achieving highly successful project performances through better risk and change management he will achieve higher profits and therefore will get incentivized to work collaboratively and to improve his performances. The NEC is a contract that provides for the strategy to procure a Design and Construct type of contract within its range of procurement options. The UAV-GC is a special created standard contract form that is only suitable for integrated contracts. The specifics of an integrated contract type is subsequently discussed in more detail.

The Egan report (Egan, 1998:4) identified the need for integrated processes and teams as one of the five key drivers of change in the construction industry. The industry is currently typically divided in a series of sequential and largely separated operations undertaken by individual designers, constructors and suppliers without any stake on the long-term success of the product and without any commitment to it. This sustains a transactional and adversarial culture. Moreover, the fragmentation leads to misunderstandings, miscommunications, errors and creates possibilities for opportunistic behaviour. Change is necessary to improve quality and lifecycle efficiency. Construction projects therefore should integrate the process and project team around the product to deliver the best value to the customer and eliminate waste in the whole lifecycle process

(Egan, 1998:4).

Integrated project processes must utilize a construction team that brings the required skills together that bear on delivering value to the employers. The process towards the delivery of successful projects should be furthermore explicit, transparent and easily understood by the participants and its employers (Egan, 1998:4). As a results, a different legal relationship is required where the employer enters into a contract with a single party which has both design and execution responsibilities in their hands. This integration of teams and processes can be set-up in two different ways, as shown in Figure A.2. One where the contracting party can be any one of the involved parties, and the other where the contracting party consists of the whole project team together.

Egan (1998:5) even proposes that integrated teams should work together on a series of projects to increase the elimination of waste through innovation and learning from experience. In this way a sustained improvement that increases efficiency and quality must be offered to employers. The NEC can provide for this repetition by the use of a framework contract that can contract several projects at once through the use of work packages.

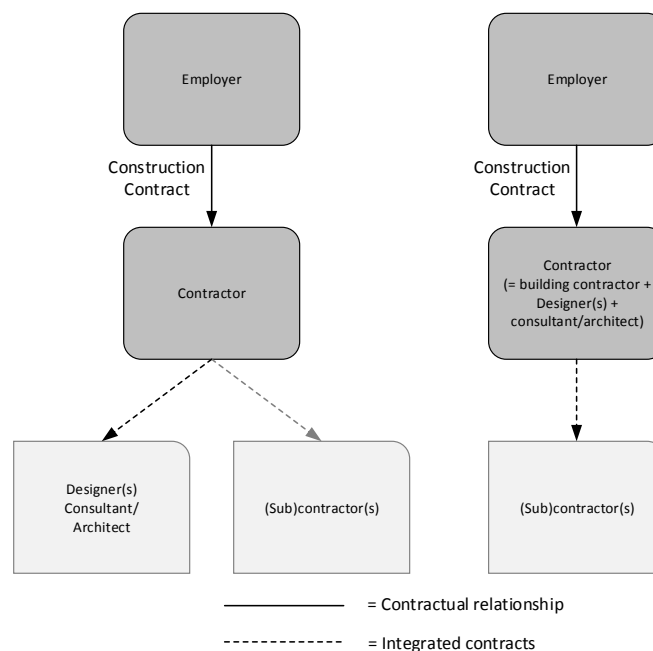


FIGURE A.2: Integrated legal relationships (Chao-Duivis *et al.*, 2013)

Lenferink (2013:125) concluded that by including the maintenance in the integrated contract, a more sustainable infrastructure development will exist because of the lifecycle optimization incentives provided by the linked contract stages of design, construction

and maintenance. Egan (1998:27) describes this as a 'design for construction and use'. Egan (1998:27) identified the separation of design from the rest of the project process to be one of the important deficiencies in the construction industry. It results in too many delivered projects that perform poorly in terms of flexibility in use, operating and maintenance costs and sustainability. Therefore, designs need proper integration with construction.

The NEC includes all the innovative mechanisms previously discussed and is amongst other noticeable innovations seen as a promising improvement towards the current mainly traditional contracting practices.

Appendix B

South African standard contract forms

The following forms of standard construction contracts are commonly used within the South African civil engineering industry:

GCC

The South African Institution of Civil Engineering (SAICE) was established in 1903 and is a recognized voluntary association with the Engineering Council of South Africa (ECSA) that aims to advance professional knowledge and improve the practice of civil engineering (SAICE,2011). SAICE published the General Conditions of Contract for Construction Works (GCC). The last editions of the GCC were published in 1972 (4th), 1982 (5th), 1990 (6th), 2004 and the current edition is the GCC 2010.

The GCC is considered as a traditional type of standard construction contract (Frehse, 2013:6).

FIDIC

FIDIC is the International Federation of Consulting Engineers. FIDIC was founded in 1913, and is charged with promoting and implementing the consulting engineering industry's strategic goals (FIDIC, 2014). It is best known for its publicized suite of standard conditions of contract, the FIDIC contracts. The FIDIC forms are the most widely used forms of contract internationally. The newest FIDIC 'Rainbow Suite' of contracts was published in 1999 and includes:

- The Red Book: Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer
- The Yellow Book: Conditions of Contract for Plant and Design-Build
- The Silver Book: Conditions of Contract for EPC/Turnkey Projects
- The Green Book: Conditions of Short Form of Contract
- The Blue Book: Contract for Dredging and Reclamation Works MDB/FIDIC Contract: FIDIC conditions incorporated in the standard bidding documents of multilateral development banks
- The White Book: Client/Consultant Model Services Agreement
- The Gold Book: FIDIC Design, Build and Operate Projects

Although the FIDIC has been innovating, the FIDIC is based on its origin and style and is still considered as a traditional type of standard construction contract (Broome & Hayes, 1997).

JBCC

The Joint Building Contracts Committee (JBCC) was established in 1984 as a non-profit company. The committee concentrates on the compilation of current contract documentation with an equitable distribution of contractual risk in the building industry (JBCC, 2014). The JBCC published its first standard contract form in 1991. In 1997 the JBCC series 2000 replaced the previous document. Since 1997 six revisions have been made to the JBCC series 2000. The latest revision was published in 2013. The JBCC document has a specific focus on building projects.

Based on its drafting style, legal relationships and transactional approach, the JBCC is considered as a traditional type of standard construction contract.

NEC

The Institution of Civil Engineers (ICE) is a in the United Kingdom registered charity that strives to promote and progress civil engineering. ICE was founded in 1818 and is currently the publisher of the New Engineering Contract (NEC). The NEC is a family of contracts that facilitates the implementation of sound project management principles and practices (NEC, 2010). There have been three editions, the first in 1993, the second in 1995, and the most recent in 2005.

The NEC is seen by the international construction industry as a modern contract that moved away from traditional contracting principles (Broome & Hayes, 1997; Lord, 2008).

Other

Mainly some private employers developed an own standard procurement document that they use in construction projects. However, these do not necessarily comply with the CIDB's Standard for Uniformity in Construction Procurement to aim for standardization in construction procurement (Klingenberg, 2014:6).

Appendix C

Interview Protocols

Subsequently the South African and Dutch interview protocols are explained.

C.1 Interview protocol (South Africa)

The additions to the in the research methodology discusses interview protocol are here discussed.

Context of the Interview

This interview is part of my thesis research to graduate for my Construction Engineering and Management Master at Stellenbosch University. My thesis research investigates the difficult introduction of the NEC in South African civil construction projects. Although the NEC already exists for almost 20 years the contract is with a found usage of around 2% in 2012 still not broadly adopted by the South African civil industry. This will be assisted by a comparison with the Dutch introduction of the UAV-GC to learn from its differences and similarities and to improve the recommendations. The UAV-GC seems to be quickly adopted by the all the national departments, although the local authorities seem more reserved. Only one year after the introduction of the UAV-GC 2005, already 11% of the civil construction projects were conducted under this new contract.

Semi-structured interview protocol

The South African interviews maintained a protocol as discussed in this paragraph. It is a semi-structured interview so the actual questions asked or the actual followed sequence may deviate from this protocol or may be further elaborated on.

Interview Ethics

1. Provide full disclosure research
2. Permission to record the interview: Yes/No
3. Provide anonymity person: Yes/Not necessary
4. Provide anonymity company: Yes/Not necessary
5. Prepared to validate and confirm a written interview transcript: Yes/No

General info

1. Name:
2. Company:
3. Function:
4. Experience:
5. NEC experience:

Semi-structured interview

1. What are currently the biggest problems in the civil contracting environment in South Africa?
2. Is the NEC currently broadly adopted by the South African civil industry?
3. Would a broader adoption of the NEC in your opinion be an improvement to the civil contracting environment in South Africa?
4. If yes, on which NEC specific aspects the most? Or: No, why not?
5. Are most South African NEC projects conducted according to the NEC philosophies?
6. What are in general the experiences from completed NEC projects?
7. What are currently the remaining critical barriers of implementing the NEC in civil projects?
8. What has to change or happen for the NEC to get broader adopted?
9. What are required factors for a successful implementation of the NEC?
10. Who should be responsible for promoting and pushing the use of the NEC within South Africa?
11. What are the disadvantages of the NEC? And are they to overcome or mitigate?
12. Does the level of project management increase by the NEC requirements?
13. Does the NEC lead to higher administration costs? If yes, are those outweighed by better results on cost and schedule performances?

Short questionnaire

In comparison to the FIDIC, GCC and JBCC, the use of the NEC in its right philosophy should lead to: (strongly disagree, disagree, neutral, agree, strongly agree) (and free to comment)

1. Better compensation procedures:
2. Better incentivizing of the contractors' performance:
3. Increased profit for contractor:
4. Increase in projects that stay within its budget:
5. Increase in the level of project management:
6. Fairer risk allocations:
7. Better risk management:
8. Increase in projects that stay within its schedule:
9. Better contractual relationship between employer and contractor (less adversarial behaviour):
10. Better communication between employer and contractor:
11. Reduction in disputes:
12. Reduction in arbitration/litigation:
13. Full potential of NEC is currently achieved in South Africa:

C.2 Interview protocol (The Netherlands)

The Dutch interviews maintained a protocol as discussed in this paragraph. The interview protocol, as described in English here, is translated and executed in Dutch.

Purpose of interview

To assist the understanding of the difficult introduction of the NEC in South Africa, this interview investigates a comparison with the Dutch introduction process of the UAV-GC within the civil industry and its experiences, such as the experienced barriers for adoption and required success factors for implementation.

Content in interview

The interview discusses the following main issues:

- Contractual problems and developments in Dutch civil projects.

- The motive for the creation of the UAV-GC.
- The experiences with the UAV-GC and its advantages and disadvantages.
- The introduction process of the UAV-GC.
- Critical barriers for the implementation of the UAV-GC in Dutch civil projects.
- Required success factors for the implementation of the UAV-GC in Dutch civil projects.

Result from interview

Firstly, the interviews are transcribed and send for approval to the interviewee. Thereafter, the most important findings of all interviews are analysed and categorized, compared amongst each other, summarized and finally compared amongst the South African situation. The information is categorized according to the main issues stated as bullet points in the previously discussed paragraph 'content in the interview'.

Interview procedure

- For an interview 90 minutes are reserved with the interviewee, however is tried to be kept within 60 minutes.
- The interview is semi-structured, the interviewee is free to further elaborate on topics and the interviewer is free to ask follow-up questions to proceed into more depth.
- After the first acquaintance, but before the interview starts, the interview procedure is clarified and the interview ethics are discussed with the interviewee.

Semi-structured interview protocol

The Dutch interviews maintained a protocol as discussed in this paragraph. It is a semi-structured interview so the actual questions asked or the actual followed sequence may deviate from this protocol or may be further elaborated on.

Interview Ethics

1. Provide full disclosure research
2. Permission to record the interview: Yes/No
3. Provide anonymity person: Yes/Not necessary
4. Provide anonymity company: Yes/Not necessary

5. Prepared to validate and confirm a written interview transcript in the next weeks:
Yes/No

General info

1. Name:
2. Company:
3. Function:
4. Experience:
5. UAV-GC experience:

Semi-structured interview

1. What are currently the biggest problems in the civil contracting environment in The Netherlands?
2. What were the motives of the creation of the UAV-GC? Which problems were addressed?
3. What are the experiences (from industry) with the UAV-GC? What are the advantages and what are the disadvantages?
4. How is the UAV-GC introduced into the industry and what are the experiences with the introduction?
5. Who was or still is responsible for promoting and pushing the use of the UAV-GC?
6. Is the UAV-GC now broadly adopted in The Netherlands?
7. What were or are still remaining critical barriers for implementing the UAV-GC in civil projects?
8. What were or are still required factors for a successful implementation of the UAV-GC?

Appendix D

Interview Samples

The persons interviewed in South Africa are presented in Table D.1.

TABLE D.1: Interview sample South Africa

Name	Government/ Company	Function	Experience (NEC)
Dirk vanden Eynde	WITS University - Campus planning and development	Senior project manager (Former Eskom PM)	20 years (20 years)
Jan van Rensburg	Department of Transport and Public Works of the Western Cape	Programme manager - General Infrastructure	28 years (2 years)
Hannes Marais	Saldana Bay IDZ licensing company	Lead - Infrastructure planning and environment	28 years (6 years)
Andrew Murray	Murray & Dickson (CE8)	Director	36 years (5 years)
Hubert van Zandvoort	RoyalHaskoningDHV	Principal Buildings	10 years (1 year)
Pierre Storey	Storey Eng (Pty) Limited	Director	31 years (4 years)
Dr. Ron Watermeyer	Infrastructure Options	Director (Former SAICE president)	34 years (17 years)

The persons interviewed in The Netherlands are presented in Table D.2.

TABLE D.2: Interview sample The Netherlands

Name	Government/ Company	Function	Experience (UAV-GC)
Thomas Munster	Ingenieursbureau Amsterdam	Advisor (Integrated Contracts, Systems Engineering, Risk Management) (UAV-GC expert)	5 years (4 years)
Paul Fondse	Brink Groep	Senior Project Manager (Current PM in NEC project - International Criminal Court The Hague)	28 years (+ NEC)
Walter Suy	CROW (knowledge institute)	Project Manager (UAV-GC) (Co-developer and current administrator of the UAV-GC)	36 years (14 years)

Appendix E

NEC3 ECC change management system

The analysis of the change management system of the NEC3 ECC is subsequently described according to its five clauses.

60. Compensation events

This clause describes 19 situations that are considered as compensation events that lead to a compensation of the contractor. Everything that is not included within those 19 situations is considered not to be compensation events. Compensation events consists for example of changes instructed by the employer, the incurrence of delay or extra costs for the contractor caused by the actions of the employer, supervisor or project manager or by an evolved employer's risk.

61. Notifying compensation events

Compensation events can arise from the project manager or supervisor by giving an instruction, issuing a certificate, changing an earlier decision or correcting an assumption. The contractor submits a quotation and puts the instruction or changed decision into effect. The project manager also has the option to instruct a 'proposed instruction' or 'proposed changed decision'. The contractor then must submit a quotation but not put it into effect yet.

On the other hand are there also compensation events that arise when the contractor notifies the project manager of an event which has happened or he expects to happen

as a compensation event. Clause 61.4 describes the reasons for the project manager to accept or reject the event to be a compensation event. Reasons for rejection can be:

- Arises from a fault of the contractor
- Has not happened and is not expected to happen
- Has no effect upon defined cost, completion or meeting a key date
- Is not one of the compensation events stated in the contract

A rejection consequently leads to nothing to be changed. If the compensation event is accepted the contractor must submit his quotations on the changes to the total price, completion date or key dates. The quotations are always based on a forecast basis. However, clause 61.6 describes that if the project manager decides that the effects of the compensation event are too uncertain to forecast, assumptions on which the assessment is based must be stated. If the assumptions are later found to have been wrong the project manager notifies a correction.

All the notification procedures are described with strict time limits for actions and responses. For example, the contractor has to notify a compensation event within eight weeks of becoming aware of the event or he is not entitled to the compensation event. On the other hand, clause 61.4 describes that if the project manager fails to reply to the contractor's notification of a compensation event within one week and to a following-up notification of his failure to respond within two weeks, the NEC3 ECC treats his notification of the compensation event as accepted and as an instruction to submit quotations. Because of these strict time limits the NEC3 ECC leads to a prompt and quick resolution of compensation events. In combination with the clear rules and procedures the compensation events should have limited opportunity to evolve into a conflict.

62. Quotations for compensation events

This clause mentions that after discussing with the contractor, the project manager may instruct the contractor to submit alternative quotations. In addition the contractor may also submit a quotation of a method he finds practicable. This gives the employer choices and stimulates the search for the best solution.

The quotation of the contractor must exist of a detailed description of the changes to the total price and any delay to the completion date and key dates. If the programme for remaining work is altered by the changes, the contractor must also include the alterations

to the accepted programme. Clause 62.3 describes the following possible replies from the project manager to the quotation of the contractor:

- An instruction to submit a revised quotation
- An acceptance of a quotation
- A notification that a proposed instruction will not be given or a proposed changed decision will not be made
- A notification that he will be making his own assessment

The project manager instructs a revised quotation only after explaining his reasons for doing so to the contractor. Similar to clause 61 also this clause describes strict time limits and therefore a requirement for prompt actions and responses. It is described in the procedures that only when both contractor and project manager agree on it upfront an extension of time limits is allowed.

63. Assessing compensation events

Clause 63 describes the assessment of the effects of a compensation event and its quotations to the total prices and accepted programme. The assessment of compensation events, as described in clause 63.1, is based on defined costs for work that is already done and forecasted costs for work that is not done yet plus a resulting fee for the contractor. In the possibility that the compensation event has the effect that the actual defined costs are reduced, clause 63.2 states that the price for the contractor will not be reduced except if otherwise agreed. The effects of a compensation event are, by means of clause 63.3, also assessed on extension of time if a key date or the completion date in the accepted programme gets delayed. Besides costs and extra time, the assessment of compensation events also contains a provision for the contractor to include risk allowances for cost and time for the contractor's risks which have a significant chance of occurring. Clause 63.7 describes that assessments are made upon the assumption that the contractor reacts competent and promptly to the compensation event. Furthermore the costs and time due to the event must be reasonably incurred and the accepted programme can be changed. This clause tries to constrain the contractor from unreasonable behaviour at a compensation event.

64. The Project Manager's assessment

Clause 64.1 describes four situations in which the project manager is allowed to make

the assessment. In general this will be when the contractor did not respond within time limits or when the contractor is in default in his assessment, in the opinion of the project manager. Also this clause prescribes strict procedures and time limits.

65. Implementing compensation events

Clause 65 is the last step of the compensation event procedures. It describes in clause 65.1 three different situations in which a compensation event is assumed to be implemented. Clause 65.2 describes that the assessment of a compensation event is not revised if a used forecast is shown by later records to have been wrong.

Appendix F

Contractual Analysis UAV-GC 2005

This appendix presents the contractual analysis of the UAV-GC 2005. The UAV-GC is subsequently analysed on its structure and project management principles.

F.1 Family of contracts

The UAV-GC 2005 is not part of a family of contracts but is a singular contract form for the execution of a construction project by one contractor.

F.2 Contractual arrangements in the UAV-GC 2005

The UAV-GC 2005 is based on a direct relationship between the employer and the contractor. The contractor can consist of a single party or as a coalition between parties. The project organization can be depicted as in Figure A.2, which is discussed under the integrated contracts section of Appendix A.

The UAV-GC 2005 doesn't define a project manager, supervisor or adjudicator as such but only describes the general rights and obligations on representation of the employer and the contractor in clause 2 (UAV-GC, 2005:19). The employer may designate one or several persons to act as his representative in matters that concern the works and long-term maintenance. In addition the employer may designate one or several persons

to act as assistants to the employer's representatives. The employer shall expressly notify the contractor in writing of the authority of his representatives. The contract therefore only refers to employer and contractor, which may concern the representative if so defined. The contractor on the other hand is compelled to designate a person, which is acknowledged by the employer, to act as his representative in all matters concerning the works and long-term maintenance. He also must appoint a substitute representative in case of absence or premature replacement.

F.3 Required contract documents under the UAV-GC 2005

The complete construction contract under the UAV-GC 2005 consists of the following documents:

1. The completed and signed model agreement
 - (a) The summaries of additional information and changes
 - (b) Minutes of pre-tender meeting
2. The employer's requirements
3. The annexes to the employer's requirements
4. The UAV-GC 2005
5. The tender
6. Documents: All data produced by or on behalf of the contractor as part of the work, irrespective of the nature of the data carrier on which or in which the data is stated.

In the case of conflict between contract documents, the order of preference of the documents shall maintain the above stated order with a) as the highest and f) as the lowest ranked preference.

F.4 Structure of the general conditions of the UAV-GC 2005

The UAV-GC 2005 is structured according to the following eighteen different components, which contain clauses about its topic:

1. General
2. General obligations of the parties
3. Assignment and subcontractors
4. Programme and co-ordination
5. Permissions and/or licenses, exemptions, orders and permissions; statutory regulations
6. Soil and site
7. Variations, suspension, dissolution, termination
8. Site, advertising
9. Quality assurance
10. Completion and acceptance and defects liability period
11. Long-term maintenance
12. Payment, provisional sums, turnover tax, penalty clause, bonus, pledge or charge and assignment
13. Security insurance
14. Intellectual property rights
15. Damage to the Works
16. Default, incapacity or death of one of the parties
17. Cost compensation, extension of time, procedure for settling consequences of variations ordered by the employer
18. Recording the condition; settlement of disputes

F.5 Arrangement for contractor's design responsibilities

With the UAV-GC 2005 the contractor is appointed based on a Programme of Requirements to design, execute and possibly maintain the project. The contractor's design freedom depends on the amount of detail in the Programme of Requirements. Less detail means more freedom for the contractor's design and more detail results in less freedom for the contractor. Also, in the design and execution by the contractor the employer involvement is not limited by the contract. However, involvement by the employer in the contractor's design and execution is not in the philosophy of the contract. The employer should therefore be cautious to be overly involved with the works because it

involves the consequence that the responsibilities are being transferred back to himself, which has also financial consequences (Chao-Duivis *et al.*, 2013:103). The choices of the level of design freedom by the contractor within the UAV-GC 2005 is also set-out, by article 5 'Design Work', in the model agreement of the contract. It provides for the following choices in different levels of the contractor's design responsibilities (UAV-GC, 2005:10):

- Developing the conceptual design into a preliminary design, a basic design and a final design
- Developing the conceptual design and preliminary design into a basic design and a final design
- Developing the conceptual design, the preliminary design and the basic design into a final design

F.6 Project management principles in the UAV-GC 2005

In this paragraph the focus is on the use of a UAV-GC 2005 in the execution of construction projects. To be able to compare the UAV-GC 2005 and its implications with the NEC3 ECC the included project management principles are discussed below according to:

- Risk management
- Programme management
- Change management
- Quality control management
- Dispute management
- Partnering

All mentioned clauses in this paragraph are derived from the UAV-GC 2005 (UAV-GC, 2005). The sub-clauses which are referred to in this paragraph are presented in Appendix G.

Risk management

There is no mentioning of any requirement for a risk management system in the UAV-GC 2005 other than a limited early warning responsibility and the allocation of risks as is

usually done by a contract such as the FIDIC, JBCC and GCC. There is no requirement for the use of a risk register and holding risk reduction meetings in the project. This doesn't exclude the employer from requiring such a register from the contractor. However the employer has to arrange as an addition to the contract. Otherwise a requirement for risk management isn't enforced by a contract with the UAV-GC 2005. The risk allocations and the existing requirements for early warnings are subsequently discussed.

Risk allocation

The risk allocations between the contractor and employer are scattered throughout the document and are described per eventuality.

Early warning

The early warning requirements in the UAV-GC 2005 are limited to eight defined situations in clause 4-7. They are all defined as duties for the contractor to warn the employer. The described early warning is a duty to warn without delay of any faults or defects in the information provided by the employer, such as the works and site information and variations. The sub-clause furthermore emphasizes the contractor's requirement to operate in good faith and the contractor therefore would be in breach of contract if he continued work without issuing any warning. As a result clause 4-8 describes that the contractor is liable for any damage if he fails on his warning obligations. The early warning requirements can be seen as limited to a specific topic and not part of a bigger risk management system to co-operatively mitigate or avoid risks.

Programme management

The programme management in the UAV-GC 2005 is mostly managed by an external required document with specifications on the information to be delivered to the employer for acceptance and is called the acknowledgement plan. This is a project-specific specified plan in contrast to the standardized standard conditions of contract as described by the UAV-GC 2005. Clauses 7-1, 7-2 and 7-3 require the contractor to observe the programme and milestones, submit a detailed programme to the employer and update it as often as stated in the acknowledgement plan. Therefore the UAV-GC 2005 prescribes a certain amount of responsibility to the contractor to observe the programme. The amount of detail in the detailed programme and the regularity of updating isn't mentioned by the UAV-GC 2005. This is therefore also project-specifically defined.

Change management

The change management in the UAV-GC 2005 is divided by variations and its consequences and cost compensations and/or time extensions because of evolved employer risks and employer involvements.

Variations

Clause 14 discusses variations ordered by the employer. In a UAV-GC 2005 project that includes design by the contractor, the employer is still entitled to order a variation. Clause 14-6 describes four situations in which the contractor is not obligated to carry out the variation, which is when the variation:

- is not ordered in writing
- creates a unacceptable disruption of work, according to good faith
- is beyond the technical know-how and/or capacity of the contractor
- is unacceptable to the contractor, according to good faith and given the mutual interests of the parties

The contractor needs to notify the employer of his decision to carry out the variation. If he refuses to carry out the variation order he must state his reasons to the employer. If the employer disagrees clause 14-9 prescribes that they shall have a consultation, to overcome the deadlock and to make an inventory of the financial and time consequences of the variation. This has a certain degree of collaboration in it.

Furthermore, the contractor is entitled to carry out variations. These variations need to be submitted to the employer according to the acknowledgement plan. The employer is however entitled to refuse acknowledgement without giving the reasons.

The variation clauses don't discuss strict time lines for responses but only mention that in the case of no response the notifying party is allowed to set a time limit to respond. The time limit to perceive something as no response is unclear and the follow-up time limit to be set by the notifying party is freely to be set. If any disagreements exist the follow-up step is a referral to the Dispute Adjudication Board.

Procedure for settling consequences of Variations ordered by the Employer

After a variation being ordered, clause 45-2 states that the contractor shall send the employer a quotation with the balance, an adjusted programme based on a calculation of the time needed for the execution of the variation and an adjustment of the payment schedule. The balance comprises of all direct and indirect costs, as well as a reasonable

surcharge for general expenses, profit and risk, related to the execution of the variation less the amount by which the price stated in the agreement can be reduced as a result of the execution. The UAV-GC 2005 states that the contractor shall be entitled to a reasonable compensation of his extra costs. The employer may invite the contractor for a consultation on the quotation and the contractor shall be obligated to accept within the bounds of good faith. If acceptance isn't achieved clause 45 describes that the quotation can be referred to the Dispute Adjudication Board, who has to decide if the quotation of the contractor is reasonable. There are no strict time limits mentioned in clause 45.

Cost compensation and or extension of time

The UAV-GC 2005 states three situations in which the contractor has the right to claim for cost compensation and/or time extension, based on clause 44-1. One of the three situations references to all the situations that are described throughout the UAV-GC. Therefore the eventualities that apply are scattered throughout the document and not summarized in one section of the document. Clause 44-5 describes that the contractor is responsible for stating his reasons and his believes to what extent he is entitled to cost compensation and/or time extension. He shall state all direct and indirect costs, as well as a reasonable surcharge for general expenses, profit and risk. In addition, he shall specify the programme, milestones and the date of completion and acceptance. Also clause 44 provides the employer with the opportunity to consult with the contractor about the respective issue. The employer is by clause 44 allowed to reject the claim. Clause 44 is subject to the rules of clause 45 and therefore also these issues can be referred to the Dispute Adjudication Board and are not subjected to strict time limits.

Quality control management

In the UAV-GC 2005 the contractor is fully responsible for the quality control of his own design work, the execution and the documents that are associated. In accordance with this responsibility, clause 19-1 and 19-2 describe the contractor has to submit a quality plan to the employer for acknowledgement in which he describes his quality assurance and control procedures. The quality plan is associated by a design work test plan, a construction work inspection plan and a maintenance work inspection plan.

The employer is authorized to test on the basis of the design work test plan if the qualifications of the contractor's designers and the design documents are in accordance with the requirements of the contract. In addition the employer is authorized to test

whether the quality assurance of the contractor's design work is in accordance with the quality plan. However the employer shall interfere the contractor's design work as little as possible when using his authority to test and is not obliged to test.

The construction and maintenance work inspection plans shall be submitted to the employer for acknowledgement. Thereafter the contractor is, according to clause 21-2, responsible for the inspections and testing and he shall demonstrate that the construction and maintenance work meet the requirements of the contract based on the results. Clause 21-3 describes that after an inspection the contractor shall inform the employer on the results containing which part is tested, by who, on which date and time and whether the results of the inspection satisfy the requirements of the contract. The employer keeps his authority to test if the quality assurance by the contractor is in accordance with the quality plan. In this way the employer changes his focus of controlling the contractor's execution himself towards the control of the quality assurance and control procedures of the contractor. However, the employer shall interfere the execution of the contractor as little as possible when using his authority to test. The employer shall also not be under any obligation to test and he shall decide himself whether and how he will use his authority to test. Nevertheless if the employer discovers a failure by the contractor he shall inform the contractor in writing without delay and the contractor will be responsible for the remedy. Because of the swift in design and quality control responsibilities towards the contractor, he stays responsible for his work during the full defects liability period of 5 years or 10 years in the case of collapse.

Dispute management

The UAV-GC 2005 waives the right to refer disputes to the common courts of law. The complementary model agreement of the UAV-GC 2005 allows the parties to refer disputes to the Dutch Dispute Adjudication Board or not. The dispute adjudication rules must be stated in the annex to the employer's requirements. If the Dutch Dispute Adjudication Board option is not chosen, clause 47 of the UAV-GC 2005 prescribes the use of the Dutch Court of Arbitration. A dispute about the final account can be referred to the Arbitration Board six months after the employer has given written notice of his decision. This is not a quick and prompt dispute resolution procedure. It is not a standardized procedure in the UAV-GC 2005 and again relies on a more project-specific description by the employer on how to solve disputes.

Partnering

Apart from some mentioning in specific clauses about actions in good faith given the mutual interests of the parties and in good faith in general, there is no partnering agreement or any relational contracting aspects to be found in the UAV-GC 2005. The furthest the UAV-GC 2005 goes, is a limited prescription of some early warning situations for the contractor and the opportunity for the employer to instruct consultations with the contractor within the acknowledgement, variation and claim procedures.

Appendix G

Contract Clauses

This appendix presents the sub-clauses that are discussed in the contractual analysis of respectively the NEC3 ECC and the UAV-GC.

G.1 Contract clauses NEC3 ECC

The discussed sub-clauses of the NEC3 ECC are subsequently presented within their chapter and main clause, cited from the NEC3 ECC (NEC3, 2013a).

General

10 Actions

10.1 The Employer, the Contractor, the Project Manager and the Supervisor shall act as stated in this contract in a spirit of mutual trust and co-operation.

11 Identified and defined terms

11.2 (14) The Risk Register is a register of the risks which are listed in the Contract Data and the risks which the Project Manager or the Contractor has notified as an early warning matter. It includes a description of the risk and a description of the actions which are to be taken to avoid or reduce the risk.

16 Early warning

16.1 The Contractor and the Project Manager give an early warning by notifying the other as soon as either becomes aware of any matter which could

- increase the total of the Prices,
- delay Completion,

- delay meeting a Key Date or
- impair the performances of the works in use.

The Contractor may give an early warning by notifying the Project Manager of any matter which could increase his total cost. The Project Manager enters early warning matters in the Risk Register. Early warning of a matter for which compensation event has previously been notified is not required.

16.2 Either the Project Manager or the Contractor may instruct the other to attend a risk reduction meeting. Each may instruct other people to attend if the other agrees.

16.3 At a risk reduction meeting, those who attend co-operate in

- making and considering proposals for how the effect of the registered risks can be avoided or reduced,
- seeking solutions that will bring advantage to all those who will be affected,
- deciding on the actions which will be taken and who, in accordance with this contract, will take them and
- deciding which risks have now been avoided or have passed and can be removed from the Risk Register.

16.4 The Project Manager revises the Risk Register to record the decisions made at each risk reduction meeting and issues the revised Risk Register to the Contractor. If a decision needs a change to the Works Information, the Project Manager instructs the change at the same time as he issues the revised Risk Register.

The Contractor's main responsibilities

21 The Contractor's design

21.1 The Contractor designs the parts of the works which the Works Information states he is to design.

21.2 The Contractor submits the particulars of his design as the Works Information requires to the Project manager for acceptance. A reason for not accepting the Contractor's design is that it does not comply with either the Works Information or the applicable law.

22 Using the contractor's design

22.1 The Employer may use and copy the Contractor's design for any purpose connected with construction, use, alteration or demolition of the works unless otherwise stated in the Works Information and for the purposes as stated in the Works Information.

27 Other responsibilities

27.1 The Contractor obtains approval of his design from Others where necessary.

Time

31 The programme

31.2 The Contractor shows on each programme which he submits for acceptance

- the starting date, access dates, Key Dates and Completion Dates,
- planned Completion,
- the order and timing of the operations which the Contractor plans to do in order to Provide the Works
- the order and timing of the work of the Employer and Others at last agreed with them by the Contractor or, if not so agreed, as stated in the Works Information,
- the dates when the Contractor plans to meet each Condition stated for the Key Dates and to complete other work needed to allow the Employer and Others to do their work,
- provisions for
 - float,
 - time risk allowances,
 - health and safety requirements and
 - the procedures set out in this contract,
- the dates when, in order to Provide the Works in accordance with his programme, the Contractor will need
 - access to a part of the Site if later than its access date,
 - acceptances
 - Plant and Materials and other things to be provided by the Employer and
 - Information from Others,
- for each operation, a statement of how the Contractor plans to do the work identifying the principal Equipment and other resources which he plans to use and
- other information which the Works Information requires the Contractor to show on a programme submitted for acceptance.

31.3 Within two weeks of the Contractor submitting a programme to him for acceptance, the Project Manager either accepts the programme or notifies the Contractor of his reasons for not accepting it. A reason for not accepting a programme is that

- the Contractor's plans which it shows are not practicable,
- it does not show the information which this contract requires
- it does not represent the Contractor's plans realistically or
- it does not comply with the Works Information.

32 Revising the Programme

32.1 The Contractor shows on each revised programme

- the actual progress achieved on each operation and its effect upon the timing of the remaining of the work,
- the effects of implemented compensation events,
- how the Contractor plans to deal with any delays and to correct notified Defects and
- any other changes which the Contractor proposes to make to the Accepted Programme.

32.2 The Contractor submits a revised programme to the Project Manager for acceptance

- within the period for reply after the Project Manager has instructed him to,
- when the Contractor chooses to and, in any case,
- at no longer interval than the interval than the interval stated in the Contract Data from the starting date until Completion of the whole of the works.

Payment

50 Assessing the amount due

50.3 If no programme is identified in the Contract Data, one quarter of the Price for Work Done to Date is retained in assessment of the amount due until the Contractor has submitted a first programme to the Project Manager for acceptance showing the information which this contract requires.

Compensation events

61 Notifying compensation events

61.4 If the Project Manager decides that an event notified by the contractor

- arises from a fault of the Contractor,
- has not happened and is not expected to happen,
- has no effect upon Defined Cost, Completion or meeting a Key Date or
- is not one of the compensation events stated in this contract

he notifies the Contractor of his decision that the Prices, the Completion Date and the Key Dates are not to be changed. If the Project Manager decides otherwise, he notifies the Contractor accordingly and instructs him to submit quotations.

The Project Manager notifies his decision to the Contractor and, if his decision is that the Prices, the Completion Date or the Key Dates are to be changed, instructs him to submit quotations before the end of either

- one week after the Contractor's notification or
- a longer period to which the Contractor has agreed.

If the Project Manager does not notify his decision, the Contractor may notify the Project Manager of his failure. A failure by the Project Manager to reply within two weeks of this notification is treated as acceptance by the Project Manager that the event is a compensation event and an instruction to submit quotations.

61.6 If the Project Manager decides that the effects of a compensation event are too uncertain to be forecast reasonably, he states assumptions about the event in his instruction to the Contractor to submit quotations. Assessment of the event is based on these assumptions. If any of them is later found to have been wrong, the Project Manager notifies a correction.

62 Quotations for compensation events

62.3 The Contractor submits quotations within three weeks of being instructed to do so by the project manager. The project manager replies within two weeks of the submission. His reply is

- an instruction to submit a revised quotation,
- an acceptance of a quotation,
- a notification that a proposed instruction will not be given or a proposed changed decision will not be made or
- a notification that he will be making his own assessment.

63 Assessing compensation events

63.1 The changes to the Prices are assessed as the effect of the compensation event upon

- the actual Defined Cost of the work already done
- the forecast of the work not yet done
- the resulting Fee.

63.2 If the effect of a compensation event is to reduce the total Defined Cost, the Prices are not reduced except as stated in this contract.

63.3 A delay to the Completion Date is assessed as the length of time that, due to the compensation event, planned Completion is later than planned Completion as shown on the Accepted Programme. A delay to a Key Date is assessed as the length of time that, due to the compensation event, the planned date when the Condition stated for a Key Date will be met is later than the date shown on the Accepted Programme.

63.6 Assessment of the effect of a compensation event includes risk allowances for cost and time for matters which have a significant chance of occurring and are at the Contractor's risk under the contract.

63.7 Assessments are based upon assumptions that the Contractor reacts competently and promptly to the compensation event, that any Defined Cost and time due to the event are reasonably incurred and that the Accepted Programme can be changed.

64 The Project Manager's assessment

64.1 The Project Manager assesses a compensation event

- if the Contractor has not submitted a quotation and details of his assessment within the time allowed,
- if the Project Manager decides that the Contractor has not assessed the compensation event correctly in a quotation and he does not instruct the Contractor to submit a revised quotation,
- if, when the Contractor submits quotations for a compensation event, he has not submitted a programme or alterations to a programme which this contract requires him to submit or
- if, when the Contractor submits quotations for a compensation event, the Project Manager has not accepted the Contractor's latest programme for one of the reasons stated in this contract.

65 Implementing compensation events

65.1 A compensation event is implemented when

- the Project Manager notifies his acceptance of the Contractor's quotation, the Project Manager notifies the Contractor of his own assessment or a Contractor's quotation is treated as having been accepted by the Project Manager.

65.2 The assessment of a compensation event is not revised if a forecast upon which it is based is shown by later recorded information to have been wrong.

Option X12: PartneringX12.1 Identified and defined terms

(5) A Key Performance Indicator is an aspect of performance for which a target is stated in the Schedule of Partners.

X12.2 Actions

(1) Each Partner works with the other Partners to achieve the Client's objective stated in the Contract Data and the objectives of every other Partner stated in the Schedule of Partners.

X12.3 Working together

(1) The Partners work together as stated in the Partnering Information and in a spirit of mutual trust and co-operation.

(2) A Partner may ask another Partner to provide information which he needs to carry out the work in his Own Contract and the other Partner provides it.

(3) Each Partner gives an early warning to the other Partners when he becomes aware of any matter that could affect the achievement of another Partner's objectives stated in the Schedule of Partners.

X12.4 Incentives

(1) A Partner is paid the amount stated in the Schedule of Partners if the target stated for a Key Performance Indicator is improved upon or achieved. Payment of the amount is due when the target has been improved upon or achieved and is made part of the amount due in the Partner's Own Contract.

(2) The Client may add a Key Performance Indicator and associated payment to the Schedule of Partners but may not delete or reduce payment stated in the Schedule of Partners.

Option W1: Dispute resolution

W1.3 The adjudication

(5) The Adjudicator may

- review and revise any action or inaction of the Project Manager or Supervisor related to the dispute and alter a quotation which has been treated as having been accepted,
- take the initiative in ascertaining the facts and the law related to the dispute,
- instruct a Party to provide further information related to the dispute within a stated time and
- instruct a Party to take any other action which he considers necessary to reach his decision and to do so within the stated time.

G.2 Contract clauses UAV-GC 2005

The discussed sub-clauses of the UAV-GC 2005 are subsequently presented within their chapter and main clause. All mentioned clauses are cited from the UAV-GC 2005 (UAV-GC, 2005).

Chapter 2 General obligations of the parties

Clause 4 Obligations of the Contractor

4-7 The Contractor shall warn the Employer in writing without delay if:

- (a) the Employer's Requirements; or
- (b) the annexes to the Employer's Requirements; or
- (c) the Agreement; or
- (d) information provided to the Contractor by the Employer pursuant to clause 3 section 1 subsection c; or
- (e) the land and/or the water put at the Contractor's disposal by the Employer pursuant to clause 3 section 1 subsection b; or
- (f) goods put at the Contractor's disposal by the Employer pursuant to clause 3 section 1

subsection c; or

(g) any measure taken by the Employer pursuant to clause 43 sections 1 and 2; or

(h) any Variations ordered by the Employer to the Contractor pursuant to clause 14 section 1; evidently contain or show such fails or defects that the Contractor would be in breach of the requirements of good faith if he were to continue Work without issuing any warning about such faults or defects.

4-8 If the Contractor fails to perform his obligation referred to in section 7, he shall be liable for any damaging consequences caused by his failure.

Chapter 4 Programme and co-ordination

Clause 7 Programme

7-1 When performing the Contract, the Contractor shall observe both the programme stated in an annex to the Employer's Requirements as well as the agreed milestone dates.

7-2 If and in so far as this is stated in the acknowledgement plan, the Contractor shall submit a detailed programme based on the programme to the Employer for Acknowledgement. The detailed programme shall relate to the period of time stated in the acknowledgement plan. The provisions of clause 23 apply.

7-3 The Contractor shall update the detailed programme as often as stated in the acknowledgement plan. The provisions of section 2 shall apply.

Chapter 7 Variations, suspension, dissolution, termination

Clause 14 Variations order by the Employer

14-6 The Contractor shall not be under an obligation to carry out a variation ordered by the Employer if:

- (a) the Variation is not ordered in writing; or
- (b) carrying out the Variation results in an unacceptable disruption of Work, according to good faith; or
- (c) carrying out Variation results in the Contractor being forced to carry out Work beyond his technical know-how and/or capacity; or
- (d) carrying out the Variation is unacceptable to the Contractor, according to good faith, given the mutual interests of the parties.

14-9 If the Employer is of the opinion that the Contractor wrongly refuses to carry out the Variation, he shall notify the Contractor accordingly in writing with all due despatch after receipt of the notification as referred in section 7. In that case, the parties shall consult without delay in order to overcome the deadlock. During the consultation, the parties shall make an inventory of the financial consequences as well as of the consequences for the programme if the Variation were to be carried out.

Chapter 9 Quality assuranceClause 19 Quality control and quality plan

19-1 Subject to all other provisions of the Contract, the Contractor shall be responsible for both the quality control of all Work and the quality of the results of Work and of Documents.

19-2 Is and in so far as this is stated in the acknowledgement plan, the contractor shall submit a quality plan as well as any quality subplans to the Employer for Acknowledgement. The provisions of clause 23 shall apply.

Clause 21 Testing Construction Work and Maintenance Work

21-2 The Contractor shall submit a Construction Work inspection plan and a Maintenance Work inspection plan to the Employer for Acknowledgement, if and in so far as this is stated in the acknowledgement plan. The provisions of clause 23 apply.

21-3 Following the execution of an inspection provided for in a inspection plan, the Contractor shall inform the Employer in writing of the results thereof with all due despatch, unless the parties after consultation have agreed upon a certain period of time. In doing so, the Contractor shall:

- (a) state which part of the Construction or Maintenance Work has been inspected, referring to the relevant inspection plan;
- (b) name the person who performed the inspection;
- (c) state the date and time of the inspection; and
- (d) state whether the result of the inspection satisfies the requirements set for the Construction or Maintenance Work pursuant to the contract.

Chapter 17 Cost compensation, extension of time, procedure for settling consequences of Variations by the EmployerClause 44 Cost compensation and/or extension of time

44-1 Subject to the provisions of clause 45, the Contractor shall be entitled to cost compensation and/or extension of time only if:

- (a) these UAV-GC 2005 expressly provide for such cost compensation and/or extension and on the condition that the costs and/or delay are caused by a circumstance that cannot be attributed to the Contractor; or
- (b) the costs and/or delay are caused by a circumstance for which the Employer is responsible pursuant to the Contract against which the Contractor did not have to warn given his obligation referred to in clause 4 section 7; or
- (c) an unforeseen circumstance arises the nature of which is such that, according to the standards of good faith, the Employer cannot expect the Contract to be unaltered.

44-5 The Contractor shall notify the Employer in writing with all due despatch, stating the reasons, to what extent he believes to be entitled to cost compensation and/or extension of time.

This notification shall also state all direct and indirect costs, as well as a reasonable surcharge for general expenses, profit and risk. In addition, he shall specify the programme stated in an annex to the Employer's Requirements, the agreed milestone dates and the date of completion and acceptance stated in the Agreement.

Clause 45 Procedure for settling consequences of Variations ordered by the Employer

45-2 Once he notifies the Employer that he will carry out the variation or once he is under an obligation to do so given the provisions of clause 14 section 7 or section 14, the Contractor shall send the Employer a written quotation with all due dispatch, stating:

- (a) the balance, comprising all direct and indirect costs, as well as a reasonable surcharge for general expenses, profit and risk, related to the execution of the Variation, less the amount by which the price stated in the Agreement can be reduced as a result of the execution of the Variation; and
- (b) the adjustment of the programme stated in the annex to the Employer's Requirements, the agreed milestone dates and the date of completion and acceptance stated in the Agreement, based on a calculation of the time needed for the execution of the Variation; and
- (c) the adjustment of the payment schedule.

Appendix H

Summary Tables South African Expert Interviews

TABLE H.1: South African expert interview findings summary table1

		Hannes Marais	Jan van Rensburg
1. Current contractual problems?	The traditional approach, such as GCC, doesn't lead to value for money. The GCC is set-up to call for conflict through the claims procedures. The GCC is unfair towards the contractors on the valuation of variation orders.	Integrate the works information with the construction contract. Over specifying by adding additional conditions of contract. A general lack of knowledge about construction contracts.	
2. Is the NEC broadly adopted?	No, industry wide the NEC is not broadly adopted. Some larger clients have adopted the NEC. But often the NEC is still not implemented in the right NEC philosophy. Activity schedule and/or target contract options are often still out of reach.	No, the NEC is not broadly adopted, certainly not in government. The NEC introduction can be seen as difficult. Eskom is however the world biggest NEC user.	
3. What are the experiences with the NEC?	Contractors often don't like it because of unfamiliarity and extra administration. The contractor has to change its tender game when a BoQ is not used. Consultants often don't like it because it is difficult to learn something new. Eskom is a big user that is positive about the NEC. NEC leads to better project outcomes.	Migrating to the NEC is quite easy and goes quick. Based on the few amendments in the NEC3 it is a mature contract. The NEC is created by our legal department and found to be legally sound for SA. Architects, contractors, professionals and consultants are resistant. Engineers least resistant because of better understanding contracts. When understanding arises the benefits become clear and NEC gets accepted. NEC leads to better project outcomes.	
4. Should the NEC be broader adopted?	Yes and also a correct implementation would be an improvement.	Yes	
5. What are the advantages of the NEC?	The NEC is modern by applying project management principles. It prevents conflict through the early warning and compensation events systems. It is highly flexible and can be used in virtually every project type. The employer is in a well-protected environment under the NEC. The NEC forces a proper execution of programme and risk management. It prevents conflicts and disputes, they are resolved before it becomes one.	The employer is better protected by the use of the compensation events. It is simple and easy and therefore creates a better understanding. Conducive to devising a better contract document with a better and clearer split in the presentation of contract information. The NEC is incredibly flexible and suitable for every project type. The NEC is very clear and without ambiguity. It creates more communication and openness between the parties. It prevents problems and disputes because it compels good sound PM. The NEC cuts very evenly both ways and is not prejudicial towards a party. Forces co-operation and prevents adversarial relationships.	
6. What are the disadvantages of the NEC?	It creates a higher administrative burden but is outweighed by the benefits. No real disadvantages.	Migrating with the programme as such an inherent tool is very beneficial. It creates a higher administrative burden but this is outweighed by the benefits. No real disadvantages.	
7. Critical barriers for NEC implementation?	Lack of knowledge about the NEC and therefore not convinced of benefits. Contractors don't understand the NEC. The included project management is for many contractors too advanced. Universities only teach the traditional contracts, such as GCC. NEC training courses are ineffective because they are too theoretical. The NEC misses case law in SA and is therefore unknown to be effective.	AOS is still more comfortable with a BoQ. Lack of in-house skills at government to control and administer Option C. High administrative burden while running a project. Lack of market penetration. Resistance from the decisive people in charge to jump the cliff with the NEC. Lack of knowledge about the NEC. Ineffective theoretical training courses by lawyers. Terminology and procedures very different and needs a change in mind-set.	
8. Required success factors for NEC implementation?	The NEC requires the client to be involved in the project. NEC case study outcomes must be shared so possible advantages become clear. Effective and practical NEC training is needed to understand the benefits. People must dare to question tradition.	It takes practical training courses what to achieve with the contract. Present the contractors with training courses on NEC throughout project. Don't amend any clauses. Make peace with more labour intensive administration and see benefits. A broader adoption will only be achieved through use and experience benefits. It has to be pushed by experienced and knowledgeable persons as the promoter. One step at a time, before immediately using a activity schedule and target contract.	

TABLE H.3: South African expert interview findings summary table3

	Andrew Murray	Pierre Stony
1. Current contractual problems?	The industry is currently adversarial in its principal-agent relationship. Problems are not dealt with promptly and have a long aftermath. Especially architects are often not good with contracts.	Most of the smaller contractors are not well versed in contracts and PM. Lack in understanding of the contracts and its differences. The GCC is complex, difficult, not clear and contains many irrelevant aspects. The GCC makes contracting practices unnecessarily difficult. Adding conditions for eventualities has become a ineffective custom in SA. The GCC often escalates to complex and long lasting conflicts.
2. Is the NEC broadly adopted?	Parastatals and some governmental bodies already use the NEC. There are definitely many NEC projects to find. However, the adoption of the NEC could be much better. The NEC is more often used in civil projects than in building projects.	Not broadly adopted, especially in the smaller projects and at the contractors. Probably not many consultants advising the NEC. Probably the NEC is broader adopted in the bigger projects. Target contracts and activity schedules are still completely unknown for many. As soon as the contractor knows the NEC it is positive of the use it. NEC leads to better project outcomes.
3. What are the experiences with the NEC?	We as contractor are very positive about the NEC. Especially on the leads to better project outcomes. Architects don't want to change the contract of use. NEC leads to better project outcomes.	NEC leads to better project outcomes.
4. Should the NEC be broader adopted?	Yes	Yes, because most of the contracting gets done in the smaller projects. The simplicity benefits the understanding of the contract by smaller contractors. Procedures are simply regulated and documented and well mapped out. Promotes co-operation by prompt problem resolution by required risk meetings. It leads to fewer claims and are easier dealt with on a lower management level. Easy to use, clearly written in simple and short sentences and covers everything. Contractors get forced to execute proper project management. People are aware of risk allocations and responsibilities because of the clarity.
5. What are the advantages of the NEC?	The NEC is simple, clear, easy to understand and logical to follow. The NEC gets things done more effectively. It helps to build a partnership in which you work as a team. Clear responsibilities and required prompt actions prevent conflicts and delays. The NEC is fair to all parties. Early warnings and risk meetings deal with problems promptly and much quicker. Compensation events are dealt with quicker and don't have a long aftermath. Better control over project finances and its performances. The final account can be settled with the NEC much quicker. With the NEC profit is not higher but more certain and better guaranteed. The NEC leads to more satisfied client.	No real disadvantages. It creates a higher administrative burden but this is outweighed by the benefits. The NEC documentation is relatively expensive to buy.
6. What are the disadvantages of the NEC?	No real disadvantages. It creates a higher administrative burden but this is outweighed by the benefits. Contractor's accounting system must be up-to-date and accurate for option C, otherwise it is the contractor's risk of losing/reimbursement and thus money.	The NEC is unknown.
7. Critical barriers for NEC implementation?	Contractors price for their lack of knowledge about the NEC or even withdraw. There is a resistance to change but people stay in their familiar comfort zone. SAICE would be a player to advise the NEC but publishes the GCC already.	People don't take time to find out about the NEC. Client bodies have in-house procedures/standard documentation around GCC. The used standard documentation by clients is already legally tested in disputes. Employers prefer to stay in their familiar comfort zone.
8. Required success factors for NEC implementation?	With a target contract the client must have a complete set of tender documents. The understanding of the application is very important when using the NEC. The employer should have a pre-tender meeting to explain the NEC. The success of a NEC project depends on trust and the attitudes of the parties. The focus should lie in advertising and educating the NEC. NEC benefits and experiences must be shared among the industry. The availability of a sort of NEC-helpdesk for quick answers would be useful. The Department of Public Works would be a big client body to push the NEC use.	Many smaller clients rely on consultants advice, should advise NEC more often. People should read available more NEC info to get familiar with experiences. Employer should base the NEC use and option on procurement strategy. Experiences from industry must share experiences on seminars more often. SAICE should be the NEC promoter but they will push their GCC instead. Z-clauses should be kept to a minimum for a successful implementation, if something doesn't fit in the NEC there is simply no place for it. People must adapt to the NEC philosophy and not try to use it in a GCC way.

TABLE H.4: South African expert interview findings summary table4

	Hibert van Zandvoort
1. Current contractual problems?	Shortage of skilled engineers in SA, leads to high workload. Lack of skills at employers. Lack of sufficient English proficiency in industry for contracting practices. Lacking knowledge transfer in industry, under-representation of middle-aged. Lacking project management level in the industry.
2. Is the NEC broadly adopted?	The NEC is not broadly adopted. Innovations from western countries often take longer to penetrate into SA. Adoption is starting to pick up now. Eskom is a big user of the NEC.
3. What are the experiences with the NEC?	As soon as people get involved with the NEC they are positive about it. NEC perfectly applicable to South Africa. We as consultants are positive about the NEC. As a big NEC user, many Eskom employees don't understand the NEC well. Eskom still has unsuccessful NEC projects, but this is more effected by persons.
4. Should the NEC be broader adopted?	Yes, it is unquestionably the future.
5. What are the advantages of the NEC?	The simplicity of the NEC leads to easiness to learn and proper understanding. The forced PM requirements are a good solution for the PM problems in SA.
6. What are the disadvantages of the NEC?	No real disadvantages.
7. Critical barriers for NEC implementation?	Employees are educated with the South African contracts, NEC is unknown. NEC use often dependent of the decision of a single decisive person. No time to learn a new contract because of high workload. Limited knowledge transfer and sharing in SA. Over-representation of older employees, they quicker decline a NEC use. The national civil institution, SAICE, has no interest in adopting the NEC. Some clients prefer to keep a certain amount of grey area in the contract. The clarity of the compensation events can scare some employers. NEC trainings are expensive, you don't easily send a whole department to it.
8. Required success factors for NEC implementation?	Client must avoid to amend or add things to the NEC in his favour. English proficiency is important to prevent wrong assumptions. The NEC must become part of the universities' programmes. Existence of university department that researches construction contracts. Affordable training courses for companies. More presentations needed to promote NEC in SA and at companies. Online training course to train people on the NEC would be useful. Independent institute should research the difference between the contracts. NEC investments are earned back on macro level because of high capital waste. Government should push the NEC.

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