



Monitoring Performance Information

Improving the effectiveness of the Best Value tender process

MSc Thesis report, Nick Hoving, Enschede July 2017

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Preface

This report is the final result of my thesis research as part of the master's degree Construction Management and Engineering at University of Twente. During the past nine months I worked eagerly and with great pleasure on this research.

It was during the courses of my master's that I first encountered the Best Value (BV) approach. This different view on the procurement and execution of construction projects immediately sparked my interest. Inspired by this new approach, I felt the desire to contribute to the application of Best Value to the Dutch construction industry and at the same time expand my knowledge, skills, and expertise in this field.

In this light I came into contact with BAM Infraconsult bv (hereinafter referred to as BAM), who provided the opportunity to perform research on the application of the BV approach to tenders. BAM pursues to expand its knowledge concerning the application of the BV approach in relation to the monitoring of performance information, which is a perfect master's thesis research subject.

I could not have performed this research without a lot of people. First of all, I would like to thank the members of my graduation committee. Hans Boes and Hans Voordijk, for their guidance, constructive feedback, and insights in practical research matters throughout the entire project. Frank Zoeter, for providing me with the unique opportunity to perform this research within the Tender Strategy department of BAM, for challenging me to be critical of my own work, and for always seeing a link between my research and BAM's corporate strategy. And Karel Sormani, for his continuous constructive feedback, enthusiasm, and for providing me with the opportunity to experience and participate in current tenders. I also want to thank all Tender Strategists for the nice working environment and for letting me be part of their team.

I want to thank all interviewees. Without their input the research could not have been so interesting. I also want to thank the several experts I approached, for willingly providing insight into their expertise and for enthusiastically supporting me in shaping and developing the performance measurement processes.

Many others have contributed to this thesis by either discussions on the topic or reading and commenting on parts of the thesis. From this position I would like to thank everyone who enabled and facilitated me to conduct this research and who provided contributions in any form.

Enjoy reading!

Nick Hoving
Enschede, July 2017

Executive summary

The Dutch construction industry is a project-based sector, due to the uniqueness of every construction location and the differences in preferences and demands by clients. This results in new construction projects being started from scratch, instead of utilizing lessons learnt from previous projects. Construction firms are aware of the latter, however to achieve the effects of these scalable learning efforts **they should further develop insight into their performances.**

A trend that is observed in the sector is the shift from a financial focus to a combined focus on financial and non-financial aspects of projects. This trend found its way into the Dutch procurement sector, which led to the introduction of new procurement methods in which both price and quality are evaluated: Most Economically Advantageous Tender (MEAT) procedures. In order to successfully give substance to quality in tender plans, construction firms should have insight in the quality they can deliver. **This again stresses the importance of having knowledge of the firm's performances.**

A particular paradigm that is gaining ground as a MEAT procurement strategy is the Best Value (BV) approach, also known as Best Value Procurement (BVP). Contrary to other MEAT procedures, which mainly focus on tender plans that offer value outside of the project scope, **the BV approach uses performance claims supported by verifiable performance information (VPI) to select the supplier which offers the best value within the project scope for the lowest price.**

Due to the focus on solely financial performance in the recent past, construction firms experience two problems in BV tenders:

1. Contractors have to derive performance measures and produce VPI from the client's strategy for the project, instead of their own corporate strategy. This means that contractors have to rely on their ability to understand all factors that contributed to the development of the clients' strategy.
2. Due to the short duration of the BV tender phase (approximately 8 weeks), contractors having a limited time frame to find all the VPI they require to support performance claims. This VPI should therefore originate from past projects. If the contractor starts thinking about what VPI they should monitor at the start of the tender, the VPI is not available on time.

In order to solve these two problems, **contractors should always have insight in how they perform on the themes that are of importance to their clients.** When this is clear, the contractor is able to develop performance measures and produce VPI which are aligned with the client's strategy and are available on time. This leads to the following research question:

'What non-financial verifiable performance information should be monitored, and how should this be conducted by BAM, in order to improve the effectiveness of the Best Value tender process?'

In order to answer this question, **a performance measurement framework for non-financial verifiable performance information is developed.** This framework is tailored to the requirements of BAM and to the demands and wishes of BAM's clients. In order to develop this framework, the research is divided into four phases.

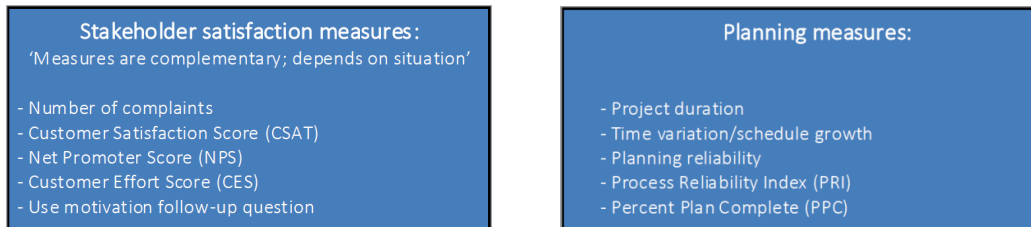
Phase 1: The client's perspective

In this phase the most frequently used project goals as defined by clients in their tender documentation for BV projects are categorized and analyzed. The aim is **to incorporate the client's perspective on what VPI is important to monitor in the research.** First, the project goals of 21 BV projects are categorized into VPI themes. The two themes which create the most value for BAM are selected and will be the focus of the rest of the research. These two themes are selected based on three criteria: 1. how often a VPI theme is mentioned in the total set of investigated project goals 2. in how many of the 21 projects a certain VPI theme is mentioned 3. the current availability of data.

The application of these criteria to the VPI theme sample **results in the selection of two themes: ‘stakeholder satisfaction’ and ‘planning.’**

Phase 2: The theoretical perspective

In this phase the theoretical perspective on performance measurement in general, the measurement of the two selected VPI themes, and the relationship between project goals and performance measures is established. First, **the characteristics of performance measures are explored.** These include: qualitative vs. quantitative data, data collection methods, simplicity of the measures, periodic measurements, generic company-wide data vs. project specific data, leading and lagging measures, benchmarking, and the verifiability of the data. Thereafter, **literature concerning the measurement of the two selected VPI themes is consulted.** This results in a list of measures for both themes which are adopted for use in this research, see the figures below.



Lastly, **the relationship between project goals and performance measures is explored.** Due to the short duration of a BV tender, contractors have a limited time frame to translate the client's project goals into VPI that is usable in their tender plans. Existing research on this topic does not offer suggestions or solutions which are helpful in the case of the BV approach. Approaching the relationship from the project goal side results in ad hoc and unorganized collection of VPI in BV tenders. Therefore, **it is important for contractors to keep striving for a database of VPI,** which corresponds with the clients' wishes and demands and is readily available for use in BV tenders.

All findings of this phase shape the theoretical framework of this research.

Phase 3: The empirical perspective

In this phase BAM's use of VPI in BV tenders is investigated and tested to the theoretical framework with the use of a multiple case study. The aim of this phase is **to discover improvement areas, by analyzing the differences and similarities between BAM's current practice in BV tenders and theory.** To conduct this, an embedded multiple case study design is adopted and five cases are selected. For each case a procedure is followed, which consists of following data collection methods:

1. Project documentation study into the documents that are used by the contractor to support and provide evidence to the VPI in their tender plans. The information in these documents is tested to the theoretical frame. This allows to establish the objective quality of the VPI in each case.
2. Interviews with two tender strategists that were involved with the case. The interviews aim to acquire insight in the maturity of the VPI as perceived by the interviewees during the tender.

The data that is collected by using these two methods is analyzed using a within-case analysis and a cross-case analysis. The former provides insight into the objective quality of the VPI (depicted as the amount of theoretical subjects that are similar to the theoretical framework, relative to the total amount of subjects) and the match between the objective quality and the perceived maturity in each case, which are shown in the tables below.

Case	Quality planning	Quality stakeholder satisfaction	Case	Quality vs. maturity
Tender 1	3/9	4/9	Tender 1	Match
Tender 2	3/9	4/9	Tender 2	Match
Tender 3	5/9	6/9	Tender 3	No match
Tender 4	2/9	6/9	Tender 4	Match
Tender 5	3/9	2/9	Tender 5	Match
Average	3.2/9	4.4/9		

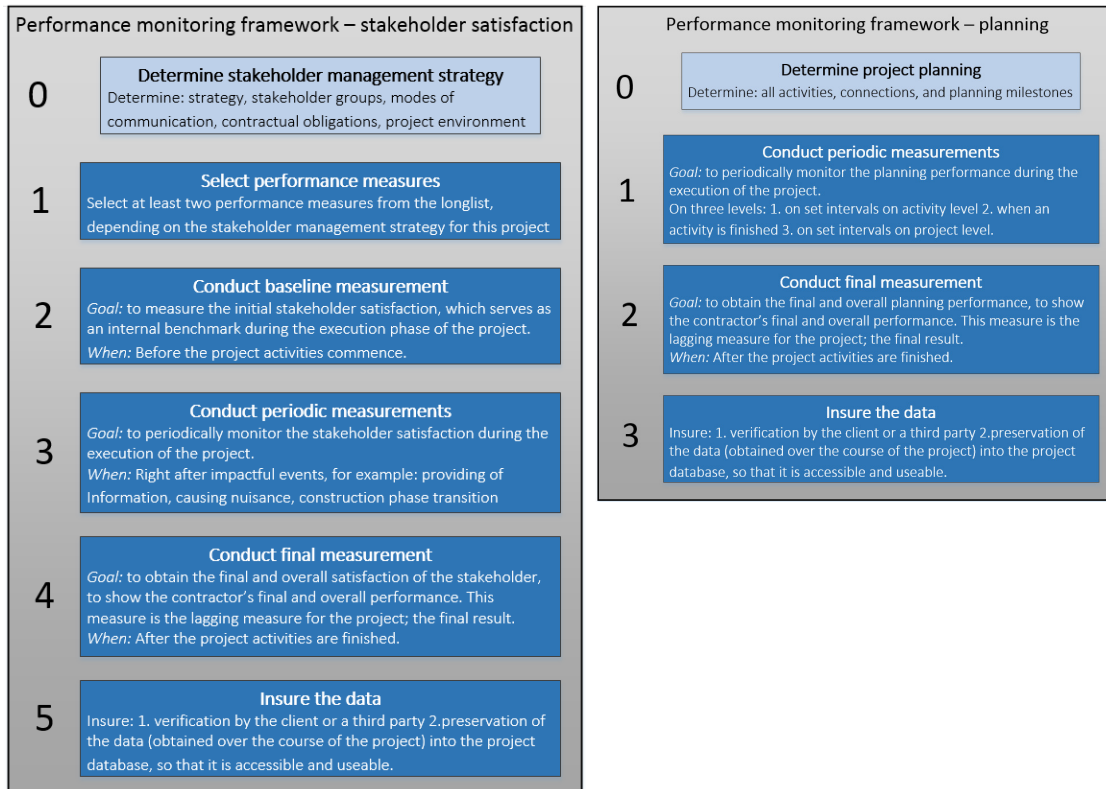
Thereafter, the results of the individual cases are compared using the cross-case analysis. **This results in empirical patterns in the data, which are used to determine the current state of BAM's practice in BV tenders.** Three areas are defined: improvement areas (these aspects are not correctly conducted and should be improved), irregular performing areas (these aspects should be uniformly applied), and good performing areas (these aspects are correctly conducted and uniformly applied). The empirical patterns of the nine theoretical subjects and the a pattern concerning the types of evidence documents are assigned to one of the three areas. The results are shown in the figure below.

Improvement areas	Irregular performing areas	Good performing areas
Mix of generic & project specific VPI All cases show the use of only project specific VPI, instead of a mix of generic and project specific VPI	Multiple types of evidence Are irregularly used, while having a positive influence on the dominance of VPI	Built-in collection process All cases show the use of a VPI collection process that is built into BAM's business process
Mix of leading and lagging measures All cases show the use of just VPI that originates from lagging measures, instead of a mix of leading and lagging measures	Quantitative/objective data Is irregularly used, while having a positive influence on the dominance of VPI	Easily understandable VPI All cases show the use of VPI that can easily be understood by laymen
	Periodically monitored VPI Is irregularly used, while enabling to show performance improvements	
	Benchmarks Are irregularly used, while providing the needed context to VPI	
	Measures proposed in theory Are irregularly used, which results in a lower objective quality	
	Verified performances Data is irregularly verified, which results in questionable performances	

Phase 4: Designing the performance measurement framework

In this phase **the performance measurement framework is designed based on the findings and results of the research.** In order to design the framework, the regulative cycle is adopted as a design process. This is an iterative process that consists of the following four steps: 1. Problem investigation 2. Solution design 3. Solution validation 4. Solution implementation. The problem investigation is shaped by the theoretical and empirical perspectives of this research. The initial framework is designed based on this investigation, BAM's requirements, and a defined architecture (roadmap). Upon discussion with stakeholder management and planning experts, the framework is improved and validated. **The designed performance measurement framework consists of two measurement**

processes, one for the VPI theme stakeholder satisfaction and one for planning, which are shown below.



By designing the two performance measurement processes it is determined which VPI themes BAM should monitor and how this should be conducted. This answers the research question.

Recommendations

The practical recommendations of this research are:

- Ensure the development of an intrinsic motivation for performance measurement within BAM, instead of only being motivated because clients require contractors to measure performance.
- Periodically analyze the client's perspective on what performances are important.
- When developing performance measures, use the knowledge concerning the subjects as discussed in the theoretical framework of this research.
- Use multiple sources of evidence and supporting documents to support every single performance claim in tender plans. This improves the objective quality of the VPI.
- Implement the performance measurement framework as presented in this research into BAM's business process.
- Evaluate the implementation and effectiveness of the performance measurement framework and make adjustments to the framework based on the evaluation.
- Keep optimizing and adjusting the performance measurement framework to BAM's requirements, the client's perspective, and to changes in the construction industry.

The scientific recommendations for this research are:

- Replicate the research at other Dutch construction firms to improve external validity.
- Conduct research into the measurement of other VPI themes.
- Conduct research into the relationship between project goals and performance measures in the light of the BV approach.
- Develop knowledge concerning the use of generic vs. project specific VPI and the use of leading and lagging measures.

Managementsamenvatting

De Nederlandse bouwindustrie is projectmatige sector, doordat iedere bouwplaats uniek is en er een grote variatie bestaat in voorkeuren en eisen van opdrachtgevers. Hierin wordt steeds het wiel steeds opnieuw uitgevonden, in plaats van dat gebruik wordt gemaakt van kennis en expertise uit eerdere projecten. De aannemerij is zich bewust van het ‘over projecten heen leren’, maar om de schat aan kennis uit voorgaande projecten succesvol in te kunnen zetten zijn **aannemers erbij gebaat om inzicht te krijgen in hun prestaties**.

Een aanwezige trend in de sector is de verschuiving van een enkel financiële focus naar een gecombineerde focus op financiële en niet-financiële prestaties in bouwprojecten. Deze trend heeft zijn weg gevonden naar de inkoopsector, wat heeft geleid tot de invoering van nieuwe aanbestedingsmethodes waarbij zowel prijs als kwaliteit worden beoordeeld: Economisch Meest Voordelige Inschrijving (EMVI) procedures. Om deze vraag naar kwaliteit succesvol in te vullen in tenderplannen, zijn aannemers erbij gebaat om inzicht te hebben in de kwaliteit die zij kunnen leveren. **Dit benadrukt het belang van de aannemer om inzicht te krijgen in de niet-financiële prestaties**.

De Best Value (BV) aanpak (ook wel Best Value Procurement (BVP) genoemd) wordt steeds vaker toegepast als EMVI-procedure en in de beheersing van projecten. In tegenstelling tot andere EMVI-procedures, die voornamelijk gericht zijn op tenderplannen die waarde bieden buiten de projectscope, gebruikt de BV-aanpak prestatiebeweringen om de aannemer te selecteren die de meeste waarde biedt binnen de projectscope voor de laagste prijs. Deze beweringen worden ondersteund door verifieerbare prestatie informatie (VPI).

Doordat in het recente verleden de focus alleen op financiële prestaties lag, lopen aannemers tegen twee problemen aan in BV-aanbestedingen:

3. Aannemers moeten prestatie-indicatoren afleiden en VPI produceren op basis van de strategie van de opdrachtgever voor het project, in plaats van de eigen bedrijfsstrategie. Dit betekent dat aannemers zijn aangewezen op hun vermogen om alle factoren te begrijpen die hebben bijgedragen aan de ontwikkeling van de strategie van de opdrachtgever.
4. Vanwege de korte duur van de selectiefase bij een BV-tender (ongeveer 8 weken) hebben aannemers beperkt de tijd om alle benodigde VPI boven water te krijgen die nodig is om de prestatiebeweringen te onderbouwen. Deze VPI moet daarom afkomstig te zijn uit reeds uitgevoerde projecten. Als de aannemer pas aan het begin van een BV-tender begint na te denken over welke VPI verzameld moet worden, dan is de VPI niet op tijd beschikbaar.

Om deze twee problemen op te kunnen lossen, **zijn aannemers erbij gebaat om inzicht te hebben in hoe ze presteren op thema's die van belang zijn voor zijn opdrachtgevers**. Als dit duidelijk is kan de aannemer prestatie-indicatoren ontwikkelen en VPI produceren die is afgestemd op de strategie van de opdrachtgever én die op tijd beschikbaar is. Dit leidt tot de volgende onderzoeksvraag:

‘Welke niet-financiële verifieerbare prestatie informatie moet worden verzameld, en hoe moet BAM dit uit te voeren, zodat de effectiviteit van het Best Value tenderproces wordt verbeterd?’

Om deze vraag te kunnen beantwoorden, **wordt een prestatietetingskader voor niet-financiële prestatie informatie ontwikkeld**. Dit kader is afgestemd op de behoeftes van BAM en op eisen en wensen van BAMs opdrachtgevers. Om dit te ontwikkelen is het onderzoek verdeeld in vier fases.

Fase 1: Het opdrachtgeversperspectief

In deze fase zijn de meest voorkomende projectdoelstellingen, zoals gedefinieerd door de opdrachtgevers in de projectdocumentatie voor BV-tenders, gecategoriseerd en geanalyseerd. Het doel hiervan is om **het perspectief van de opdrachtgevers op welke VPI belangrijk is, te integreren in het onderzoek**. Als eerste zijn de projectdoelstellingen van 21 BV-projecten gecategoriseerd in VPI-thema's. De twee thema's die de meeste waarde hebben voor BAM zijn geselecteerd en

functioneren als de focus voor de rest van het onderzoek. Deze twee thema's zijn geselecteerd op basis van drie criteria: 1. Het aantal keer dat een VPI-thema wordt genoemd in de totale reeks van onderzochte projectdoelstelling, 2. Het aantal projecten waarin een bepaald VPI-thema wordt genoemd, en 3. De huidige beschikbaarheid van data binnen BAM voor een bepaald VPI-thema. Het toepassen van deze selectiecriteria op alle VPI-thema's **resulteert in selectie van de thema's 'omgevingstevredenheid' en 'planning'**.

Fase 2: Het theoretische perspectief

In deze fase wordt het theoretische perspectief op prestatie-indicatoren in het algemeen, de meting van de twee geselecteerde VPI-thema's, en de relatie tussen projectdoelstellingen en prestatie-indicatoren vastgesteld. Als eerste zijn **de kenmerken van prestatie-indicatoren onderzocht**. Deze omvatten: kwalitatieve versus kwantitatieve data, dataverzamelmethode, eenvoud van de indicatoren, periodieke metingen, generieke bedrijfsgegevens versus projectspecifieke data, leidende en volgende indicatoren, benchmarking, en verificatie van de data. Verder is **literatuur over het meten van de twee geselecteerde VPI-thema's geraadpleegd**. Dit resulteert in een lijst van indicatoren voor beide thema's die in dit onderzoek worden opgenomen, hieronder weergegeven.

Omgevingstevredenheid indicatoren:
'Indicatoren zijn aanvullend op elkaar; het is afhankelijk van de situatie welke indicatoren geschikt zijn'
- Aantal klachten
- Customer Satisfaction Score (CSAT)
- Net Promoter Score (NPS)
- Customer Effort Score (CES)
- Vraag door naar motivatie

Planning indicatoren:
- Projectduur
- Tijdvariatie/planningsgroei
- Planningsbetrouwbaarheid
- Process Reliability Index (PRI)
- Percent Plan Complete (PPC)

Ten slotte **is de relatie tussen de projectdoelstellingen en prestatie-indicatoren onderzocht**. Het benaderen van de relatie vanuit de projectdoelstellingen resulteert in een ad hoc en ongeorganiseerde verzameling van VPI. Daarom is het **belangrijk dat aannemers blijven streven naar het aanleggen van een database van VPI**, die overeenkomt met de wensen en eisen van de opdrachtgevers en die beschikbaar is voor gebruik tijdens BV-tenders.

Alle bevindingen en resultaten van deze fase vormen samen het theoretisch kader van dit onderzoek.

Fase 3: Het empirische perspectief

In deze fase is BAM's gebruik van VPI in BV-tenders onderzocht en vergeleken met het theoretisch kader met behulp van een meervoudige casestudy. Het doel van deze fase is om **verbeterkansen te ontdekken door de verschillen en overeenkomsten tussen de praktijk in BAM's BV-tenders en de theorie te ontdekken**. Dit is uitgevoerd met behulp van een onderzoeksontwerp waarin vijf cases zijn geselecteerd. Voor elke case wordt een procedure gevolgd die bestaat uit de volgende dataverzamelmethode:

3. Projectdocumentatiestudie naar de documenten die door de aannemer worden gebruikt om de VPI in de tenderplannen te ondersteunen en bewijzen. De informatie in deze documenten is vergeleken met de negen onderwerpen uit theoretisch kader. Op basis van deze vergelijking is de objectieve kwaliteit van de VPI voor elke case vastgesteld.
4. Interviews met de twee tenderstrategen die betrokken waren bij de case. Het doel van de interviews is om inzicht te krijgen in volwassenheid van de VPI, zoals waargenomen door de geïnterviewde tijdens de tender.

De data die is verzameld met deze twee methodes is geanalyseerd met behulp van een ‘within-case’ analyse en een ‘cross-case’ analyse. De eerste analyse geeft inzicht in de objectieve kwaliteit van de VPI (weergegeven als het aantal theoretische onderwerpen die overeenkomen met het theoretisch kader ten opzichte van het totale aantal onderwerpen) en de match tussen de objectieve kwaliteit en de waargenomen volwassenheid van iedere individuele case. Deze resultaten zijn weergegeven in de onderstaande tabellen.

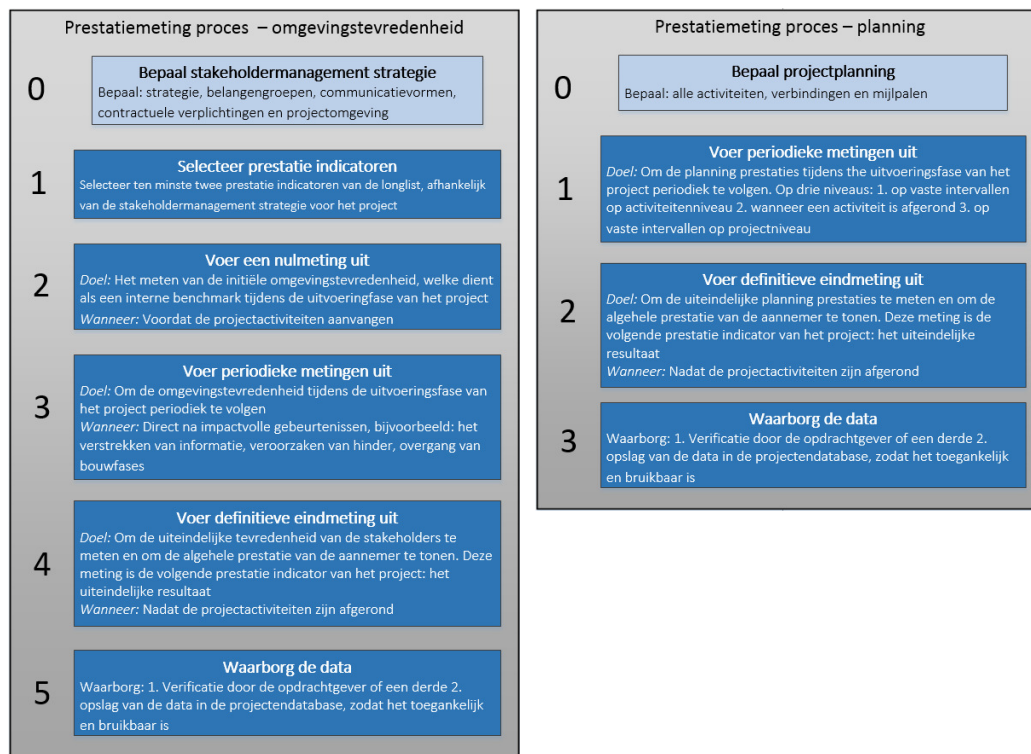
Case	Kwaliteit planning	Kwaliteit omgevingstevredenheid	Case	Kwaliteit vs. volwassenheid
Tender 1	3/9	4/9	Tender 1	Match
Tender 2	3/9	4/9	Tender 2	Match
Tender 3	5/9	6/9	Tender 3	Geen match
Tender 4	2/9	6/9	Tender 4	Match
Tender 5	3/9	2/9	Tender 5	Match
Gemiddeld	3.2/9	4.4/9		

Vervolgens zijn de resultaten van de individuele cases vergeleken met behulp van de ‘cross-case’ analyse. **Dit resulteert in empirische patronen in de data die zijn gebruikt om de huidige stand van zaken van BAMs activiteiten in BV-tenders te bepalen.** Deze patronen zijn ingedeeld in drie verschillende gebieden: verbeterkansen (deze aspecten worden niet correct uitgevoerd en moeten worden verbeterd), onregelmatige prestaties (deze aspecten dienen uniform te worden toegepast) en goede prestaties (deze aspecten worden correct uitgevoerd en uniform toegepast). De empirische patronen van de negen theoretische onderwerpen en het patroon betreffende het gebruik van meerdere soorten bewijsdocumenten zijn toegewezen aan één van deze drie gebieden, zie onderstaand figuur.

Verbeterkansen	Onregelmatige prestaties	Goede prestaties
Mix van generieke & project specifieke VPI Alle cases tonen het gebruik van enkel project specifieke VPI, in plaats van een mix van generieke en project specifieke VPI	Meerdere soorten bewijs Wordt onregelmatig gebruikt, terwijl het een positieve invloed op de dominantie van de VPI heeft	Ingebouwde datacollectie Alle cases tonen het gebruik van een datacollectie proces dat is ingebouwd in BAM's bedrijfsproces
Mix van leidende en volgende indicatoren Alle cases tonen het gebruik van enkel VPI die afkomstig is van volgende indicatoren, in plaats van een mix van leidende en volgende indicatoren	Kwantitatieve/objectieve data Wordt onregelmatig gebruikt, terwijl het een positieve invloed op de dominantie van de VPI heeft	Eenvoudig begrijpbare VPI Alle cases tonen het gebruik VPI die gemakkelijk te begrijpen is voor leken
	Periodiek gemeten VPI Wordt onregelmatig gebruikt, terwijl verbeteringen van prestaties hierdoor zichtbaar worden	
	Benchmarks Wordt onregelmatig gebruikt, terwijl het de VPI van context voorziet	
	Indicatoren uit de theorie Wordt onregelmatig gebruikt, wat resulteert in een lagere objectieve kwaliteit van de VPI	
	Geverifieerde prestaties Data wordt onregelmatig geverifieerd, wat resulteert in twijfelachtige prestaties	

Fase 4: Ontwerp van het prestatietmetingskader

In deze fase is het prestatietmetingskader ontworpen op basis van de bevindingen en resultaten van het onderzoek. Om het kader te ontwerpen is de 'regulative cycle' opgenomen als ontwerpproces. Dit is een iteratief proces dat bestaat uit de volgende vier stappen: 1. Probleemonderzoek, 2. Oplossingsontwerp, 3. Oplossingsvalidatie, en 4. oplossingsimplementatie. De eerste stap, de probleemonderzoek stap, wordt gevormd door de theoretische en empirische perspectieven van dit onderzoek. In de tweede stap is het initiële prestatietmetingskader ontworpen op basis van het probleemonderzoek, de behoeftes van BAM en een gedefinieerde architectuur (stappenplan). Na discussie met omgevingsmanagement en planning experts is het prestatietmetingskader verbeterd en gevalideerd, waarmee de derde stap is voltooid. **Het ontworpen prestatietmetingskader bestaat uit twee meetprocessen**, één voor omgevingstevredenheid en een voor planning. Voor de vierde stap, de implementatie, is aangegeven waar in BAMs huidige bedrijfsprocessen het prestatietmetingskader het best tot zijn recht komt. De twee prestatietmeting processen zijn hieronder weergegeven.



Met het ontwerp van de twee prestatietmeting processen is bepaald welke thema's BAM moet meten en hoe dit uitgevoerd moet worden. Hiermee is de onderzoeksvraag beantwoord.

Aanbevelingen

De praktische aanbevelingen van dit onderzoek zijn:

- Realiseer de ontwikkeling van een intrinsieke motivatie voor het meten van prestaties binnen BAM, in plaats van enkel gemotiveerd te zijn omdat opdrachtgevers prestatietmetingen voorschrijven.
- Analyseer periodiek het opdrachtgeversperspectief op welke VPI-thema's belangrijk zijn.
- Neem de kennis in acht van de theoretische onderwerpen zoals besproken in dit onderzoek bij het ontwikkelen van prestatie-indicatoren.
- Gebruik meerdere soorten bewijsdocumenten om de prestatiebeweringen in de tenderplannen te onderbouwen. Dit verbetert de objectieve kwaliteit van de VPI.

- Implementeer het prestatietetingskader zoals ontworpen in dit onderzoek in BAMS bedrijfsprocessen.
- Evaluer de implementatie en effectiviteit van het prestatietetingskader en maak aanpassingen op basis van de evaluatie.
- Blijf het prestatietetingsraamwerk optimaliseren en aanpassen aan BAMS behoeftes, het opdrachtgeversperspectief en veranderingen in de bouwsector.

De wetenschappelijke aanbevelingen van dit onderzoek zijn:

- Repliceer het onderzoek bij andere Nederlandse bouwbedrijven om de externe validiteit van het onderzoek te verbeteren.
- Doe onderzoek naar het meten van andere VPI-thema's.
- Doe onderzoek naar de relatie tussen projectdoelstellingen en prestatie-indicatoren in combinatie met de BV-aanpak.
- Ontwikkel kennis ontwikkelen over het gebruik van generieke en projectspecifieke VPI en het gebruik van leidende en volgende indicatoren.

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Section I: Introduction and context

This first section of the research report aims to introduce the research, set its context, and analyze the client's perspective on the research topic. Chapter 1 describes the background to the research, introducing the research problem, defining the research objective and research questions, and explaining the research design. Chapter 2 elaborates on the current application and the development of the BV approach. Lastly, Chapter 3 determines the client's perspective on performance measurement through analyzing the project goals as provided in the tender documentation. The results of this last chapter are the two most occurring VPI themes, which serve as a guide through the rest of the research.

1 Introduction

In this chapter the background of the study is introduced to give insights in the reasons behind the study and to make the process of the study and the report more clear. Firstly, the background is explained using a trend in the Dutch construction industry. Secondly, the research problem is stated. Thereafter, the research objective and research questions are defined. The research design is presented and lastly, the research structure and a guide to the reader are provided.

1.1 Background information

This subchapter describes the subjects which motivate this research. First the project-based character and a trend in the Dutch construction industry are introduced. Second, the subjects of Most Economically Advantageous Tender and Best Value are introduced. Third, two problems that occur when applying Best Value to contractors are discussed. Lastly, the need for a performance measurement framework is described.

1.1.1 Dutch construction industry: inter-project learning and non-financial performance

The Dutch construction industry is characterized as a project-based sector. This is a result of multiple factors, for instance, the uniqueness of every construction location (which provides unique environmental aspects) and the differences in preferences and demands by clients (Mbugua *et al.*, 1999; Silva *et al.*, 2016). As a result, new construction projects are approached as unique cases which are started from scratch. The realization that projects are not unique and are characterized by some degree of repetition changes the paradigm from 'every project is unique' to 'every project is the same, with some differences'. Also, construction firms are aware that lessons learnt from projects should be applied in new projects, and in the company as a whole. However, to achieve the desired effects of these scalable learning efforts, construction firms should have knowledge of their own performances. This is also evident from the strategic agenda of the Royal BAM Group nv, which focuses on three aspects: 'doing the things better', 'doing better things', and 'doing new things' (BAM, 2016). Especially the first aspect aims to increase the firm's performance by adding value to everyday work processes. However, in order to add value one must be aware of one's own strengths and weaknesses, in other words, of ones performances.

A trend that is observed in the sector is the shift from a financial focus to a combined focus on financial and non-financial aspects of projects. The focus on solely financial performance was a common trend for a long time. Traditionally, performance measurement in the construction industry has been assessed purely on time, cost, and quality; which are referred to as the 'Iron Triangle' (Atkinson, 1999; Oyewobi *et al.*, 2015; Silva *et al.*, 2016). The main advantage of these financially based performance measures is that they are easily captured and provide quantitative output (Eccles, 1991). The dissatisfaction with using solely financial performance measures started in the 1950s (Eccles, 1991; Bassioni *et al.*, 2004). According to Atkinson (1999), time and costs are only guesses, calculated at a time when least is known about the project. He continues, stating that quality is a phenomenon; an emergent property of people's different attitudes and beliefs, which often changes over the development life-cycle of a project. In addition, it is held that financial measures have a backward-looking focus and concentrate on short term 'quick-wins', rather than long-term goals, which tends to promote a reactive management style (Mbugua *et al.*, 1999; Beatham *et al.*, 2004; Costa *et al.*, 2006). Financial measures only indicate the level of past success or failure that has been achieved, can hardly be used to predict future performance (Mbugua *et al.*, 1999; Bassioni *et al.*, 2004; Oyewobi *et al.*, 2015), and can give misleading signals for continuous improvement and innovation (Kaplan & Norton, 1992; Bititci *et al.*, 1997; Ali *et al.*, 2013). Bassioni *et al.* (2004) state that what remains in the minds of project participants after completion is not the financial success or early completion, but memories of "harmony, goodwill, and trust, or conversely,

arguments, distrust, and conflict.” In addition, Bassioni *et al.* (2004) state that managers require current, up-to-date, and mostly non-financial information to be able to take better decisions and actions in the current business environment. In the light of this transition, Eccles (1991) proposes the inclusion of non-financial indicators, such as innovation, market share, and customer satisfaction. These measures would be an addition to the traditional Iron Triangle, because “no single measure, financial or otherwise, can provide a clear performance view for the overall business” (Mbugua *et al.*, 1999).

1.1.2 Procurers’ response: Most Economically Advantageous Tender and Best Value

The trend described above also found its way into the Dutch procurement sector, which led to the adoption of a new public procurement law (Aanbestedingswet 2012). This law forces public clients to use both price and quality in their tender evaluation (Hardeman, 2013). These procurement methods, collectively named Most Economically Advantageous Tender (MEAT) procedures, are increasingly used for the purchase of all sorts of construction works (Hardeman, 2013). In order to successfully give substance to quality in tender plans, construction firms should have insight in the quality they can deliver. This stresses the importance of having knowledge of the firm’s performances.

A particular paradigm that is gaining ground as a MEAT procurement strategy is the Best Value (BV) approach, also known as Best Value Procurement (BVP). This approach, which was founded by Dean Kashiwagi in the United States of America over two decades ago, focuses on calculus-based trust development through the use of metrics and alignment of goals and risks between client and vendor (Snippert *et al.*, 2015). So far it shows promising results: increased customer satisfaction, minimal deviation from schedule and budget, minimal risks, short tender duration, and higher profits for the suppliers without increasing project costs (van Duren & Dorée, 2008; van de Rijt & Santema, 2013). Contrary to other MEAT procedures, which mainly focus on tender plans that offer value outside of the project scope, the BV approach uses performance claims supported by verifiable performance information (VPI) to select the supplier which offers the best value for the lowest price within the project scope. This VPI should be specific, measurable, and dominantly show the suppliers performance. The Best Value approach is explained in more detail in Chapter 2.

1.1.3 Applying Best Value at construction firms

The character of the sector and trend as described in subchapter 1.1.1 require construction firms to have insight in their non-financial performance. This is particularly important in the light of the Best Value approach, due to the use of VPI in determining which contractors get awarded with the project. But due to the focus on solely financial performance in the recent past, construction firms have limited insight in their non-financial performances (van de Rijt & Santema, 2013). This leads to two problems in BV tenders.

Firstly, contractors have to derive performance measures and produce VPI from the client’s strategy for the project instead of their own corporate strategy. This is because, as part of the BV approach, the clients translate their request for quality using project goals according to their strategy and their stakeholders’ views. Contractors have to proof they meet these project goals by supporting their performance claims with VPI. As a result, contractors have to rely on their ability to understand all their client’s wishes, demands, stakes, and restrictions; i.e. all factors that contributed to the development of the clients’ strategy.

The second problem concerns the short duration (in practice approximately eight weeks) of the tender phase of the BV approach. This leads to contractors having a limited time frame to find all the VPI they require to give substance to the client’s project goals in a tender. Therefore, the VPI that is required for the drawing up of the plans has to originate from past projects. If the contractor starts

thinking about what VPI they should measure at the start of a tender, the VPI is never available on time.

In order to solve these two problems contractors should always have an insight in how they perform on the themes that are of importance to their clients. Therefore, investigating the client's wishes, demands, and their perspective on performance is of great importance and should periodically be investigated. Chapter 3 elaborates on this aspect. When this client's perspective on performance is clear for the contractor, he is able to develop performance measures and produce VPI which are aligned with the client's strategy and are available on time.

1.1.4 Existing performance measurement frameworks

When developing performance measures to produce VPI, the need for a performance measurement framework arises (Egan, 1998). Attachment 1 discusses the three most frequently adopted performance measurement frameworks by construction companies around the world. Although they are undoubtedly valuable, their adoption is often constrained by the fact that they are simply frameworks. They suggest some areas in which measures of performance might be useful, but provide little guidance on how the appropriate measures can be identified, implemented, monitored, and ultimately used to manage the business (Neely *et al.*, 2000; Bassioni *et al.*, 2004). Suggestions on how to measure performance in practice are not offered; little work has been completed on the process of actually designing performance measurement systems (Neely *et al.*, 2000). Therefore, these frameworks do not meet the requirements that contractors have regarding performance measurement.

1.2 Problem statement

As is described above, the trend in the Dutch construction industry requires contractors to gain insight in their non-financial performances. Because for a long time the sector focused solely on financial performances, construction firms lack this insight. Consequently, they are unable to successfully support their performances when faced with quality aspects in tenders. This is due to the fact that there is no readily available performance measurement framework which can easily be adopted by construction firms. Because of this, knowledge about which specific non-financial performances should be monitored and how this should be conducted in order to successfully give substance to this request for quality is missing. The problem is also recognized by van de Rijt and Santema (2013), who state that a lack of performance information is one of the main problems during the execution of a BV tender. The lack of knowledge ensures that every BV tender can be characterized as a 'hunt' for verifiable performance information (VPI), which is an inefficient, difficult, and lengthy process. The VPI that is required in the tender phase of a current construction project should have been collected in the execution phase of other projects in the past, as explained above. As a result of the missing VPI, the firm's ability to effectively acquire projects is hampered. This jeopardizes the firm's business continuity in the long run. In addition, no existing performance measurement frameworks are directly applicable for construction firms.

The problem definition and its context derive from the situation as explained above and are based on scientific research and on multiple conversations with tender strategists from BAM. The problem that is identified within BAM is:

'The knowledge as to what non-financial VPI should be monitored, and how this should be conducted by BAM, is not developed sufficiently. This hampers the effectiveness of the Best Value tender process.'

1.2.1 Problem scope

The scope of this research is defined by the following factors:

- Selection phase of the BV tender process; the research problem occurs in this phase.
- Recent and current BV tenders that are supported by the Tender Strategy department of BAM; in order to study the research problem, active cases should be investigated.
- Dutch construction industry; because the original BV approach has been adapted for use in the Dutch construction industry (van de Rijt *et al.*, 2011), this study focuses on BV tender processes for projects in the Netherlands.

1.3 *Research objective*

In order to address the research problem, this study focuses on developing a performance measurement framework for non-financial verifiable performance information. This framework is tailored to the requirements of BAM and to the demands and wishes of BAM's clients. This results in the following research objective:

'To develop a framework for the monitoring of non-financial verifiable performance information by BAM, in order to improve the effectiveness of the Best Value tender process.'

It is expected that the results of this study are beneficial to BAM, due to improved effectiveness in the BV tender process. In addition, the knowledge developed by this study concerning measuring and monitoring performance can serve as a stepping stone for further improvements.

1.4 *Research questions*

Based on the introduced research problem and the research objective, research questions are formulated to guide the study in developing the framework. The following main research question has been formulated:

'What non-financial verifiable performance information should be monitored, and how should this be conducted by BAM, in order to improve the effectiveness of the Best Value tender process?'

The main research question already hints at what should be investigated in order to reach the research goal. The sub research questions, which are stated below, support the main research question.

1. *'What are the most frequently used project goals in Dutch Best Value tenders as defined by clients?'*

The focus on customer satisfaction has been rising in all sectors. This is also the case in the construction industry; fulfilling the client's goals is crucial (van de Rijt & Santema, 2013). This makes the client's view on what VPI should be monitored an important aspect of this research. Therefore, this sub research question is aimed at defining which project goals, and corresponding VPI themes, are most frequently stated in the tender documentation which is provided by clients at the start of a new BV tender. These VPI themes are selected for use in the research.

2. *'What is the theoretical perspective on performance measurement in the construction industry, and in particular the measurement and monitoring of the selected VPI themes?'*

This second sub research question aims at developing the theoretical perspective to which the empirical part of this research can be reflected. For this purpose, literature concerning the

measuring and monitoring of VPI in construction projects and firms is investigated. In addition, literature concerning the relation between the project goals and VPI is studied, in order to be able to study this relation in practice.

3. *'What VPI is used in Best Value tenders within BAM to give substance to the project goals and how is this information found and gathered during the tender?'*

This sub research question aims at discovering the effects of the occurrence of the research problem in practice. The process of actually finding useful VPI, which is of sufficient quality to be used in the tender, is expected to be difficult. In addition, the relationship between the project goals and the VPI is studied. This is expected to be currently hampering the effectiveness of BV tenders. Answering this question shapes the empirical part of this study.

4. *'What are the differences and similarities between the theoretical perspective on VPI and VPI used in practice during Best Value tenders of BAM?'*

The fourth sub research question aims at discovering the differences and similarities between the answers on sub research questions 2 and 3. These insights are necessary to design a framework for the measuring and monitoring of VPI which is tailored to BAM's requirements.

5. *'What framework can be constructed regarding the process of measuring and monitoring the selected VPI themes in the execution phase of BAM's construction projects?'*

This phase aims at using the knowledge obtained during this research to develop a framework for the measuring and monitoring of the most frequently used VPI themes in the execution phase of construction projects. The goal of this framework is directly linked to the research objective: to improve the effectiveness of the BV tender process of BAM. This is accomplished by ensuring that VPI that is useful in the tender phase of projects is being measured and monitored in the execution phase of projects through the use of the framework. Figure 1 visualizes the contribution of the framework.

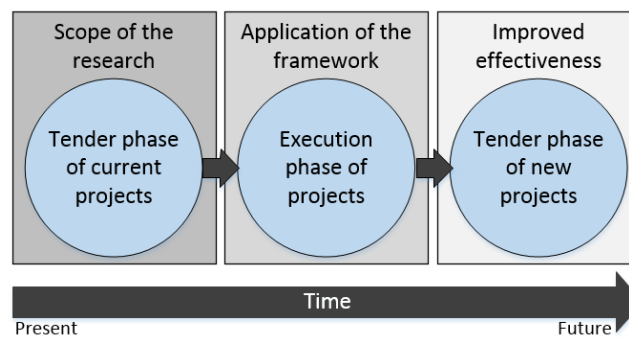


Figure 1: Contribution of the performance measurement framework

1.5 Research design

In order to answer the research questions and fulfil the research objective, a research design is determined. It consists of four phases: an exploratory phase, a literature study, a multiple case study, and a design phase. These phases are briefly introduced below. Each phase is explained in further detail in their respective sections in this report.

1.5.1 Phase 1: Exploring the context and the client's perspective

This phase is focused at exploring the context and background of the research for the following subjects:

- The current application and development process over the past few years of the BV approach in Dutch construction industry. Goal: to set the context for this research.
- The client's perspective on performance information, displayed through the project goals defined in the tender documentation of BV tenders. Goal: to incorporate the client's perspective into this research by selecting the two most frequently occurring VPI themes. These serve as a guide through the remaining sections of the research. The results of this analysis provide an answer to sub research question 1.

In this phase, data is collected by consulting scientific research, analysis tender documentation, and conversing with tender strategists of BAM. The result of this phase is an understanding of the context of this research and the selection of the two most frequently occurring VPI themes.

1.5.2 Phase 2: Theoretical perspective

The second phase is aimed at discovering how well developed the subjects are that are mentioned below. This is executed by conducting a literature study. The overall goal of this phase is to determine the theoretical framework for this research.

- Measuring and monitoring of non-financial performances in general. Goal: to develop knowledge concerning this subject, which helps shape the theoretical framework for this research.
- Measuring of monitoring of the two selected VPI themes. Goal: to develop knowledge concerning this subject, which helps shape the theoretical framework for this research.
- The relationship between the client's project goals and the measuring and monitoring of VPI. This relationship is expected to be problematic in practice, due to the two problems occurring with the application of BV at construction firms (as discussed in Chapter 1.1). Goal: to develop knowledge concerning this subject, which helps one to understand the process of measuring VPI.

In this phase, data is collected by consulting scientific research and conversing with tender strategists of BAM. The result of this phase is a theoretical framework which is used to be tested against BAM's current practice in BV tenders and in the development of the performance measurement framework. This phase answers sub research question 2.

1.5.3 Phase 3: Empirical perspective

In the third phase, a multiple case study is conducted. Multiple BV tenders are thoroughly analyzed, with the help of the theoretical framework. The goal of this phase is to discover the differences and similarities between BAM's current practice in BV tenders and the theoretical perspective. The following activities are executed:

- A case study design is determined, case selection criteria are developed, and cases are selected.
- The objective quality of the VPI used in BAM's BV tenders is tested to the theoretical framework using a project documentation study. Goal: to find the differences and similarities between theory and practice concerning the quality of VPI.
- The perceived maturity on the VPI used in BV tenders, as perceived by the tender strategists working on these tenders, is measured using semi-structured interviews. Goal: to determine if the perceived maturity matches the actual objective quality of the VPI.
- The results of the project documentation study and the interviews are analyzed using a within-case and cross-case analysis. Goal: to find patterns in the results and to determine the overall differences and similarities between theory and practice.

In this phase, data is collected by a project documentation study and by conducting interviews with tender strategists. The result of this phase is an insight into the differences and similarities in the

quality of VPI between the theoretical framework and BAM's practice in BV tenders. This phase answers sub research questions 3 and 4.

1.5.4 Phase 4: Framework design

In the last phase, the results of the multiple case study are used to design a framework for the measuring and monitoring of the selected VPI themes in the execution phase of construction projects. The goal of this phase is to develop two performance measurement processes and to guarantee their place in the current business process of BAM. The following activities are executed:

- Collaboration with the departments responsible for the two selected VPI themes is sought. Goal: utilize their expertise and create support for the performance measurement process.
- Design the two performance measurement processes, using the theoretical framework, the differences and similarities discovered in the third phase, and BAM's expertise concerning the two selected VPI themes as input. Goal: to design a performance measurement framework which is corresponding to theory, adjusted to BAM's requirements, and is supported by the departments that possess the expertise for the selected VPI themes.
- Collaboration with BAM's process control department is sought. Goal: to guarantee the placement of the two performance measurement processes in BAM's current business process.

In this phase, no new data is collected. The results of this phase are two performance measurement processes for the selected VPI themes. This phase answers sub research question 5.

When the design phase is completed, conclusions and recommendations of the overall research are provided. Here the research questions are answered and recommendations are given.

1.6 *Research structure*

The structure of the research is shown in Figure 2, including the activities and results for each of the four phases.

1.7 *Guide to the reader*

This first chapter describes the background of the study, states the research problem, defines the research objective and research questions, and elaborates on the research design. The two remaining chapters in this first section explore the current application and development of BV in the Netherlands and determine the two most frequently occurring VPI themes in the tender documentation as provided by clients. Section II describes the theoretical perspective of this research, by exploring literature concerning performance measurement, the two selected VPI themes, and the relationship between project goals and VPI. The empirical perspective of this research is introduced in Section III. This section determines the multiple case study design, selects cases, describes the project documentation study and interviews, and discusses the results. Section IV describes the design of the two performance measurement processes. Section V answers the research questions, draws conclusions, and provides recommendations. In the appendices, a glossary is presented and the references used in this research are provided. The attachments enclose elements such as an overview of the selected cases and the interview formats.

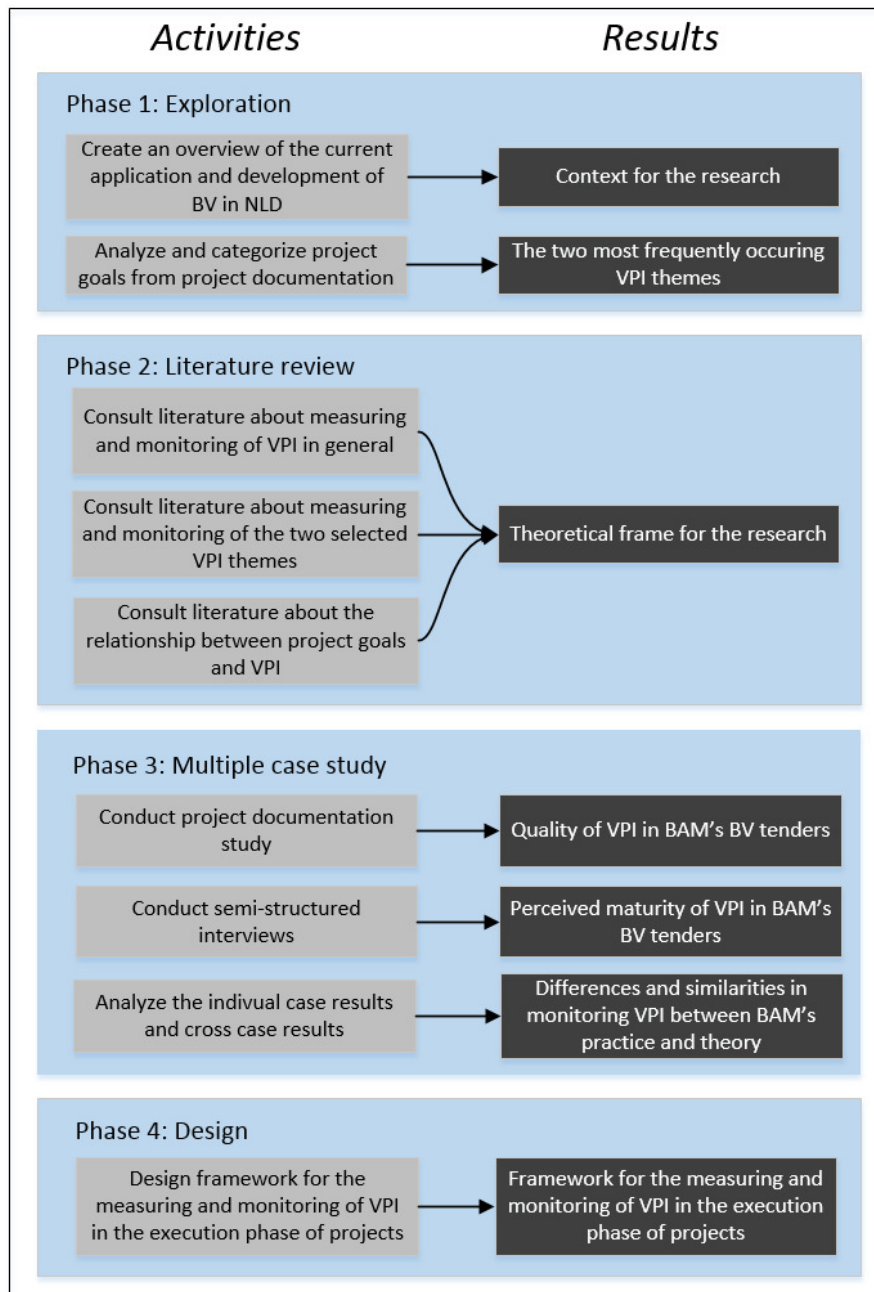


Figure 2: Structure of the research

2 Setting the context: the Best Value approach

This chapter provides an overview of the BV approach and of its current application in the Netherlands. In addition, the origin and development of the approach in the Netherlands is discussed. This overview is provided early in the report, in order to better understand the context in which the research is conducted. In addition, this chapter also enables readers to comprehend the terminology concerning BV that is used throughout the report. Firstly, the BV approach and its step-by-step application to projects are explained. Thereafter, the origin and development of the BV approach is described. Lastly, conclusions are drawn.

2.1 The BV approach: a critical review

The BV approach is developed and refined by Prof. Dean Kashiwagi and the Performance Based Studies Research Group (PBSRG) from Arizona State University between 1991-2010. The approach is also known as Best Value Procurement (BVP) and Performance Information Procurement System (PIPS), or a combination of the two terms. It includes a deductive logic named Information Measurement Theory (IMT) and has undergone multiple stages of development over the years (Kashiwagi, 2010). The BV approach is a process where both price and performance are evaluated; it minimizes the need for decision making, uses measurements to show dominant value, does not use minimum standards, covers the entire supply chain, and is aimed at selecting the expert that offers the best value for money. In addition, the BV approach moves away from the traditional manage, direct, and control relation between client and contractor (van de Rijt & Santema, 2013; Verheul *et al.*, 2013). Another aspect stated by Kashiwagi (2010) is that BV minimalizes the time and cost for contractors to prepare the procurement process. However, this aspect is not always true in practice due to the contractor's inability to collect, monitor, and use VPI (Verheul *et al.*, 2013). In addition, (Kashiwagi *et al.*, 2003) state that BV results in 98% client satisfaction, no contractor caused cost deviations, minimized client's risk, and increased contractor profits. These statements were evaluated by van Duren and Dorée (2008), who state that Kashiwagi's explanation for the positive effects (which is the IMT theory) is not satisfactory. With their research they showed that these effects can also be explained using New Institutional Economics perspectives. They concluded that the statements made by Kashiwagi concerning the performance of the BV approach are justified, only not to the extent that is claimed. However, they do believe that the BV approach can contribute to industry performance and that its application should be expanded (van Duren & Dorée, 2008). This shows that even the more critical authors do recognize the advantages of the BV approach.

The application of the BV approach to procurement consists of four phases, as shown in Figure 3. Each phase is discussed below, along with the most important parts of each phase.

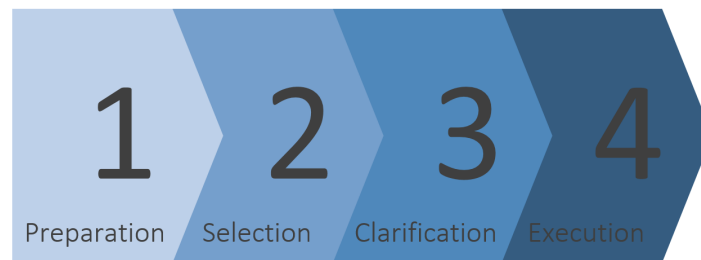


Figure 3: The four phases of the application of the BV approach

1. Preparation: In the first phase the client prepares the project; here it is of great importance that the client's organization totally understands BV and applies it strategically in order for the project to be successful (van de Rijt & Santema, 2013).
2. Selection: In this phase of approximately eight weeks, the contractors provide the client with three written plans (performance underpinning, risk assessment plan, value added plan) on a total six sheets of paper. The contractor has to motivate their claims in these plans using VPI. If the plans are positively evaluated by the client on their dominance, two interviews are conducted with the contractor's key staff for the project. In these interviews the contractor has the chance to elaborate on their written plans. Lastly, the contractors provide the client with

their price for the execution of the project. The goal of this phase is to provisionally select the contractor that offers the best value for money.

3. Clarification: In this phase the provisionally selected contractor defines the details of his offer, the corresponding planning, and the performance measurements. The contractor is in the lead and needs to take the client 'for a ride' through his plans. The aim of this phase is to make more concrete, explain, clarify, and underpin the plans to enable a successful execution of the project in the next phase. In addition, project specific performance indicators need to be established, in order to track project performance during execution. The data collected from measuring these indicators can be used in future BV tenders by the contractor (Horstman & Witteveen, 2013). The result of the clarification phase is the signing of the contract: the official awarding of the project to the contractor. Major pitfalls in this phase are negotiations and the changing of the project scope (van de Rijt & Santema, 2013; Snippert *et al.*, 2015).
4. Execution: After the successful completion of the clarification phase, the procurement phase has been completed. It is now time to actually execute the project. The performances of the contractor and client are monitored in this phase using the risk management plan (which is derived from the Risk assessment plan of phase 2) and the Weekly Report. This report is a weekly overview of projects deviations that occurred. The great advantage of this report is that it reduces bureaucracy, because it provides a short and clear overview of the current state of the project (van de Rijt & Santema, 2013).

2.2 Origin and development

After the large scale fraud and collusion scandal in the Netherlands that led to a Parliamentary Inquiry in 2002, a sense of urgency to reform the building and construction sector was felt. This inquiry resulted in objectives, of which one is to 'make use of award criteria based on price and quality' (van de Rijt & Santema, 2012). In the light of this objective, Dutch public officials started looking for new innovative ways of procurement (Ang, 2011). They found this in the form of Prof. Dean Kashiwagi from Arizona State University, who had developed the BV approach. Around the year 2004 conferences were being organized and people and knowledge were being exchanged between Arizona and the Netherlands, as an initiative from the Dutch Ministry of Housing. The first BVP projects in the Netherlands started in 2005, with most project between 2005 and 2010 being in the construction industry (van de Rijt & Santema, 2012). A major milestone for the BV approach in the Netherlands came in 2008, when it was applied by Rijkswaterstaat to the procurement of 16 projects that had to resolve major road bottlenecks (Witteveen & Dorée, 2011). By 2009, the first Dutch book on BV was published (van de Rijt & Santema, 2013), which aided in the diffusion of the approach. After this, the BV approach became a trend and spread exponentially through multiple industries in the Netherlands. Today, it is used in all layers of government and in the private sector to procure works and services. The BV approach is also increasingly applied in the Dutch construction industry. For instance, Rijkswaterstaat continues to procure projects using the BV approach in the near future: approximately 25% of all projects until 2020 will be procured using the BV approach (Rijkswaterstaat, 2016).

In order to successfully apply the BV approach into European legislation, some developments and adaptations had to be made to the original approach. These changes have been studied and explained by van de Rijt *et al.* (2011). A main difference for instance, is that the use of Past Performance Information is changed to the use of pre-qualification. This is the so-called 'Restricted Procedure' in European procurement law. Also, the evaluation of the Risk Assessment plan is conducted independently from the Value Added plan. In the original approach one overall grade is provided for both plans. A third main difference is that contractors are ranked on their absolute scores, not on their relative scores. This means that the contractor's plans are not compared to each

other during their evaluation, which increases the objectivity. The application of these differences shows that the BV approach can be adjusted in order to fit with local legislation, and still keep true to the original philosophy.

2.3 Conclusion

This chapter provided an overview of the BV approach, by discussing the values, contents, and process. In addition, the origin and development of the approach in the Netherlands is described. Multiple authors conclude that BV is still in its stage of development in the Netherlands, and will be increasingly used in the coming years (van de Rijt *et al.*, 2011; Witteveen & Dorée, 2011; van de Rijt & Santema, 2013). Even the more critical authors have a strong belief that the further application of the BV approach in the Netherlands can contribute to industry performance (van Duren & Dorée, 2008). In the next chapter, the client's perspective on performance information is explored by analyzing the project goals stated in tender documentation.

3 Project goal analysis: the client's perspective

In this chapter, the most frequently used project goals as defined by clients in their tender documentation for BV projects are defined, categorized, and analyzed. Through these goals, the clients communicate what aspects of construction projects they deem most important. It is up to the contractors to give substance to these goals in their tender plans and show, in a verifiable way, that they are able to contribute to them. This chapter aims to answer the first sub research question:

'What are the most frequently used project goals in Dutch Best Value tenders as defined by clients?'

It has the following structure: firstly, the goal of this analysis is explained. Secondly, the method of categorization, analysis, and selection is described. Thirdly, the results of analysis are provided. Finally, conclusions are drawn.

3.1 Goal

The Dutch construction industry is heavily client-driven (Santema *et al.*, 2011). This means that if construction firms want to be certain of a steady flow of projects, they need to adapt to their client's wishes and demands. Therefore, the aim of this chapter is to incorporate the client's perspective on what VPI is important to monitor in the research by investigating the project goals. This perspective is investigated at the beginning of the research, in order to provide a focus on the most frequently used goals. In addition, this prevents dwelling on less frequently used goals that might be found in theoretical and empirical parts of this study. In this chapter, the most frequently used project goals are examined in the form of categorized VPI themes. The two themes which create the most value for BAM are selected and will be the focus of the rest of the research. This is done in order to monitor the scope of the research and to allow a thorough investigation of the themes.

3.2 Method

This section describes the method for categorization, analysis, and selection of the client's perspective using project goals.

3.2.1 Categorization

To analyze the client's perspective, the tender documents of the most recent (handled in the past three years) construction projects as provided by multiple clients have been selected. This results in a sample of 21 projects which have the following characteristics:

- Dutch projects
- Large variety of clients: ProRail, Rijkswaterstaat, provinces, municipalities, and private parties
- Design & Construct contracts

- Both infrastructural and building projects
- Handled by the Tender Strategy department of BAM Infra

An overview of the projects and their clients can be found in Attachment 2. The project goals stated in the documents of these projects are formulated in many different ways, which makes them difficult to categorize. Therefore, the project goals are investigated for common themes. These themes serve as categories, which can easily be analyzed. The project goals are evaluated for common VPI themes in a parallel manner: the author and two tender strategists of BAM independently categorize the goals into VPI themes. The results of these individual categorizations are discussed until consensus is reached. The VPI themes are established in this way, in order to objectify the categorization.

3.2.2 Analysis

After the VPI themes have been established, the client's perspective is analyzed and ranked using two methods:

1. How often a certain VPI theme is mentioned in the total set of investigated project goals (%)
2. In how many of the 21 projects a certain VPI theme is mentioned

The result of this analysis is a set of VPI themes, ranked by occurrence in the tender documents provided by the client. Two different analyses are used, because some clients mention a certain VPI theme multiple times in one project. This means that if only analysis 1 is conducted, false results on the client's perspective could be obtained. The two different analyses are compared, in order to validate the ranking.

In addition to these two analyses, which show the client's perspective on VPI themes, the current availability of data on the categorized VPI themes in BV tenders is analyzed. The aim of this third analysis is to ensure that the VPI themes that are selected for use in this research are not yet well developed within BAM. This improves the value of the research for BAM. For this purpose, a survey is distributed among employees of the Tender Strategy Department of BAM who recently worked on BV tenders. The survey requests to answer the following question: "What is the current status of the availability of the data concerning this VPI theme?" For each categorized VPI theme, the respondent has to assign a value between 1 and 5, where 1 is "excellent availability" and 5 is "unavailable". A 5-point scale has been used to allow the respondents to pick a neutral option (Leedy & Ormrod, 2014). The outcomes of the survey are discussed with the respondents until consensus is reached.

3.2.3 Selection

In order to select the most frequently used VPI themes for further use in this research, that are also of the greatest value for BAM, the results of three methods of analysis are merged into a single weighted value. This weighted value for VPI theme t_i is calculated using the following equation:

$$t_i = \left(\frac{k_a}{n_a}\right)w_a + \left(\frac{k_b}{n_b}\right)w_b + \left(\frac{k_c}{n_c}\right)w_c \quad (1)$$

where $k_{a,b,c}$ are the values that VPI theme i scored on analyses a,b,c ; $n_{a,b,c}$ are the total values that VPI theme i can score on analyses a,b,c ; $w_{a,b,c}$ are the weighting factors of analyses a,b,c . The calculation results in a value between 0 and 1, which shows the client's perspective on the VPI theme and incorporates the urgency to develop knowledge on these themes within BAM. The higher the value, the higher the importance to investigate this VPI theme. The calculation is repeated for every VPI theme. The two VPI themes with the highest weighted value are selected for further use in this research.

3.3 Results

This section discusses the results of the client's perspective analysis in the following order: firstly some general characteristics concerning the analyzed project goals, secondly the categorization of

the goals into VPI themes and the analysis of these themes, and lastly the selection of two VPI themes for further use in the research.

3.3.1 General characteristics

Previously to the project goal categorization, the general characteristics regarding the goals mentioned in the 21 projects are explored. The results are shown below:

- A wide variation in the amount of goals, ranging from three to seven goals (rounded average and median of five goals)
- Half of the analyzed projects use a main project goal along with less important sub goals. The other half uses multiple equally important goals. For the purpose of this research, all goals are treated equally
- If clients use a main goal along with less important sub goals, the main goal always consists of multiple subjects. The project goals of projects with equally important goals mainly consists of one subject per goal
- The subject of the main goals mostly concerns the quality of the project
- The length of the project goal descriptions vary, ranging from only a few words to whole paragraphs of explanation

3.3.2 Categorization and analysis

The results of the categorization of the project goals into VPI themes, along with a description of the themes, are shown in the first and second column in Table 1. The third and fourth column show how often a certain VPI theme is mentioned in all the project goals (expressed as a percentage of the total amount of mentioned VPI themes) and in how many of the projects a certain VPI theme is mentioned. When comparing the percentages in the third column to the amount of projects in the fourth column, one can clearly see that both analysis methods yield almost identical results. This validates the analysis.

As can be seen in the fourth column, some VPI themes occur in almost every investigated project despite the large variety of clients; these VPI themes are valued by many different clients. Remarkably, project goals concerning the VPI themes quality and finance are mentioned multiple times in the sampled projects. This is not in line with the BV approach, because that already focuses on the best value (quality) for money (finance). The fact that some clients deem it necessary to include these aspects in their project goals shows the novelty and inexperience with the application of the BV approach by clients. Another remarkable finding are the project goals that directly request the contractor to contribute to the successful application of the BV approach. This shows the client's willingness to collaborate and improve its own performance.

The fifth column of Table 1 shows the results of the survey concerning the unavailability of data that is distributed and discussed among tender strategists of BAM. One can clearly see the variety in unavailability of data concerning the VPI themes. However, the average unavailability of more than 3 out of 5 is alarming and shows BAM's urgency to develop knowledge and data concerning these VPI themes.

Table 1: VPI theme categorization and analysis

VPI theme	Description	% Occurrence in sample(a)	# Occurrence in projects (b)	Data unavaila- bility(c)	Weighted value t_i
Stakeholder satisfaction	Satisfaction of individuals, groups, and companies with a stake in the project during construction	29,2	20/21	3/5	0,61
Planning	The ability to reliably reach a deadline, or to reach it in advance	10,8	12/21	5/5	0,56
Accessibility	The accessibility of the project site area and its near vicinity during construction	7,5	8/21	4/5	0,42
Traffic flow	The flow of various vehicles through or closely past the project site during construction	3,3	4/21	5/5	0,41
Interface management	How successful interfaces with other parties, companies, and projects are managed	4,2	4/21	4/5	0,34
Aesthetic	Aspects concerned with the integration of the end product's looks with its surroundings	3,3	4/21	4/5	0,34
Safety	The safety of all people at and near the construction site	7,5	9/21	2/5	0,30
Low maintenance	The amount of maintenance efforts in a certain period after completion	4,2	5/21	3/5	0,29
User satisfaction	Satisfaction of all individuals, groups, and companies with a stake in the project after construction	3,3	4/21	3/5	0,27
Quality	How well the project scope is being realized	5,8	7/21	2/5	0,26
Client satisfaction	Satisfaction of the client	3,3	3/21	3/5	0,26
Flexibility	How easily changes can be made, without large consequences concerning cost, time, or quality	3,3	3/21	3/5	0,26
Changes	The ability to minimize and mitigate changes in the project	2,5	3/21	3/5	0,26
Sustainability	Sustainability of the construction methods and of the final product	5,0	6/21	2/5	0,25
Financial BVP	The price of the project	4,2	5/21	2/5	0,23
	To which extent the contractor helps the client to successfully apply the BV approach	2,5	3/21	2/5	0,19
Total:		100			

3.3.3 Selection

To select the two VPI themes for further use in this research, Equation 1 is applied. For the variable k the results from Table 1 are used. For variable n the total values of the three analyses are used: $n_o=100\%$, $n_b=21$ projects, and $n_c=5$. The weighting factor w is determined on $1/3$ for all three analysis methods. Applying these variables to Equation 1 results in a number between 0 and 1 for every VPI theme, of which the themes 'Stakeholder satisfaction' (0,61) and 'Planning' (0,56) have the highest value (see the sixth column of Table 1 for all results). This means that these two themes have the combination of being valued as most important by clients and for which the least amount of information is available within BAM. These two themes are selected for further use in the research, and serve as a guide.

3.4 Conclusion

This chapter incorporates the client's perspective into the research, by analyzing the project goals as defined by clients in their project documentation. The project goals of 21 different construction projects are investigated and categorized into VPI themes. From the large variety in project goals can be concluded that the BV approach is applied in many different forms and shapes; clients do not agree on one simple way to define their goals. On the contrary, almost all clients value certain VPI themes, while some other VPI themes are rather uncommon. For instance, project goals involving the themes finance and quality are a remarkable finding, considering the BV approach.

As described in this chapter, the two VPI themes which have the combination of being valued as most important by clients and for which the least amount of information is available within BAM are selected. These themes, stakeholder satisfaction and planning, serve as a guide throughout the remaining part of the research. By defining the VPI themes, this chapter answers the first sub research question:

What are the most frequently used project goals in Dutch Best Value tenders as defined by clients?

In the next chapter, these VPI themes are investigated using a literature review.



Section II: Theoretical perspective

This section of the research report aims to provide the theoretical perspective on performance measurement in the construction industry. Its aim is to answer the second sub research question:

2. 'What is the theoretical perspective on performance measurement in the construction industry, and in particular the measurement and monitoring of the selected VPI themes?'

This section is structured as follows: firstly in Chapter 4 the terminology related to this topic, characteristics of performance measures, the concept of leading and lagging measures, and benchmarking efforts are discussed. Thereafter, in Chapter 5, the theoretical perspective on the practical processes and methods for measuring the two selected VPI themes (stakeholder satisfaction and planning) are elaborated. Furthermore, in Chapter 6, the theoretical perspective on the relationship between project goals and VPI is discussed and translated to the scope of this research. This topic is explored because, as described in Chapter 1, it develops issues during the tender phase of BV-projects. This information is used to determine the maturity of this relationship in practice. Lastly, in Chapter 7 all the information from this section comes together in the theoretical framework. This framework is be used in the comparison with practice in Section III of this research. In addition, information from this section is used in the development of the project performance measurement and monitoring framework in Section IV of this research.

4 Performance measurement in construction

The goal of this chapter is to get an understanding of the theoretical perspective on performance measurement. For this purpose firstly the terminology used in performance measurement literature is explored and the terms used in this research are determined. Thereafter, the characteristics of successful performance measures are established. Thirdly, the concept of leading and lagging performance measures is explained. Lastly, benchmarking of performance measures is described. These topics are of importance and are used in the theoretical framework in Chapter 0, from where it is used the comparison with practice in Section III and in the development of the performance measurement framework in Section IV of this research.

4.1 Terminology in performance measurement literature

This subchapter explores various terms and definitions used in performance measurement literature and aims to determine a set of consistent measures to use in this research.

The majority of authors agree on the definition of the term performance. The following definition of performance, provided by Oyewobi *et al.* (2015), is adopted for this research: “a measure of how effective and efficient the mechanism/process put in place by an organization attains its desired results”. On the other hand, concerning the term performance measure (a numerical or quantifiable parameter that produces VPI), some discussion exists in literature. For instance, a distinction is made between performance indicators and performance measures. It is stated that when indicators can be measured with some degree of precision and without ambiguity they are called measures (Mbugua *et al.*, 1999). However, when it is not possible to obtain a precise measurement, it is usual to refer to performance indicators (Takim & Akintoye, 2002). Thus, indicators are less precise than measures. Despite this distinction being made, authors like Mbugua *et al.* (1999) prefer to use the term performance measure for both instances.

Another term that is defined in various ways is performance measurement. For instance, Neely (1999) defined performance measurement as the process of quantifying the efficiency and effectiveness of past actions, whereas a performance measure is defined as the parameter itself used to quantify the efficiency and/or effectiveness of past actions (which corresponds with the definition of performance measure as discussed above). This first definition of performance measurement shows similarities with what Oyewobi *et al.* (2015) refers to as a performance measurement system: “as a means of monitoring and maintaining organizational control, which is the process of ensuring that an organization pursues strategies that lead to the achievement of overall goals and objectives.” Takim *et al.* (2002) define performance measurement as “the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects”. It is clear that all three authors refer to the process, and not the measurement itself with these definitions. The main purpose of performance measurement, as stated by H. Yang *et al.* (2010), is to measure and improve the efficiency and the quality of the performance, and identify opportunities for progressive improvements in performance.

Bititci *et al.* (1997) add a third level to this with the aspect performance management. They explain the distinction between performance management and performance measurement in that the first “is seen as a closed loop control system which deploys policy and strategy, and obtains feedback from various levels in order to manage the performance of the system” whereas the performance measurement system “is the information system which is at the heart of the performance management process and it is of critical importance to the effective and efficient functioning of the performance management system” (Kagioglou *et al.*, 2001). The performance measurement system is the information system which is at the heart of the performance management process (Bititci *et al.*, 1997). This means that the performance measurement systems have no use if not used as

guidance to management decisions. The feedback loop and consequent decision making are necessary to convert measurement systems into management systems (Bassioni *et al.*, 2004).

In addition to the terms that refer to performance, another stream of research focuses on success factors. Semantically, the success of a construction project is measurable only after the project is completed, while the performance of a project can be measured during the project (Silva *et al.*, 2016). Within project success research there are two topics: project success factors and project success criteria. The former are the independent variables that make project success more likely. The latter are the dependent variables that measure the success or failure of a project (Silva *et al.*, 2016). So, the dependent variables reflect the measured performance or success of the project. The independent variables are those factors, including project delivery decisions, which can impact performance outcome (Esmaeili *et al.*, 2013). So, one can say that project success criteria are actually the same as the term performance measures, which is discussed above. In addition to project success factors, there also exists literature concerning critical success factors (CSFs). These are defined as the few issues which are fundamental to the achievement of a particular strategic objective (Mbugua *et al.*, 1999). In other words, CSFs represent factors which are critical to the success of the industry. It is these factors which are necessary for the project participants to achieve their goals in a project (Sanvido *et al.*, 1992; Silva *et al.*, 2016). Because this research is focused on monitoring performance using quantifiable VPI and not on whether a project has been successful or not, the terminology concerning project success is not used.

In conclusion, this research adopts three levels of terminology: performance measure (which is the numerical or quantifiable parameter itself that produces VPI), performance measurement (the process of collecting VPI), and performance management (the overarching process of collecting, monitoring, and acting on the VPI in order to improve performance).

4.2 Characteristics of performance measures

This subchapter provides an overview of the characteristics that a performance measure should possess to successfully represent performance. These characteristics are approached from multiple directions by various authors. For instance, Chan and Chan (2004), Atkinson (1999), and Globerson (1985) developed a simple list of practical characteristics. An overview of these characteristics is provided in Table 2. Others, like Yu *et al.* (2007), approach the subject in a more abstract way. They state that performance measures should have a certain validity, measurability, and comparability to be successful. In addition, some authors propose to differentiate performance measures on how they are calculated or measured. For instance, Chan and Chan (2004) propose to divide measures into two groups: one group calculated using mathematical formulas and the other group determined

Table 2: Characteristics of performance measures adopted from literature

Characteristic	Globerson (1985)	Atkinson (1999)	Chan & Chan (2004)
Measures should be derived from company objectives	X	X	X
Limited, manageable number of measures (max 15)		X	X
Objective measures are preferable to subjective ones	X		
Measuring process must be made as simple as possible	X		X
Measures should be designed to use on every building project for benchmarking purposes	X		X
Measures must be accepted, understood, and owned across the organization	X	X	X
Measures need to evolve over time			X
Graphic displays of measures need to be simple in design and easy to update			X

using subjective opinions and personal judgement of stakeholders. This division is also used in the KPI framework (Raynsford, 2000). Takim *et al.* (2002) agree with this division into a quantitative and a qualitative group; just like Globerson (1985) (see Table 2). Naturally, when translating this to the data-driven BV approach, it is evident that preference is given to objective and quantitative measures that are calculated using mathematical formulas.

Another example of differentiating measures on their data collection approach is provided by Globerson (1985). Their research states a difference between the built-in data collection approach and the initiative approach. The former concerns data that is collected as part of a process, requiring a one-time investment and little maintenance. The latter concerns data for which the collection has to be initiated whenever it is required. Globerson (1985) concludes that the initiative approach is less dependable than the built-in approach.

In addition to these lists and division into groups, multiple authors provide some general remarks. For instance, Cox *et al.* (2003) and Costa *et al.* (2006) state that measures should remain simple, easy to gather, and easy to apply, while not placing a heavy burden on operating personnel. Yu *et al.* (2007) and Oyewobi *et al.* (2015) add that in order to assess performance levels and to allow benchmarking, measures should be determined periodically. Another recommendation, made by authors conducting research into the BV approach, is to always include a mixture of project specific and generic measures. By doing this, the performance of individual projects can successfully be measured, while it allows for project performance to be compared and benchmarked (Horstman & Witteveen, 2013). Finally, Costa *et al.* (2006) conclude that measures should include a mixture of leading and lagging performance measures. This subject is explained in the next subchapter.

4.3 Leading and lagging performance measures

This subchapter elaborates on the concept of leading and lagging performance measures, which is recognized as an important subject by multiple authors. The concept is most easily explained using the example of a persons' body mass. If one seeks to improve its health, periodically stepping on a weighing scale can be used as a method for monitoring the progress. However, this information is only the result and cannot be used to influence ones health. Measures that are able to influence this are calorie intake and burned calories, for instance. Monitoring these measures does have an influence on the 'performance' of increasing ones health. In this example, weight is a lagging measure and calorie intake and burned calories are leading measures.

Neely *et al.* (2000) explains the subject as a difference between measures that relate to results and measures that relate to the determinants of the results. This highlights the fact that results obtained are a function of past business performance with regard to specific determinants. In this example, results are lagging measures and their determinants are leading measures. Beatham *et al.* (2004) agree with this explanation, stating that lagging measures are used to assess completed performance results in the form of a historic review. This does not offer the opportunity to adjust performance or change the results of a project. Leading measures are measures of performance which are used to predict future performance, present the opportunity to change practice accordingly, and to enable future decisions. When translating this to the BV approach, a lagging measure is very suitable to describe past performance achieved by a company. However, using leading measures in addition to lagging measures in tender plans allows contractors to show their ability to improve their performance over the course of a project.

Some general insights concerning this topic are provided by multiple authors. For instance, for performance measurement to be successful, one should always strive for a combination of leading and lagging performance measures (Costa *et al.*, 2006). In addition, a lagging measure used to measure a certain part of a project can be used as a leading measure for a subsequent part, and thus also for the end result of the project (Beatham *et al.*, 2004). Josephson and Lindström (2007) agree

with this view, stating that the principle idea of performance measurement is to measure before a project begins (to analyze the situation and to provide context), during the project (to enable adjustments and influence the final outcome), and after the project is finished (to be used in future projects). For this research, the terms leading and lagging measures are used to point out if it concerns a result measure or a result determining measure.

4.4 *Benchmarking performance information*

The topic of benchmarking performances in the construction industry cannot be viewed separately from performance measurement, and has gotten more and more attention recently (Jin *et al.*, 2013). The importance of benchmarking is recognized by multiple authors. For instance, Costa *et al.* (2006) state that “an important role of performance measurement is to enable a company to do benchmarking”. Alarcon *et al.* (1998) agree with this view, stating that “performance measurement and benchmarking are the cornerstones of challenging any industry to become world class”. In addition, Beatham *et al.* (2004) explain that for performance to be predictable, benchmarked data through experience is required. If this is not available, decisions based on newly collected data are only based on intuition. Benchmarking provides context to newly collected data, which allows better decision making.

In the light of the BV approach, benchmarking is a very important topic due to its positive impact on the dominance of performance information. If a company is able to benchmark its VPI, it provides context to its performances. This subchapter firstly defines benchmarking and its aim. Thereafter, different types of benchmarking are described. Lastly, the state of benchmarking in the Dutch construction industry is explained.

4.4.1 Definition

The majority of authors define the term benchmarking quite similarly, although some variations exist. For instance, Costa *et al.* (2006) define benchmarking as a systematic process of measuring and comparing an organization’s performance against that of other similar organizations in key business activities. Lessons learned from other organizations should then be used to establish improvement targets and to promote changes in the organization. The Construction Industry Institute (a US based knowledge institute) defines benchmarking as “a systematic process of measuring one’s performance against results from recognized leaders for the purpose of determining best practices that lead to superior performance when adapted and implemented” (Ali *et al.*, 2013). The British Construction Best Practice Program (CBPP) defines benchmarking as “a systematic process of comparing and measuring the performance of the companies against others, and using lessons learned from the best to make targeted improvements” (Takim & Akintoye, 2002). Lastly, Bakens *et al.* (2005) define benchmarking as “a process of making structured comparisons of the performance of firms or other bodies, either with their peers or with externally defined reference criteria”. According to Takim and Akintoye (2002), the aim of benchmarking ones performance is twofold: either an attempt to gauge where one stands against peers or competitors, or to learn and incorporate successful ideas from best practices. These comparisons allow for better decision making on where to spend resources in order to improve performance (Beatham *et al.*, 2004).

Common in these definitions is the fact that the performance of a certain entity is systematically compared to the performance of another entity, with the goal to improve the formers’ performance. This does not necessarily have to be a competitor. When translating this to the BV approach, benchmarking also serves the purpose of providing perspective on VPI used in the contractor’s tender plans.

4.4.2 Type of benchmarking

There are different types, or levels, of benchmarking. According to Ali *et al.* (2013) and Beatham *et al.* (2004) the classifications of benchmarking are: internal, competitive, and functional. Internal

benchmarking is carried out with similar business units within the same organization, for example between different divisions or departments. This can be used to identify areas of best practice within a company, which could in turn be shared throughout the company (Beatham *et al.*, 2004). Competitive benchmarking involves comparing performance of an organization with those of its direct competitors in the same industry. Functional or generic benchmarking identifies best practices in any type of organization, and then compares this with best practices applied in other fields or industries (Ali *et al.*, 2013). This last type of benchmarking is thought to lead to the most change in an organization's process, due to the comparisons with those who are best in class. Also, because the organizations involved are no competitors, they are more likely to share the secrets of their success (Beatham *et al.*, 2004). Takim and Akintoye (2002) agree with this classification, but are using different terms. They only acknowledge two types of benchmarks: internal and external. In turn, they divide external into two classes: competitive and generic, which correspond to the three levels of benchmarking as previously stated. For this research, these three levels of benchmarking are adopted.

4.4.3 Benchmarking efforts in the Netherlands

Throughout the world efforts have been made to set up national benchmarking systems. For instance in Saudi Arabia (Ali *et al.*, 2013), the United Kingdom (Raynsford, 2000; Beatham *et al.*, 2004), and also the Netherlands (Bakens *et al.*, 2005). The goal of these systems is to improve industry performance (Raynsford, 2000) and transparency (Bakens *et al.*, 2005). For the purpose of this research, the current state of benchmarking in the Dutch construction industry is discussed. Where in other countries, like the United Kingdom, benchmarking systems have existed in the construction industry for quite some time, industry-wide benchmark data is not available in the Netherlands (Horstman & Witteveen, 2013). The only benchmarking system that does exist in the Netherlands is one for economic (i.e. financial) performance of construction companies. This system should serve as a starting point for a non-financial benchmarking system (Bakens *et al.*, 2005). Recently some efforts were made to practically implement such a system in the Netherlands. This started with research conducted by Bakens *et al.* (2005), who explored benchmarking efforts around the globe and selected best practices. Part of their investigation involves the application of PIPS (i.e. the BV approach) and incorporated this in their plan for the creation of a Netherlands Construction Performance Database (NCPD). This database should contain information on project, organization, and industry level benchmarking. They concluded that benchmarking on an industry-wide scale is a radical step for construction. "Other countries have gone down that route, and although experience is limited, there is evidence that it is a strong stimulus and support for reform." With their report they have shown that benchmarking is very relevant to increase the performance of the industry. Bakens *et al.* (2005) envision their research to provide "the foundation for to the development of a comprehensive system of construction benchmarking in the Netherlands". According to Horstman and Witteveen (2013), this system is required to improve performance of the sector.

At the time of this writing, a bill has just been accepted by the Dutch House of Representatives concerning a nationwide voluntary benchmarking system for the entire construction industry (TweedeKamer, 2017). According to the social cost benefit analysis (SCBA) that has been conducted for this new law, the introduction of the benchmarking system will greatly professionalize the sector (Koning *et al.*, 2016). The main benefit of this system is the increased transparency for small non-professional clients. This group of clients often finds it difficult to select suitable contractors for their projects. In addition, after awarding the contract this group finds it difficult to estimate the quality that will be delivered (Koning *et al.*, 2016). In addition to an increase in transparency, this law will allow contractors to assess their performance using external benchmarking. This opens up new possibilities for contractors to show dominance in tender plans.

In conclusion, the construction industry should be ready to reap the benefits and rewards that the new law provides. However, Costa *et al.* (2006) note that a benchmarking initiative demands a joint effort from several organizations, such as governmental entities, construction clients, individual companies, research institutions, and industry organizations to be successful. In addition, companies should be aware to not only use the industry performance measures as an indication of their performance; they still have to use their own specific measures for internal benchmarking and improvement (Beatham *et al.*, 2004).

4.5 Conclusion

This chapter provided an overview of the theoretical perspective on the terminology, characteristics of performance measures, the concept of leading and lagging measures, and benchmarking efforts in the construction industry. It defined the adoption of three levels of terminology: performance measure, performance measurement, and performance management. These terms are consistently used throughout this report. In addition, the characteristics to which successful performance measures should comply are discussed. Furthermore, it explained the concept of leading and lagging measures and endorsed its importance in the BV approach. Lastly, different types of benchmarking and its positive influence on company performance and the dominance in BV tender plans are described. The information provided in this chapter is used in the theoretical framework in Chapter 0, from where it is used the comparison with practice in Section III and in the development of the performance measurement framework in Section IV of this research.

5 The selected VPI themes: planning and stakeholder satisfaction

This chapter provides an overview of measures suggested in performance measurement literature concerning the selected VPI themes planning and stakeholder satisfaction. These VPI themes, determined in Chapter 3 of this report, are selected because of their importance to clients and due to VPI for these themes not being sufficiently available within BAM. Ali *et al.* (2013) determined the ten most significant measures for a construction company through a thorough research of international literature, which include measures for the selected VPI themes planning and stakeholder satisfaction. This shows that the importance of these selected themes is recognized around the globe. The information in this chapter is used in the theoretical framework in Chapter 0, from where it is used in the comparison with practice in Section III and in the development of the performance measurement framework in Section IV of this research.

5.1 Planning measures

On first glance, the VPI theme planning is closely connected to one of the three aspects of the 'Iron Triangle' (time, cost, quality); namely time. Performance measures for this topic are provided by multiple authors, but come down to simple measures like project duration or construction speed (Raynsford, 2000; Chan & Chan, 2004; Esmaeili *et al.*, 2013). However, when looking at the results from Chapter 3, it is evident that the VPI theme planning actually refers to the contractor's ability to reliably meet certain deadlines in a project. The measures that research provides for this aspect have various names, such as time variation (Chan & Chan, 2004), time predictability (Raynsford, 2000; Ali *et al.*, 2013), and schedule growth (Esmaeili *et al.*, 2013). All these measures come down to a comparison of planned project duration and actual project duration, displayed by the percentage of increase or decrease in duration. However, when the VPI that is produced by these measures is used in a contractor's tender plan for a BV tender, it does not acknowledge the fact that every project in this sector is susceptible to change due to complexities and outside influences. This would detract from the contractor's performance. Therefore, some authors propose to process the duration of mutually agreed and contractually approved change orders in the performance measure (Raynsford,

2000; Chan & Chan, 2004). The calculation for this measure, for which the name 'planning reliability' is adopted in this research, is provided below.

$$\text{Planning reliability} = \left(\frac{\text{Actual construction time} - \text{Revised contractual construction time}}{\text{Revised contractual construction time}} \right) 100\%$$

The previously discussed measures are determined at the end of a project, thus making them lagging measures for project performance. In addition, multiple authors propose leading measures for planning performance on projects. For instance, Gonzalez *et al.* (2008) developed the Process Reliability Index (PRI), which is the ratio of actual weekly progress to planned weekly progress of an activity. This measure serves as a leading indicator of project and planning progress, due to measuring single activities within a project. Another measure that allows monitoring planning performance and reliability during the execution of a project is Percent Plan Complete (PPC). This measures the percentage of activities that are 100% completed as planned (Olano *et al.*, 2009). A high PPC means that the planning is reliable and that the workflow is predictable (González *et al.*, 2010). PPC is the main measure used in the Last Planner System, which is a production planning and control system based on lean production principles (Ballard, 2000; González *et al.*, 2010).

In conclusion, as previously stated in Chapter 4, a combination of both leading and lagging measures is preferable. In addition, to ensure a valid representation of the contractor's performance, the contractually approved change orders should be processed in the performance measures in the form of a revised contractual construction time.

5.2 Stakeholder satisfaction measures

This subchapter aims to identify stakeholder satisfaction measures that are suggested in literature. A stakeholder satisfaction measure displays the result of a stakeholder management strategy, thus making it a lagging measure. However, as stated in Chapter 4, a lagging measure used to measure a certain part of a project can be used as a leading measure for a subsequent part, and thus also for the end result of the project. Previously to defining measures, it is important to know what aspects contribute to stakeholder satisfaction. For this purpose, unstructured interviews are conducted with two stakeholder manager of BAM who have contributed to both the selection and execution phase of construction projects. They state that stakeholder communication and collaborating with stakeholders are two aspects of importance when managing stakeholders. Jergeas *et al.* (2000) confirm this, stating that "communication with stakeholders" and "collaboratively setting common goals, objectives and project priorities" are the two aspects to improve the management of stakeholders. In addition, J. Yang *et al.* (2009) identified and ranked the top fifteen CSFs for stakeholder management in construction projects, in which "communicating with and engaging stakeholders properly and frequently" is in the top 3 factors.

Takim and Akintoye (2002) define six different stakeholder groups for construction projects: client, consultant, contractor, supplier, end-user, and the community. For this research, the VPI theme stakeholder satisfaction refers to the satisfaction of individuals, groups, or companies who have a stake in or are affected by a construction project during execution. When assigning this definition to one of the groups defined by Takim and Akintoye (2002), it corresponds with the community. Client and user satisfaction are regarded as separate VPI themes (see Chapter 3).

The research field of stakeholder management has been productive over the years. However, most research is aimed at identifying stakeholders (Mitchell *et al.*, 1997; Olander & Landin, 2005), matching stakeholder satisfaction to business success (Hallowell, 1996; Ittner & Larcker, 1998), influencing stakeholder satisfaction (Mihelis *et al.*, 2001; Strong *et al.*, 2001), or managing stakeholders in the context of a project (J. Yang *et al.*, 2011). Research into measuring company performance regarding the satisfaction of project stakeholders is limited. Most measures proposed are based on a single question or statement, in which a 5-point or 7-point Likert scale is used to

determine stakeholder satisfaction (Hallowell, 1996; Chan & Chan, 2004; Hartmann & Hietbrink, 2013; Li *et al.*, 2013). Other authors, like Ali *et al.* (2013), propose the use of a customer satisfaction survey or the number of complaints, without specifying how to collect VPI for these measures.

The research field concerning customer satisfaction in business-to-customer relations is more fruitful regarding satisfaction measures. Measures developed in this field of research are applicable to the construction industry mainly because contractors start viewing their stakeholders as customers, in addition to the client of the project. Therefore, the relation between the construction company and its stakeholders changes, which makes research from this field applicable. Techniques such as customer satisfaction survey (simply asking customers how satisfied they are), Customer Satisfaction Score (CSAT) (asking customers to rate their satisfaction on various aspects on a 5-point scale), Net Promoter Score (NPS) (customers are asked how likely they are to recommend your company), and the Customer Effort Score (CES) (asking customers how much effort they put in a certain interaction) are well-known methods and are applied in various industries. Especially NPS has received increased interest in research and Dutch businesses lately. This measure is introduced by Reichheld (2003) and is based on the idea that word of mouth is the metric that is linked to business growth and customer satisfaction. When applying this measure, first survey respondents are asked to rate their likelihood of recommending a company on a scale 1-10. Second, the proportion of respondents rating the firm a 6 or less (called “detractors”) is subtracted from the proportion of respondents rating the firm a 9 or 10 (called “promoters”); this difference represents the NPS (Reichheld, 2003). Keiningham *et al.* (2007) assessed the claim that NPS is the one measure to indicate business growth, for which they did not find evidence. Still, NPS is widely adopted and regarded as a solid measure for customer loyalty and customer satisfaction (Keiningham *et al.*, 2007). When the NPS is modified with a follow-up question regarding a motivation for the chosen score, using this measure to assess stakeholder satisfaction becomes more useful.

In addition to NPS, CES has also received increased interest lately. Although being less the subject of scientific research, early findings are promising. CES builds on the idea that delighting stakeholders by exceeding their expectations does not largely affect their loyalty and satisfaction; reducing their effort (e.g. the work they must do to get their problem solved) does. Acting deliberately on this insight can help improve stakeholder satisfaction and loyalty (Dixon *et al.*, 2010). The authors do stress to use CES along with other measures for stakeholder satisfaction.

When comparing these customer satisfaction measurement techniques, it is important to note that they are complementary. Companies should combine multiple measures, and find out through experimentation which mix of measures is most effective (Dixon *et al.*, 2010; Checkmarket, 2014). Table 3 provides an overview of the pros and cons of satisfaction measures discussed in this chapter. In conclusion, stakeholder satisfaction measures are lagging by definition. However, they are able to serve as leading measures when monitored over the course of a project. This chapter presented various different methods to measure stakeholder satisfaction. The most important finding is that in

Table 3: Stakeholder satisfaction measures proposed outside of construction industry literature

Measure	Properties	Pros	Cons
CSAT	Usually asked in relation to an event	Allows understanding of effect of an event	One event does not reflect entire project; easy to answer in middle range
NPS	Also indicates stakeholder loyalty	Simple, single question	Does not guarantee interviewee to actually recommend
CES	Focus on lowering effort, instead of meeting expectations	Easily pinpoints areas of improvement	Neglects influence of external factors

order to successfully measure stakeholder satisfaction, one should combine measures and adjust them to the specific situation.

5.3 Conclusion

This chapter discussed and presented a variety of leading and lagging measures for the selected VPI themes planning and stakeholder satisfaction. Important for the planning measures is to incorporate the contractually approved change order, to ensure a valid representation of the contractor's performance. In addition, when developing stakeholder satisfaction measures it is important to develop a set of multiple measures and adjust them to the specific situation. The measures presented in this chapter are used in the theoretical framework in Chapter 0, from where they are used in the comparison with practice in Section III and in the development of the performance measurement framework in Section IV of this research.

6 Relationship project goals and performance measures

As discussed previously, one of the main reasons why the BV approach was adopted in the Netherlands, is due to the short duration of the selection phase (Witteveen & Dorée, 2011). Consequently, contractors have limited time to analyze the clients' project goals, to develop measures, and to prepare their plans in the tender phase of a project. As described in Chapter 1, this leads to problematic situations in practice, which is confirmed by observations conducted within BAM during BV tenders. This chapter explores the theoretical perspective on this relationship and translates it to the scope of this research. This information is used to compare how this relationship expresses itself in practice (i.e. during a tender) and to gauge BAM's maturity in Section III of this research.

6.1 Theory

Multiple authors agree that for performance measurement to be effective, it has to be linked to the strategic objectives of an organization or business (Globerson, 1985; Mbugua *et al.*, 1999; Neely *et al.*, 2000). This approach is also used by Kaplan and Norton (1992) in their Balanced Scorecard (see Attachment 1), stating that a performance measurement framework takes business strategy as input and uses it to derive measures, which are used to examine the validity and implementation of the strategy later on. Bititci *et al.* (1997) describes this as a proactive closed loop control system, where the business strategies are deployed to all business processes, activities, tasks and personnel, and feedback is obtained through the performance measurement system to enable appropriate management decisions. This closed loop system is visualized in Figure 4.



Figure 4: The closed loop deployment and feedback system for the performance management process (adopted from Bititci *et al.* (1997))

One exception to this 'derive measures from strategy' movement is the research of Neely *et al.* (2001). They consider this approach a fallacy and advocated that performance measurement should first focus on measuring stakeholders' requirements and contributions and then on required strategies, processes, and capabilities. They claim that this is the case because there exists a reciprocal relationship between stakeholders and the organization. Therefore, in their framework (called the performance prism) they do not derive measures directly from strategy, but instead claim to first ask "Who are the important stakeholders and what do they want and need?" From there a strategy can be developed that ensures the satisfaction for the stakeholders. Thereafter, the core business processes and the required capabilities for these processes are established. When these aspects are in place, the firm can start thinking about how to measure their capabilities and performances (Neely *et al.*, 2001). Other authors agree with this approach, stating that performance measures and related outcomes should be developed based on the needs and expectations of stakeholders in order to determine the successful deployment of strategy (EFQM, 2012). Research on the relationship between the clients' project goals and the contractor's use of VPI in the light of the BV approach is limited (Horstman & Witteveen, 2013). This is mainly due to the novelty of the BV approach and the fact that it is only recently starting to be applied as a mainstream procurement process. In conclusion, at this point in time, research does not provide contractors with hand-on knowledge on how to approach this relationship in practice.

6.2 The relationship in a project-based BV environment

There is a major difference between the theoretical perspective on the goal – measure relationship as described above and the relationship in BV tenders in practice. Namely, the fact that in the case of BV tenders the project goals are defined by a different organization (the client) than the organization that has to develop the measures (the contractor). This results in a situation in which the contractor is only aware of the project goals at the start of a new tender. This fact in combination with the short duration of BV tender prevents contractors to only initiate the development of measures when a BV tender is commenced. There is simply no time to develop, implement, and periodically measure performance which results in usable VPI for the tender. This directly relates to the problem definition of this research, in which is described that due to the short duration of the selection phase there is no time to initiate the development of measures during a BV tender. This situation is defined as having a low maturity regarding the project goal – VPI relationship. It is characterized by an ad hoc 'hunt' for VPI, performance measurement is initiated during the tender, and the source of VPI is mainly restricted to a few project references.

In order to establish a higher maturity in this relationship, VPI should already be available at the start. Thus contractors should therefore always have insight in how they perform on the themes that are of importance to their clients in order to collect suitable VPI. To this end, investigating the client's perspective on performance, as conducted in Chapter 3, is of great importance. In order to keep up with one's client's wishes and demands, their perspective on performance should periodically be investigated. This client perspective should then be used by the contractor to develop measures, and periodically monitor them, and initiate the creation of a database of VPI that is usable in BV tenders. When this database has been established, the tender characterizes itself by a structured inquiry and collection of VPI, performance measurement is built-in into the business process, and the VPI originates from a company-wide database.

6.3 Conclusion

In conclusion, due to existing research on this topic focusing on approaching the relationship from the project goal side within an organization and not the performance measure side, it does not offer suggestions or solutions which are helpful in the case of the BV approach. Approaching the relationship from the project goal side results in ad hoc and unorganized collection of VPI in BV

tenders. It is important for contractors to keep striving for a database of VPI, which corresponds with the clients' wishes and demands and is readily available for use in BV tenders. Only when this is done correctly, and the VPI is available, can the relationship be approached from the VPI side: what VPI do we as a company possess that is suitable to give substance to the project goals? This research contributes to this by developing the performance measurement framework in Section IV. In addition, BAM's degree of maturity in this relationship in tenders is investigated in Section III.

7 Theoretical framework

The previous chapters in this section provided an overview of performance measurement in construction, measures for the selected VPI themes planning and stakeholder satisfaction, and discussed the relationship between project goals and performance measures. The recommendations and conclusions from these chapters are processed in the theoretical framework of this research, which is shown in Figure 5. By investigating and discussing the various topics in this section, it succeeds in answering the second sub research question:

What is the theoretical perspective on performance measurement, and particular the measurement and monitoring of the selected VPI themes?

The theoretical framework is used in the comparison between theory and practice in Section III and in the development of the project performance measurement and monitoring framework in Section IV of this research.

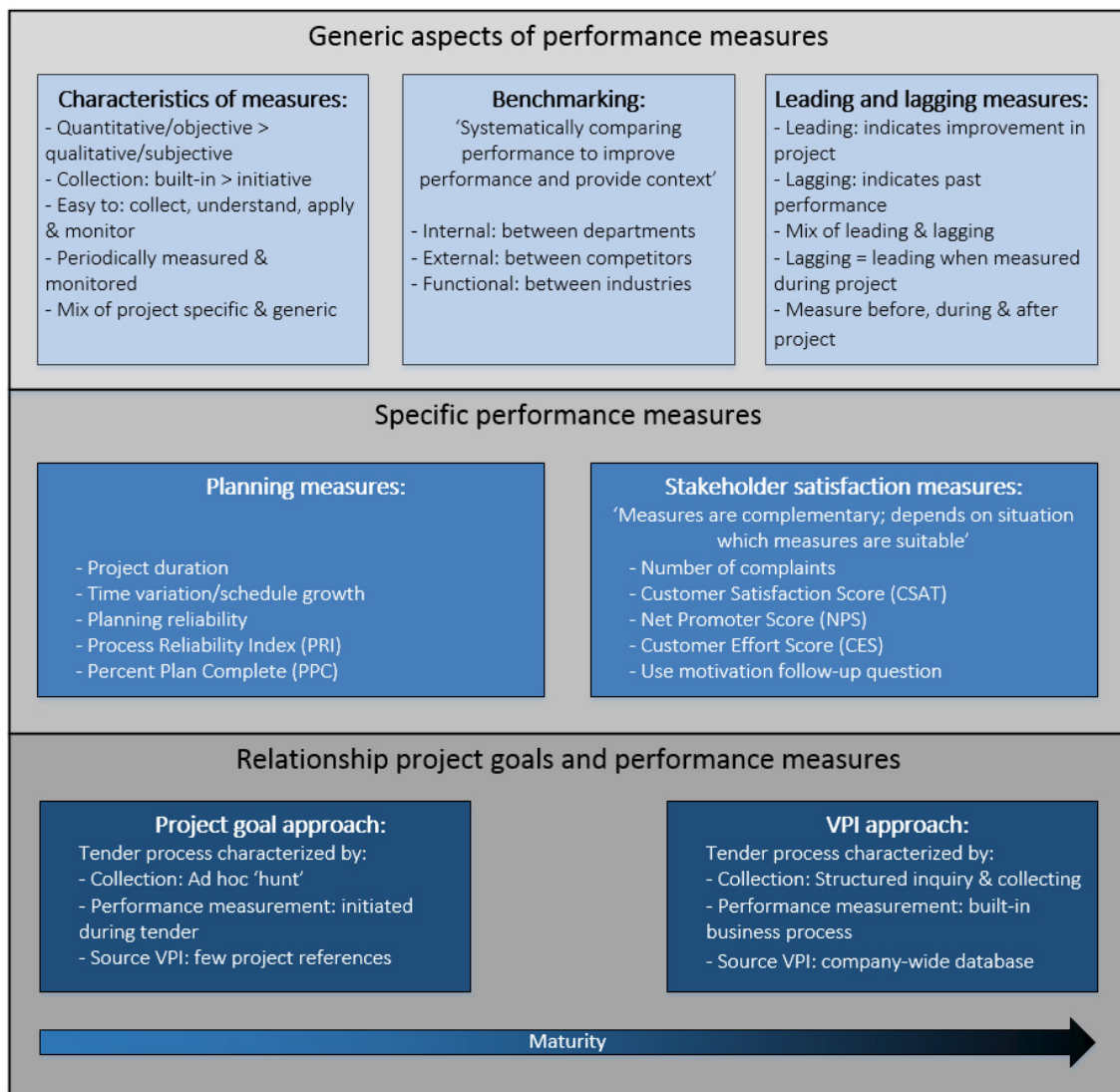


Figure 5: Theoretical framework



Section III: Empirical perspective

Central in this section are the third and fourth sub research questions which are related to how BAM uses VPI in BV tenders and how this compares to the theoretical framework, as presented in Chapter 7. To gain an in-depth understanding of how VPI for the selected VPI themes planning and stakeholder satisfaction are used in practice, a multiple case study is designed and executed to answer the following research questions:

3. *‘What VPI (for the selected themes) is used in Best Value tenders within BAM to give substance to the project goals and how is this information found and gathered during the tender?’*
4. *‘What are the differences and similarities between the theoretical perspective on VPI and VPI used in practice (for the selected VPI themes) during Best Value tenders of BAM?’*

The aim of this section is to determine the current state of performance measures, and corresponding VPI, used in BV tenders of BAM. Comparing this to the theoretical framework reveals differences and similarities, and thus areas of improvement, which are used in the development of the performance measurement framework in Section IV of this report. This third section discusses the following topics: in Chapter 8 the research method including case study design, case selection, data collection, and case analysis are described. Chapter 9 presents and analyzes the results of the multiple case study. Lastly, in Chapter 10 the patterns in the results are presented and reflected upon.

8 Methodology

This chapter describes how the multiple case study is conducted. First, the research design of the case study is explained. Secondly, the case selection is described. Thereafter, the data collection and analysis methods are presented. Lastly, the validity and reliability of the research method is discussed.

8.1 Case study design

A case study is an empirical study that investigates a contemporary phenomenon in depth and within a real-life context (Yin, 2009). It is suitable for learning more about a little known or poorly understood situation. In a case study a particular individual, program, or event is studied in depth. In this research, a BV tender is considered a case. Multiple cases are investigated in order to get an understanding of the current use of VPI within BAM. Data obtained when executing a multiple case study is generally more compelling and robust in comparison to investigating a single case. This is mainly due to the enhanced likelihood of reaping results and to the positive effects on the generalizability of the findings. As a result, the conclusions are more powerful (Leedy & Ormrod, 2014).

Yin (2009) makes the distinction between holistic and embedded case studies. Holistic design is concerned with examining the global nature of a case. It is most often used when there is no logical subunit to investigate within the case. A typical problem with this approach is that the study remains on an abstract level and does not give clear results. Embedded case study design is concerned with particular units of analysis within a case. It can serve as a tool to focus on a certain inquiry.

This research is interpreted as an embedded case study, because the object of study is limited to VPI concerning the selected themes planning and stakeholder satisfaction. These are embedded as a part of all VPI used within a tender. The next subchapter elaborates on how the cases are selected.

8.2 Case selection

The selection of tenders is an important first step in the case study of this research, because it sets the initial boundaries of the research sample that is analyzed. The selection of cases is therefore not performed in a random manner, but is conducted using a structured approach using selection criteria to optimize the generalizability of the results. This subchapter describes the selection of cases for analysis in this research. First, the selection criteria are explained. Thereafter, the selected cases are presented.

8.2.1 Selection criteria

The criteria that are used to select the cases are based on the research scope. Additional criteria have been added to ensure that the sub research questions can be answered, which are shown below:

- In order to have access to all data and employees that worked on the tender, it must have been handled by the Tender Strategy department of BAM.
- The tender must be executed in the past two years. This ensures that all details and particularities are still fresh and have not been forgotten or mixed up. It is also important to study current and recent BV tenders, because the professionalism of these tenders is increasing rapidly over the past few years (van de Rijt & Santema, 2013).
- To enable a solid analysis of the cases and the VPI used in the cases, the underlying evidence and supporting documents must be available.
- The selected VPI themes, planning and stakeholder satisfaction, must be present in the project goals.

For a case to be selected, it should comply with all selection criteria.

8.2.2 Selected cases

The presented selection criteria are used to select cases for the multiple case study. Applying the selection criteria to BAM's project sample results five tenders that comply with all criteria. Five cases are considered by Yin (2009) as sufficient to draw conclusions using a multiple case study approach. The selection consists of the following five tenders, provided with contract type and size to give an indication of the type of project:

- Tender 1: Design and Construct, €6.75M
- Tender 2: Design and Construct, €18.1M
- Tender 3: Design and Construct, €18.7M
- Tender 4: Framework contract, €2.3M
- Tender 5: Design and Construct, €3.15M

An overview of the general background and content of the selected cases is provided in Attachment 3. The procedure that is followed for the analysis of each case is described in the next subchapter.

8.3 *Case study procedure*

In order to enhance the reliability the process of analyzing the selected cases, a procedure is used. This enhances the possibility to compare results between cases and to generalize the findings (Yin, 2009). This subchapter describes this procedure by discussing the data collection and data analysis methods.

8.3.1 Data collection

In this research, data is collected in two different ways: using project documentation and interviews with tender strategists of BAM. The two collection methods are described below.

Project documentation

Project documentation is used to gather information concerning the cases. It is used to provide an objective view on the quality of the VPI used in tenders by BAM. The strengths of using documentation include that they are stable and can be revisited repeatedly to acquire information. Besides, the documentation is created in the light of the tender and not specifically for this research. This has a positive influence on the objectivity of the information. Documents that are analyzed include the tender documents provided by the client, the contractor's tender plans, and the evidence that supports the performance claims made in the tender plans. These documents are available for use in this research through the Tender Strategy department database of BAM.

Interviews

Interviews are used to acquire insight in the maturity of the relationship between the project goals and VPI (as described in Chapter 6) used in tenders, as perceived by the involved tender strategists. These employees have a good position to provide a comprehensive overview of the maturity of this relationship throughout a tender. Interviewees are requested to estimate their perceived maturity on the relationship at the start of the tender using a number from 1 till 5, where 1 stands for a project goal approach and 5 stands for a VPI approach (see theoretical framework in Chapter 0). Next, they are asked to motivate their answers. Lastly, the interviewees are requested to repeat these two steps for their perceived maturity at the end of the tender. This allows reviewing the development process of the VPI during the tender. To ensure the collection of reliable results, interviewees are required to have been involved in the tender from start to finish.

Important strengths of the interview method are that it is directly focused on the research topic and provides specific insight in the cases. Possible weaknesses relate to biased responses, poor questioning, or interviewees giving desired answers (Yin, 2009). These weaknesses are mainly overcome by using a format for the questions, enabling the interviewees to prepare by providing them with an overview of the content and reviewing the answers with the interviewees in a later stage. The interview formats are provided in Attachment 6.

The interviews have a semi-structured nature, which allows open conversation. In this way, interviewees tend to bring up other aspects as well that may be of importance to the research. The questions are guided by using the interview format, which gives direction to the interviews and ensures the collection of specific data. At the same time, the possibility to acquire additional insights remains. For each case, interviews are held with the tender strategists responsible for that tender. Two interviews are conducted for each case; this allows the comparison of the individual perception of the tender strategists and improves the reliability of the data. Attachment 4 provides an overview of the interviewees.

8.3.2 Data analysis

The data collected using the project documentation and interviews is analyzed on two levels: individual cases (within-case analysis) and between cases (cross-case analysis). The two levels of analysis are described below, while making a distinction between the project documentation and interview methods for the within-case analysis. The within-case analysis results are important input for the cross-case analysis.

Within-case analysis: project documentation

The within-case analysis is the in-depth exploration of a single case, without acknowledging outside influences. It is used to develop a standalone understanding, conclusions, and recommendations of each case and to understand the unique elements of each case. It is the important first step in understanding the nature of the cases in a multiple case study, by providing an overview of the quality of VPI used in each tender. In order to establish this, for each case the following steps are conducted:

1. The client's project goals concerning the VPI themes planning and stakeholder satisfaction are designated
2. BAM's performance claims which address these project goals are designated
3. The VPI which supports these performance claims is designated
4. The evidence and supporting documents that proof the VPI are tested using the theoretical framework (as presented in Chapter 0), to expose the differences and similarities between theory and BAM's practice.

Table 4 summarizes the findings from the theoretical framework, where the first column shows the subjects as discussed in Section II. The second column shows the classifications for these subjects. For instance, the data collection process is either built-in into BAM's process or has to be initiated during a BV tender. In this example the former is the viable option in the case of the BV approach, as discussed by Globerson (1985). The third column shows the symbols which are used in Table 5 and Table 6 in the next chapter (Chapter 9), to enable a clear presentation of the results of this analysis. These results represent the quality of the VPI used in the selected cases.

Within-case analysis: interviews

After the interviews with the two involved tender strategists for each case are conducted, the individual results provided by the first interviewee are compared to the results provided by the second interviewee. When the maturity within a case is perceived unequally by the two interviewees, the results are discussed with the two interviewees on the basis of which they are allowed to alter their responses once. Next, the maturity as perceived by the tender strategist is compared to the results that the project documentation study provides. This allows for conclusions to be drawn concerning the differences and similarities between the objective quality of VPI and subjective perceived maturity of VPI within each case. The interview results represent the perceived maturity on the relationship between project goals and VPI within each case.

Table 4: Project documentation analysis: Theoretical subjects and classifications linked to result symbols

Theoretical subject	Classification	Result symbols
Type of data	Qualitative / subjective	Ql
	Quantitative /objective	Qn
Data collection	Initiative	In
	Built-in	Bu
Easily understandable	Difficult	No
	Easy	Yes
Periodically monitored	Not periodic	No
	Periodic	Yes
Project specific & generic data	Generic	Generic
	Specific	Specific
	Mix	Mix
Leading & lagging	Lagging	Lagging
	Leading	Leading
	Mix	Mix
Benchmark	Benchmark not used	-
	Internal	Internal
	External	External
	Functional	Functional
Planning/satisfaction measure	Theory measures not used	-
	Measure proposed in theory	Measure ‘...’
Verifiable	Not verifiable	No
	Verifiable	Yes

Cross-case analysis

In the cross-case analysis the results of the within-case analysis are compared to identify commonalities and differences between the cases. First, the project documentation results are compared. Next, the interview results are compared. Lastly, it is compared whether the perceived maturity matches the objective quality between the cases. This analysis allows to find patterns in the data across multiple cases and to generalize the findings. As previously stated, this improves the quality of conclusions that are drawn based on the collected data.

8.4 *Validity and reliability of the research method*

In this subchapter the validity and reliability of the research methods are considered. First validity is considered, next the reliability of the study is explained.

8.4.1 Validity

Validity refers to the notion if it is possible to draw useful and meaningful conclusions from the results of this study (Leedy & Ormrod, 2014). Two types of validity are important to consider for this study: construct validity and external validity.

Construct validity is concerned with the question if the correct measures are used for the concepts that are being studied. It is concerned with the link between the research questions, the collection of data, and the analysis methods (Yin, 2009). In this study, construct validity is achieved by using multiple sources of evidence, such as project documentation and interviews, to collect data and develop insights. The use of a multiple case study, instead of a single case, also contributes. Throughout the study a chain of evidence is presented, which links sources of evidence and data to

each other. This is maintained according to the structure of the research. In addition, experts for the two selected VPI themes are involved with checking the results of Section III and with developing the performance measurement framework in Section IV. Lastly, the expertise of BAM's tender strategists is utilized throughout the entire research project, which also has a positive influence on the construct validity.

External validity is concerned with if the findings of the multiple case study can be generalized beyond the study itself. Because the five selected cases are different in size, location, and objects to construct (see Attachment 3) the case sample is representative. This means that the findings in this study are valid outside these five cases.

8.4.2 Reliability

The reliability of scientific research is concerned with to what extent the data and corresponding analysis can be replicated by others, in order to arrive at the same results (Leedy & Ormrod, 2014). The main effort to enhance the reliability in this research is the use of the case study procedure, which ensures that for every case the same data is collected and analyzed in a systematic and similar manner. In addition, the use of a clear research structure in which is defined what activities provide which results improves the reliability.

8.5 Conclusion

This chapter described the methodology for the multiple case study, which serves as the empirical part of this research. Firstly the type of case study, namely an embedded case study, is defined. Thereafter, the criteria for the selection of five cases are described and the selected cases are presented. Third, the case study procedure is described. This procedure ensures that for each case the collection and analysis methods are similar. The two data collection methods, project documentation and interviews, are discussed. In addition, the two levels of data analysis (within-case and cross-case analysis) are adopted and described. Lastly, the validity and reliability of the research method is considered. The next chapter presents and analyzes the results of the multiple case study.

9 Presentation and analysis of the results

This chapter presents and analyzes the results of the multiple case study. First the results of the project documentation study and interviews are presented. Secondly, the results are analyzed using the within-case and cross-case analysis. The within-case analysis tests the results to the theoretical framework in Chapter 0, which results in the objective quality of the VPI used in each case. The cross-case analysis compares the results of the individual cases to find patterns in the differences and similarities between the theoretical framework and BAM's BV tenders.

9.1 Result presentation: project documentation

This subchapter describes the results of the project documentation study. This study tested the quality of the VPI used in the cases with the theoretical framework (as presented in Chapter 0). Attachment 7 provides a table with the raw data. An overview of the results is presented in Table 5 for the VPI theme planning and Table 6 for the VPI theme stakeholder satisfaction. As can be seen, the subjects shown in the top row of Table 5 and Table 6 correspond with the classifications as presented in Table 4 in the previous chapter. The symbols used in the tables in this chapter also correspond with the symbols presented in Table 4, with the addition of 'Source of evidence'. This column provides insight into the type of evidence and supporting documents that are collected in this project documentation study. Thereafter, the results of this study for the two VPI themes as presented in Table 5 and Table 6 are described.

9.1.1 VPI theme planning

When looking at the results of the project documentation study for the VPI theme planning in Table 5, some general statements can be made. These are provided per theoretical subject.

Source of evidence

Figure 6 visualizes the distribution of the sources of evidence that are used to support the performance claims for the VPI theme planning. Below some examples of these sources are provided:

- Project duration of reference projects in combination with forms stating that the client is overall satisfied with the project, without referring to planning performance directly
- Project delivery reports of reference projects
- Grades provided by the clients of reference projects for planning performance

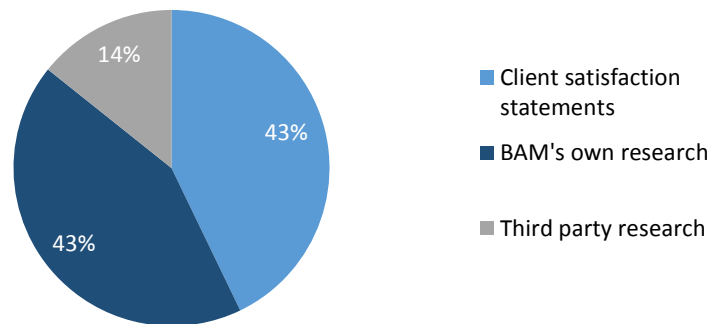


Figure 6: Sources of evidence VPI theme planning

Qualitative vs. quantitative

All VPI used in the selected cases is of a qualitative/subjective nature. This is due to varying reasons:

- In case 1, the VPI only consists of forms stating that the client is overall satisfied with the project, without referring to planning performance directly.
- In case 2, the VPI consists of the project duration of two reference projects in combination with forms stating that the client is overall satisfied with the project, without referring to planning performance directly.

Table 5: Results project documentation study VPI theme planning. Type of evidence: A = client satisfaction statement, B = BAM's data, C = third party research

Case	Source of evidence	Qualitative/quantitative	Initiative/built-in	Easy to understand	Periodically measured	Generic/specific	Leading/Lagging	Benchmarks	Planning measures	Verifiable
Tender 1	A	QI	Bu	Yes	No	Specific	Lagging	-	-	Yes
Tender 2	A, B	QI	In	Yes	No	Specific	Lagging	-	Project duration	Yes
Tender 3	B, C	QI	Bu	Yes	Yes	Generic	Lagging	External	-	Yes
Tender 4	B	QI	Bu	Yes	No	Specific	Lagging	-	-	No
Tender 5	A	QI	Bu	Yes	No	Specific	Lagging	-	-	Yes

- In case 3, the VPI consists of subjective grading on planning performance by the client on past projects in combination with BAM's own performance measurement.
- In case 4, the VPI is not numerically or objectively measured
- In case 5, the VPI is based on grades that originate from the subjective view of clients

Built-in vs. initiated data collection

Data collection is built-in BAM's business processes in all cases, with the exception of case 2. The collection of the VPI used in this case, which consists of design and construction times, is initiated during the tender.

Easy to understand

All VPI is found to be easily understandable.

Periodically measured

Case 3 is the only case in which the VPI is periodically measured. All other cases use VPI that originates from a single measurement at the end of reference projects.

Project specific vs. generic data

Project specific VPI is used in all cases except case 3, where only generic company-wide VPI is used. The combination of both generic and project specific VPI is never made.

Leading and lagging measures

All VPI is found to originate from lagging performance measures. VPI that originates from leading measures or the mix of leading and lagging measures is never utilized.

Benchmarks

Only in case 3 an external benchmark is used to provide context to BAM's performance. This benchmark is provided by the 'Bewuste Bouwers' foundation.

Measures proposed in literature

Planning measures that are proposed by literature, as discussed in Chapter 5, are only present in case 2. This case utilizes the design and total project duration to support the performance claim.

Verifiable

All performance information is found to be verified by a client or third party, with the exception of case 4. In this case the performance information originates from internal project delivery documents, which are not verified by the client or third party.

9.1.2 VPI theme stakeholder satisfaction

When looking at the results of the project documentation study for the VPI theme stakeholder satisfaction in Table 6, some general statements can be made. These are provided per theoretical subject.

Source of evidence

Figure 7 visualizes the distribution of the sources of evidence that are used to support the performance claims for the VPI theme stakeholder satisfaction. Below some examples of these sources are provided:

- BAM's own satisfaction surveys are used, which are conducted at reference projects. Stakeholders are asked to provide their satisfaction on certain topics
- Research conducted by the 'Bewuste Bouwers' Foundation
- Number of complaints register of reference projects

Qualitative vs. quantitative

All VPI used in the selected cases is of a qualitative/subjective nature, with the exception of one performance claim in case 3 and both performance claims in case 4. These two cases utilize the total number of complaints on reference projects as VPI, which is quantitative/objective performance information. The VPI in the other cases being qualitative is due to varying reasons:

- In case 1, the results of the stakeholder satisfaction surveys are comprised of stakeholder opinions provided with a grade.

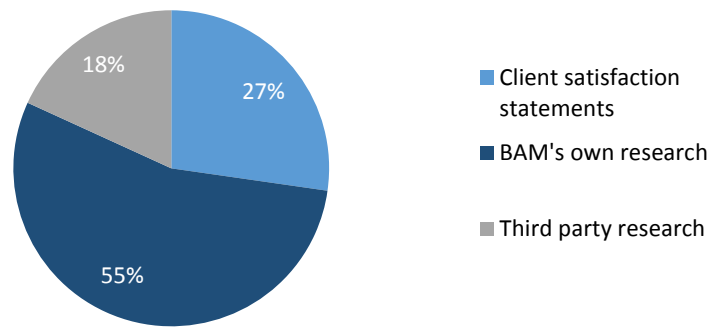


Figure 7: Sources of evidence VPI theme stakeholder satisfaction

- In case 2, an audit report which is comprised from the perspective of the auditor is used as evidence document
- The VPI for the first claim in case 3 is qualitative/subjective, due to it consisting of stakeholders' opinions
- In case 5, the VPI also consists of stakeholders' opinions

Built-in vs. initiated data collection

For all cases the VPI originates from data collection processes that are built-in BAM's business process.

Table 6: Results project documentation study VPI theme stakeholder satisfaction. Type of evidence: A = client satisfaction statement, B = BAM's data, C= third party research

Case	Source of evidence	Qualitative/quantitative	Initiative/built-in	Easy to understand	Periodically measured	Generic/specific	Leading/Lagging	Benchmarks	Satisfaction measures	Verifiable
Tender 1	B	Ql	Bu	Yes	Yes	Specific	Lagging	External	-	No
Tender 2	C	Ql	Bu	Yes	No	Specific	Lagging	External	-	Yes
Tender 3	C	Ql	Bu	Yes	Yes	Specific	Lagging	External	CSAT	Yes
	A, B	Qn	Bu	Yes	Yes	Specific	Lagging	-	# Of complaints	Yes
Tender 4	A, B	Qn	Bu	Yes	Yes	Specific	Lagging	External	# Of complaints	Yes
	A, B	Qn	Bu	Yes	Yes	Specific	Lagging	Functional	# Of complaints	No
Tender 5	B	Ql	Bu	Yes	No	Specific	Lagging	-	-	No
	B	Ql	Bu	Yes	No	Specific	Lagging	External	-	No

Easy to understand

All VPI is found to be easily understandable.

Periodically measured

In case 1, 3, and 4 the VPI is periodically measured throughout the course of the reference projects. The other two cases use VPI that originates from a single measurement at the end of reference projects.

Project specific vs. generic data

Project specific VPI is used in all cases. The combination of both generic and project specific VPI is never made.

Leading and lagging measures

All VPI is found to originate from lagging performance measures, which is to be expected as described in Chapter 5.

Benchmarks

The VPI is provided with context through the use of benchmarks in all cases. Only for two performance claims, one in case 3 and one in case 5, are not provided with a benchmark. The benchmarks originate from the 'Bewuste Bouwers' foundation or are provided by the client.

Measures proposed in literature

In case 3 and 4 VPI is used that originates from stakeholder satisfaction measures which are also proposed in literature, as discussed in Chapter 5. Case 3 utilizes the CSAT score and the number of complaints on reference projects. Case 4 also utilizes a complaints register from reference projects.

Verifiable

55% of the VPI for this theme originates from BAM's own research (see Figure 5). The performance information generated by this research is currently not being verified by clients or a third party. Consequently, only the performance information in case 2, 3, and 4 is verified.

9.2 Result presentation: interviews

This subchapter describes the results of the interviews, which are used to acquire insight in the maturity of the relationship between the project goals and VPI (as described in Chapter 6) used in tenders, as perceived by the involved tender strategists. For each case two interviews are held, in which the interviewees have to estimate their perceived maturity at the start and end of the tender. For this purpose they use a number from 1 till 5, where 1 stands for a project goal approach and 5 stands for a VPI approach (see Chapter 0). The results of these interviews are presented in Table 7 for the VPI theme planning and in Table 8 for the VPI theme stakeholder satisfaction. The interviewees are also asked to motivate their estimates. All these motivations are shown in the filled in interview formats in Attachment 6. Thereafter, the results of the interviews are described.

9.2.1 VPI theme planning

The insights provided by the interviewees are described per case for the VPI theme planning.

Case 1

The interviewees state that a lot of information is stored. However, they are doubtful whether the information is centrally stored because they found it difficult to find project specific VPI. "There should be much more reference projects within BAM, so I do not believe that the source of this VPI is company-wide". This statement provided by an interviewee confirms the low maturity scores because, as it discussed in Chapter 6, a company-wide database is required to move to a higher maturity. The interviewees mainly mentioned client satisfaction surveys as a basis for VPI, instead of addressing BAM's data about planning performance. This confirms a lack of quantitative/objective and numeric data for this VPI theme.

Table 7: Interview results VPI theme planning (maturity 1-5)

Case	Interviewee	Maturity start tender	Maturity end tender
Tender 1	Interviewee 1	2	3
	Interviewee 2	2	3
Tender 2	Interviewee 1	1	2
	Interviewee 2	1	3
Tender 3	Interviewee 1	3	4
	Interviewee 2	2	3
Tender 4	Interviewee 1	1	2
	Interviewee 2	1	2
Tender 5	Interviewee 1	1	2
	Interviewee 2	1	2
Average		1.5	2.6

Table 8: Interview results VPI theme stakeholder satisfaction (maturity 1-5)

Case	Interviewee	Maturity start tender	Maturity end tender
Tender 1	Interviewee 1	1	2
	Interviewee 2	1	2
Tender 2	Interviewee 1	2	4
	Interviewee 2	2	3
Tender 3	Interviewee 1	2	3
	Interviewee 2	2	3
Tender 4	Interviewee 1	4	4
	Interviewee 2	4	4
Tender 5	Interviewee 1	2	2
	Interviewee 2	2	2
Average		2.2	3.0

Case 2

The interviewees state that the VPI at the start of the tender consisted of a few client satisfaction surveys, which contradicted each other. The VPI was available at the end of the tender, although only being project specific according to the interviewees. The difference in perceived maturity between the interviewees is due to interviewee 2 noting that the combination of using project durations and client satisfaction surveys is a new way of supporting the performance claim.

Case 3

The interviewees state that the VPI at the start of the tender consists of a structured and uniform performance grade, provided by the client. At the end of the tender, additional grades were found, which increased the dominance of the VPI. However, BAM's own data concerning a Monte Carlo analysis is not verifiable according to the interviewees. The difference in perceived maturity between the interviewees is due to interviewee 2 weighing BAM's own VPI heavier.

Case 4

The interviewees state that the VPI at the start of the tender was mostly absent. The VPI that was available was not centrally stored. At the end of the tender, the VPI for the reference projects was available but still not centrally stored.

Case 5

The interviewees state that the VPI at the start of the tender was mostly absent. The VPI that was available was unstructured. At the end of the tender the VPI originated from a limited amount of reference projects and was still unstructured.

In addition to these insights per case, in all cases the maturity improved, meaning that the tender team was able to find useful VPI during the tender phase.

9.2.2 VPI theme stakeholder satisfaction

The insights provided by the interviewees are described per case for the VPI theme planning.

Case 1

According to the interviewees, the VPI collection in the tender was ad hoc, with a limited amount of reference projects. However, they did state that the VPI was collected in a built-in manner during the execution of the reference projects. The maturity increase during the tender is mainly due to the tender database of the Tender Strategy department. The interviewee noted that this database provided the VPI for this theme.

Case 2

Both interviewees state that only some unsatisfactory client satisfaction surveys were available at the start of the tender. In addition, they state that at the end of the tender the 'Bewuste Bouwers' scores were available. These scores were found in an incomplete company-wide database. The difference in maturity between the interviewees is due to the fact that interviewee 2 experienced the finding of VPI to be more ad hoc than interviewee 1.

Case 3

Both interviewees mention that at the start of the tender the VPI was not consistent, not uniform, and not centrally available. At the end, surveys and a complaints register were accessible. These were found to be unstructured by both interviewees.

Case 4

Both interviewees mention that at the start of the tender the VPI concerning the number of complaints was available and structurally stored as part of the reference projects. By the end of the tender the VPI was not improved according to the interviewees.

Case 5

Both interviewees mention that at the start of the tender the VPI only originated from a limited amount of reference projects. Also, the VPI is not structurally or centrally stored. Interviewee 1 states that by adding the found VPI to the Tender Strategy database, the maturity of the VPI improved.

In addition to these insights per case, it can be stated that in most cases the maturity improved, meaning that the tender team found useful VPI during the tender.

9.3 Result analysis: within-case analysis

In this subchapter the results of step 4 of the within-case analysis are described (as explained in Chapter 8). This step concerns the testing of the BAM's practice in BV tenders to the theoretical framework in Chapter 0, which results in the objective quality of the VPI used in each case. In addition, this subchapter describes the remarkable results within in the individual cases. Lastly, the objective quality (as determined using the project documentation study) and the perceived maturity (as determined using the interviews) of the VPI are compared.

9.3.1 Objective quality of the cases

To determine the objective quality of the VPI for each case, the nine subjects in the theoretical framework are used (see Chapter 0). The objective quality of a case is portrayed as the amount of theoretical subjects that are similar to what is proposed in theory. For example, the planning VPI in case 1 is collected using a built-in process, is easy to understand, and is verified by a client or third party (see Table 5). This results in three out of the total of nine theoretical subjects that are similar to what is proposed in the theoretical framework. Table 9 provides an overview of the objective quality of all individual cases for both VPI themes.

9.3.2 Remarkable results within the individual cases

In case 2, the collection of VPI for the theme planning had to be initiated during the tender. This can be explained by the fact that to support the performance claim for this tender, BAM used the design duration and total project duration of two reference projects. This VPI is used to show that BAM can meet a certain deadline. For BAM this is a new way of supporting their performance claim, which has not been used previously. Therefore, the VPI was not already collected and readily available for use in the tender plans.

Table 9: Overview of the objective quality of the VPI in all cases

Case	Quality planning	Quality stakeholder satisfaction
Tender 1	3/9	4/9
Tender 2	3/9	4/9
Tender 3	5/9	6/9
Tender 4	2/9	6/9
Tender 5	3/9	2/9
Average	3.2/9	4.4/9

In case 3, only generic VPI is used for the theme planning. This VPI consists of performance grades provided by a client on reference projects. Although this grade specifically concerns planning performance, it is the average grade over a variety of different projects, which makes the VPI generic. The link between generic and project specific VPI is not utilized to show BAM's performance. This result can be explained by the fact that BAM was not able to collect project-specific VPI for this case during the tender phase, for instance, by using their own research. Because the document that provides the grade on planning performance also shows insight in other contractors planning performance, the generic VPI in this case could be benchmarked.

In case 3, all three sources of evidence are used concerning the stakeholder satisfaction performance. These are used to support two different performance claims. One claim concerns overall stakeholder satisfaction, which is measured using the CSAT score. In addition, a complaints register of reference projects is used for a second performance claim. This combination of multiple sources of evidence and different performance claims for one VPI theme result in a high objective quality of 6/9 (see Table 9).

In case 4, planning performance information is not verified by a client or third party. This is due to only using BAM's own research as a source of evidence without asking a client or third party for a verification of the performance. In case 5, a similar result is observed concerning the performance information for stakeholder satisfaction. This performance information also originates from BAM's own research, which has not been verified. When reflecting this on the BV approach, one can say that performance information which has not been verified can cause discussions and arguments to form between the client and contractor concerning the validity of the performance. This result can be explained by the fact that only recently clients have become stricter concerning the verifiability of the performance information.

9.3.3 Objective quality vs. perceived maturity

This subchapter aims to explore if the perceived maturity on the VPI of BAM's tender strategists who worked on the selected cases matches with the objective quality as determined in the previous subchapter. This is discussed below for every case.

Case 1

The objective quality of the VPI as determined by the document study matches the perceived maturity of the VPI. This is shown through some similar results, such as:

- No use of BAM's performance data for planning VPI: documentation study shows that only client satisfaction surveys have been used. The interviewees also only refer to these surveys.
- The limited amount of reference projects for stakeholder satisfaction VPI: the documentation study found that only six reference project were used, the interviewees confirmed this finding in the interviews

Case 2

The objective quality of the VPI as determined by the document study matches the perceived maturity of the VPI. This is shown through some similar results, such as:

- The use of only two reference projects: the documentation study and interviewees both show the lack of references
- VPI for both themes is only project specific: this is a results of both methods
- The company-wide database for the stakeholder satisfaction VPI as mentioned by the interviewees confirms the built-in collection process.

Case 3

The objective quality of the VPI as determined by the document study does not match the perceived maturity of the VPI in this case. This is due to the perceived maturity being more pessimistic than what is shown by the results of the project documentation study. This can be explained by the interviewees' ability to propose improvements to the VPI and its collection process in the interviews, while the objective quality in this case is the highest out of all cases (see Table 9).

Case 4

The objective quality of the VPI as determined by the document study matches the perceived maturity of the VPI. This is shown through some similar results, such as:

- The low perceived maturity for the VPI theme planning is consistent with the objective quality which is found in the documentation study
- The structured databases for the number of complaints at the start of the tender are consistent with the built-in and periodically collection of the VPI as found in the documentation study.

In addition, this case shows extremely varying results between the two VPI themes. Only the facts that the VPI for both themes is collected using a built-in process, is easy to understand, and is derived from lagging performance measures are similar.

Case 5

Within this fifth case, the objective quality of the VPI as determined by the document study matches the perceived maturity of the VPI. This is shown through the VPI not being similar to the theoretical perspective, which is confirmed by the interviewees stating the unstructured and not centrally stored VPI.

Table 10 provides an overview of the match between the objective quality and perceived maturity for each case.

Table 10: Overview of the match between objective quality and perceived maturity

Case	Quality vs. maturity
Tender 1	Match
Tender 2	Match
Tender 3	No match
Tender 4	Match
Tender 5	Match

9.4 Result analysis: cross-case analysis

This subchapter compares the results of the individual cases to find patterns in the differences and similarities between the theoretical framework and BAM's BV tenders. These patterns between the cases are discussed below.

9.4.1 Type of evidence, benchmarks, verifiable performance

When a combination of types of evidence is used, the objective quality of the VPI increases. This becomes evident when looking at the type of evidence and supporting documents used in the cases and compare this to the results in Table 9. For instance, in cases 3 and 4 multiple types of evidence

are used. These cases also show a high objective quality for the VPI theme stakeholder satisfaction (both 6/9, see Table 9). This pattern indicates that a combination of different sources, which all support the performance claim, is preferable. This can be explained by making the comparison with triangulation, where also multiple sources are used to prove that something is true (Leedy & Ormrod, 2014).

When only BAM's own research is used without a benchmark, the objective quality of the VPI is low (2/9, see Table 9). In addition, the data used in these instances is found to not be verified. This is shown by the results for planning VPI in case 4 and stakeholder satisfaction VPI in case 5. This pattern shows that data which is produced by the contractor but is not benchmarked or verified in any way, is insufficient to support performance claims. This pattern can be explained by reflecting it on the BV approach: one can say that this data does not show dominance because it is only data in itself without providing any context (van de Rijt & Santema, 2013).

9.4.2 Quantitative/objective VPI

When the use of quantitative/objective VPI is compared to using qualitative/subjective VPI, cases using the former score a higher objective quality. For example in case 3 and 4, quantitative/objective VPI is used to support the performance claim for the VPI theme stakeholder satisfaction. These cases both score an objective quality of 6/9 on this VPI theme (see Table 9). The similarity between these two cases and theory can be explained by the fact that the number of complaints is used in these cases to support the stakeholder satisfaction performance claims. The performance measure 'number of complaints' is a quantitative and numerical measure by definition.

9.4.3 Measuring performance periodically

When the use of periodically measured VPI in tenders is compared to the objective quality of the cases in Table 9, cases where the VPI originates from periodically monitored performance measures have a higher objective quality. For example, the VPI for planning in case 3 and the VPI for stakeholder satisfaction in case 3 and 4 are periodically measured and respectively score 5/9 and two times 6/9 on objective quality (see Table 9). This can be explained by translating this pattern to the BV approach: periodically monitoring VPI allows for performance improvements to become visible during a project, which is especially useful when the effectiveness of a certain action or approach has to be supported in a BV tender plan.

9.4.4 Results present in all cases

Some results are similar in all cases for both VPI themes. These include: a built-in collection process, easily understandable VPI, project specific VPI, and the use of VPI which originates from lagging indicators. All these patterns are discussed below.

BAM possesses the insight that its performance on current projects has an impact on future tenders. This result is shown by the use of VPI which originates from built-in collection processes in every case. This pattern can be explained by the fact that BAM makes a lot of effort to enable scalable learning throughout the company (BAM, 2016). However, some of the interviewees stated that while the collection of the VPI was initiated in the past, it is not structurally stored and made available for later use. This stresses the need to preserve the VPI in a structurally organized and accessible database.

In addition, BAM ensures that all performance claims and VPI used in their tender plans is easily understandable for any member of the client's team that has to assess these plans. This pattern can be explained by the fact that if the VPI is not easily understandable for the assessment team, BAM is provided with a lower grade on their plans. This harms their ability to acquire new projects.

The multiple case study shows that only project specific VPI is used by BAM to support their performance claims in all cases, instead of a mix of generic and project specific VPI. By doing this, the performance of individual projects can be successfully measured, while it allows for project

performance to be compared and benchmarked. This is an opportunity to improve the dominance of BAM's performance claims. As an explanation for why this is currently not the case one can say that due to BAM's large amount and variety of projects, it can be difficult to establish the collection of generic VPI. To achieve this, generic performance measures should be uniformly applied and used throughout all business units of the firm. This can be a challenging task for a construction firm of BAM's size.

Another result that is uniformly similar in all cases is the use of VPI which originates from lagging measures. Translating this to the BV approach, a lagging measure is very suitable to describe past performance achieved by a company. However, using leading measures in addition to lagging measures in tender plans allows contractors to show their ability to improve their performance over the course of a project. This is not yet executed by BAM and can improve the dominance in their tender plans. An explanation for this pattern is that leading measures are much more difficult to develop and apply than lagging measures (Beatham *et al.*, 2004).

9.4.5 Performance measures suggested in the theoretical framework

Every case in which stakeholder satisfaction performance claims are supported by VPI which originates from performance measures that are suggested in the theoretical framework, have a high objective quality. For instance, in case 3 and 4, the number of complaints and CSAT score are used to support the performance claims. Both cases score 6/9 on objective quality for the VPI theme stakeholder satisfaction (see Table 9). This pattern can be explained by the fact that performance measures which have been tested on their effectiveness by scientific research are more likely to result in dominant VPI.

9.4.6 Planning vs. stakeholder satisfaction

The average objective quality of planning VPI is 3.2/9, for stakeholder satisfaction this is 4.4/9 (see Table 9). The results of the interviews show an average perceived maturity of planning VPI of 1.5/5 at the start and 2.6/5 at the end of the tender. For the VPI theme stakeholder satisfaction the perceived maturity is higher, namely 2.2/5 at the start and 3.0/5 at the end of the tender (see Table 7 and Table 8). Both methods (project documentation study and interviews) show higher numbers for the VPI theme stakeholder satisfaction. This pattern is also reflected in the results concerning the sources of evidence, shown in Figure 6 and Figure 7. The figures clearly show that BAM's own research is more often used to support performances for the VPI theme stakeholder satisfaction. This pattern in the results can be explained by the fact that the Dutch construction industry is heavily client-driven (Santema *et al.*, 2011). Clients require contractors to provide insight in their stakeholder management performance and also grade them on this performance. Regarding the VPI theme planning, normally contractors only have to meet certain milestones in the project planning. This does not encourage contractors to measure other aspects of their planning performance.

When reflecting the higher scores for the VPI theme stakeholder satisfaction on the BV approach (which values numerical and quantitative/objective data above qualitative/subjective data), one could say that this is not logical. Because, when comparing planning performance to stakeholder satisfaction performance, the former is easier to numerically and periodically measure. This is due to the ability to use units of time (e.g. hours, days, weeks) to calculate planning performance. An example of this is planning reliability, which is discussed in Chapter 5. This information can easily be benchmarked internally and externally, because of the simple calculations (for instance 'planning reliability' as presented in Chapter 5). However, this is not reflected in the results of this study. All VPI that is used to support planning performance is qualitative/subjective, not periodically measured, and only once a benchmark is used for this VPI theme (in case 3). If BAM is able to implement simple performance measures for the VPI theme planning (such as the ones proposed in the theoretical framework in Chapter 0), the quality of planning VPI can quickly be greatly improved.

9.4.7 Match between objective quality and perceived maturity VPI

The tender strategists of BAM that worked on the selected cases estimate a perceived maturity that matches the objective quality in four out of five cases. This shows that the tender strategists have a realistic view of the quality of the VPI they use to support BAM's performance claims. This can be explained by the fact that these employees have multiple years of experience in conducting BV tenders and have extended knowledge about what works and what does not work in a tender plan. This allows them to accurately estimate the quality of the VPI.

The case in which the maturity does not match the quality is case 3, which shows the highest objective quality of all cases: 5/9 for planning and 6/9 for stakeholder satisfaction (see Table 9). The perceived maturity of the VPI in this case is lower than the objective quality as measured using the project documentation study. This can be explained by the fact that the interviewees proposed a lot of improvements in their motivations in the interview and are critical on their performance overall. This shows that the tender strategists underestimate their own performance and are eager to improve the quality of their plans.

9.5 *Conclusion*

This chapter presents and analyzes the results of the multiple case study. The results of the project documentation study and the interviews are presented separately. The within-case analysis discusses the objective quality for every case, the remarkable results within the cases, and matches the objective quality to the perceived maturity. Thereafter, these results are used as input for the cross-case analysis. This analysis compares the cases and determines and discusses patterns in the results. The insights granted by the cross-case analysis are used in the next chapter to reflect upon the result and to develop an overview of BAM's current practice in BV tenders.

In addition to the patterns that are used in the next chapter, this chapter shows that the VPI for the theme stakeholder satisfaction has an overall higher objective quality and perceived maturity than the VPI theme planning. It is concluded that BAM can easily increase the quality of planning VPI, due to its simple and quantitative/objective nature. In addition, the cross-case analysis shows that the tender strategists have a realistic view of the quality of the VPI that they use to support BAM's performance claims. This is due to the perceived maturity matching with the objective quality in four out of the five cases.

10 Reflection on the results

This chapter reflects on the patterns observed in the results of the multiple case study. These patterns provide an overview of BAM's current practice in BV tenders, which serves as the concluding part for Section III of this research. Chapter 9 presented the results of the project documentation study, the interviews, and the analysis of the results using the within-case and cross-case analysis. This results in patterns that are observed in the similarities and differences between BAM's current practice in BV tenders and the theoretical framework. These patterns are discussed below.

The following empirical patterns have an influence on the objective quality of the VPI:

- When multiple types of evidence are used to support performance claims, the quality of the VPI increases. This pattern indicates that a combination of different sources, which all support the performance claim, is preferable. This can be explained by showing the similarity with triangulation, where also multiple sources are used to prove that something is true (Leedy & Ormrod, 2014).
- When BAM's own research is used as evidence without benchmarks and without being verified by the client or a third party, the objective quality is low. This pattern can be explained by reflecting on the BV approach: one can say that data that is not benchmarked and verified

cannot show the dominance of performance because it is only data in itself without providing any context (van de Rijt & Santema, 2013).

- When quantitative/objective VPI is used, the objective quality increases. This pattern is similar to theory as discussed in Chapter 4, where is stated that in the case of the BV approach quantitative/objective and numerical data is preferable.
- The use of periodically monitored performance measures as basis for the VPI results in a higher objective quality. This finding is confirmed by Yu *et al.* (2007) and Oyewobi *et al.* (2015), who state that in order to successfully assess performance levels and to allow benchmarking, performance should be periodically measured. This similarity between the empirical pattern and theory can be explained by the characteristics of the BV approach: periodically monitoring VPI allows for performance improvements to become visible during a project, which is especially useful when the effectiveness of a certain action or approach has to be supported in a BV tender plan.
- Using performance measures that are proposed in the theoretical framework results in a high objective quality for these cases. This is consistent with what Ali *et al.* (2013) state, who propose the use of the number of complaints to support stakeholder satisfaction performance. This similarity between the empirical pattern and theory can be explained by the fact that performance measures which have been tested on their effectiveness by scientific research are more likely to result in dominant VPI.

The cross-case analysis also revealed some theoretical subjects which are uniform in all cases. These include:

- The use of a built-in collection process is present in every case. Globerson (1985) states that the built-in collection process is more dependable than a process that has to be initiated on the spot. This similarity between the empirical pattern and theory can be explained by the fact that BAM makes a lot of effort to enable scalable learning throughout the company by standardizing business processes (BAM, 2016).
- Easily understandable VPI is present in every case. This is in line with theory, which states that suppliers need to be able to dominantly show their performance in an easily understandable manner, even to laymen (Kashiwagi *et al.*, 2003). This similarity between the empirical pattern and theory can be explained by the fact that if the VPI is not easily understandable for the assessment team, BAM is provided with a lower grade on their plans. This harms their ability to acquire new projects.
- Only project specific VPI is used in every case. Horstman and Witteveen (2013) state to always include a mixture of project specific and generic measures. As an explanation for why this empirical pattern is different from theory one can say that due to BAM's large amount and variety of projects, it can be difficult to establish the collection of generic VPI. This factor requires further research in order to understand the difference between theory and practice.
- Only lagging performance measures are used in every case. This is not in line with what is stated by Costa *et al.* (2006). They state that for performance measurement to be successful, one should always strive for a combination of leading and lagging performance measures. According to Beatham *et al.* (2004), lagging measures are used to assess completed performance results in the form of a historic review. This does not offer the opportunity to adjust performance or influence the final project outcome. An explanation for the difference between this empirical pattern and theory is that leading measures are much more difficult to develop and apply than lagging measures (Beatham *et al.*, 2004). This factor requires further research in order to understand the difference between theory and practice.

10.1 The current state of BAM's practice in BV tenders

Based on the results of the multiple case study and the empirical patterns as described in the previous subchapter, the current state of BAM's practice in BV tenders is determined. For all nine theoretical subjects as shown in the theoretical framework in Chapter 0, with the addition of the sources of evidence, the current state of BAM's practice in BV tenders is shown in Figure 8. The patterns are classified in three different areas: improvement areas (these aspects are not correctly conducted and should be improved), irregular performing areas (these aspects should be uniformly applied), and good performing areas (these aspects are correctly conducted and uniformly applied) and are shown in Figure 8.

Improvement areas	Irregular performing areas	Good performing areas
Mix of generic & project specific VPI All cases show the use of only project specific VPI, instead of a mix of generic and project specific VPI	Multiple types of evidence Are irregularly used, while having a positive influence on the dominance of VPI	Built-in collection process All cases show the use of a VPI collection process that is built into BAM's business process
Mix of leading and lagging measures All cases show the use of just VPI that originates from lagging measures, instead of a mix of leading and lagging measures	Quantitative/objective data Is irregularly used, while having a positive influence on the dominance of VPI	Easily understandable VPI All cases show the use of VPI that can easily be understood by laymen
	Periodically monitored VPI Is irregularly used, while enabling to show performance improvements	
	Benchmarks Are irregularly used, while providing the needed context to VPI	
	Measures proposed in theory Are irregularly used, which results in a lower objective quality	
	Verified performances Data is irregularly verified, which results in questionable performances	

Figure 8: The current state of BAM's practice in BV tenders

From Figure 8 can be concluded that the current state of BAM's practice in BV tenders should be improved on two aspects, should be uniformly applied on six aspects, and should be maintained on two aspects.

The two sub research questions that are central in this section are shown below:

3. 'What VPI (for the selected themes) is used in Best Value tenders within BAM to give substance to the project goals and how is this information found and gathered during the tender?'
4. 'What are the differences and similarities between the theoretical perspective on VPI and VPI used in practice (for the selected VPI themes) during Best Value tenders of BAM?'

The project documentation shows clearly what VPI BAM uses to give substance to the project goals. In addition, the interviews provide insight in how this data is found and gathered during BV tenders.

So by conducting these two activities, sub research question 3 is answered. The answer to sub research question 4 is provided by conducting the within-case and cross-case analysis, which allowed patterns to be found in the differences and similarities between BAM's current practice and theory. By summarizing these patterns in Figure 8, sub research question 4 is answered. The results of this section are used to design the performance measurement framework in Section IV.



Section IV: Design

Central in this section is the design of the performance measurement framework for the measurement and monitoring of planning and stakeholder satisfaction performances. An answer to the fifth sub research question is sought-after:

5. 'What framework can be constructed regarding the process of measuring and monitoring the selected VPI themes in the execution phase of BAM's construction projects?'

The aim of this section is to design and construct this framework, based on all the insights that are provided in the previous sections of this research report. After introducing and discussing the purpose of the framework and adopting a design process in Chapter 11, Chapter 12 describes the four steps of the framework design process: problem investigation, solution design, design validation, and solution implementation. Thereafter, Chapter 13 presents the two performance measurement processes: one for the VPI theme planning and one for the VPI theme stakeholder satisfaction. In addition, this chapter elaborates on the place that the designed framework has in BAM's current business processes. Lastly, conclusions are drawn and the fifth sub research question is answered.

11 Introduction

This chapter introduces the design of the performance measurement framework. Firstly, the purpose that the performance measurement framework serves is described. Thereafter, a design process for the development of the framework is adopted.

11.1 Purpose of the framework

The purpose of the performance measurement framework, to which is already slightly alluded in Chapter 1, is to ensure that VPI for the two most frequently occurring VPI themes is collected in the execution phase of projects. In addition, the data collected in the projects should be preserved in a database and verified by a client of third party. This ensures that the VPI is available for use in future tenders. This directly contributes to the research objective, namely to improve the effectiveness of the BV tender process. Figure 1 in Chapter 1 visualizes the contribution of the performance measurement framework.

11.2 Design process adoption

Multiple authors have developed guidelines and steps for the research design process (Peffer *et al.*, 2007; Offermann *et al.*, 2009; Hevner & Chatterjee, 2010). The work of these authors always consists of the following three steps:

1. Problem identification/investigation
2. Solution design
3. Solution validation/evaluation

When reflecting these steps on the purpose of the framework as discussed above, one can see that these steps do not ensure the preservation of the VPI in a database. In order for this to be realized, the designed performance measurement framework has to be implemented in BAM's current business processes. Therefore, this research adopts the regulative cycle, as discussed by (Eshuis & Wieringa, 2002), to aid in the design of the performance measurement framework. The four steps of the regulative cycle are shown in Figure 9.

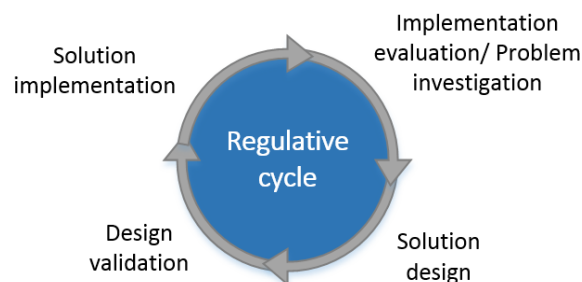


Figure 9: The regulative cycle, adopted from Eshuis & Wieringa, 2002

The regulative cycle is an iterative process, as is clearly shown in Figure 9. The next chapter described the execution of the design process for this research.

12 Framework design

This chapter describes the execution of the four steps of the regulative cycle, as presented in the previous chapter. The steps are conducted in the following order: problem investigation, solution design, design validation, and solution implementation.

12.1 Problem investigation

The design process begins at the problem investigation step. For this research, the problem investigation is shaped by the preceding sections of this research. By firstly defining the research problem in Section I of this research, the problem investigation is initiated. Thereafter, by exploring the theoretical perspective in Section II, the research problem becomes understandable and relatable to already conducted research in the field of performance measurement. Further, the multiple case study in Section III tested the research problem in practice, while utilizing the knowledge obtained in Section II. The work that has been conducted in these three sections all contribute to a better understanding of the research problem in practice. This understanding allows for the second step in the regulative cycle to be conducted: the solution design. This step is discussed in the next subchapter.

12.2 Solution design

This subchapter elaborates on the design of the performance measurement framework. Peffers *et al.* (2007) developed the theoretical perspective on the solution design step, by comparing research by various authors on this topic. Based on this perspective they developed activities that should be determined in order to successfully conduct this step in the regulative cycle. These activities include:

- Determine the desired functionality
- Determine the framework's architecture
- Create the framework

These activities are discussed below.

12.2.1 Desired functionality

Throughout the previous sections of this report, requirements and functionalities for the performance measurement framework have been described. These are the aspects that define how the framework should function. This subchapter provides a summary of these requirements and functionalities.

- Currently existing performance measurement frameworks only suggest some abstract areas for performance measurement and provide little guidance on how to practically measure performance. Little work has been done on actually designing measurement frameworks (Neely *et al.*, 2000). So the designed performance measurement framework should meet the requirements that BAM has. This is achieved through adjusting the framework to the two most frequently occurring VPI themes. In addition, the framework is constructed based upon the results of the multiple case study, which ensures that it is adjusted to the areas that need improvement.
- The frameworks should provide VPI which is easily understandable. This is achieved by using performance measures that are suggested in literature. These measures are comprised of a limited amount of variables and are validated for use by experts of both VPI themes.
- Multiple authors state that performance measurement frameworks should be dynamic and flexible and should be modified with the occurrence of relevant and internal changes (Bassioni *et al.*, 2004). However, this means that not only performance measures should be added over time, but also removing them in order to stay competitive (Kaplan & Norton, 1992; Bassioni *et al.*, 2004). Therefore, the designed framework should be flexible and adjustable to the contractor's requirements.
- According to Ali *et al.* (2013), performance measurement frameworks need to consist of multiple performance measures. They state that no single measure can provide a clear view of the performance of a firm.
- The non-financial performance information should be verified by a client or third party. To ensure this, a collaboration is entered with an information manager of BAM. This employee is

responsible for preserving all filled in client satisfaction surveys and for the content of these surveys. As part of this research it is explored if the performance measures for planning and stakeholder satisfaction can be included in these surveys, so that the client can verify them along with all other aspects of the project. At the time of this writing, the author is still pursuing this goal.

In addition to these requirements and functionalities, the performance measures that are used in the frameworks should comply with the theoretical framework as presented in Chapter 0 and to the patterns found in the multiple case study as presented in Chapter 10.

12.2.2 Framework architecture

The architecture of the framework consists of two performance measurement processes, portrayed as roadmaps. This ensures the framework to be easily understandable and applicable in practice. The definitive processes are presented in Chapter 13. As can be seen in Chapter 13, the processes include a 'step 0', which describes the activities that should be conducted before the performance measurement process can be initiated.

12.2.3 Create the framework

Based on the theoretical perspective as presented in Chapter 0 and on BAM's current practice in BV tenders as presented in Chapter 10, the performance measurement framework is created. The definitive framework is presented in Chapter 13.

12.3 Design validation

In order to ensure that the designed performance measurement framework complies with today's standards in fields of stakeholder management and planning, BAM's experts in these fields are consulted. The consultation aims to incorporate their expert knowledge into the designed framework. This subchapter describes the input for the performance measurement framework provided by the experts for both VPI themes. First, the VPI planning is discussed. Thereafter, the VPI theme stakeholder satisfaction is described.

12.3.1 Planning

For the VPI theme planning, a planning expert of BAM is consulted. This expert validated the use of the planning measures proposed in the theoretical framework. In addition, the steps of the performance measurement framework for the VPI theme planning are validated by the expert. The performance measures that are discussed in Chapter 5, the lagging measure planning reliability and the leading measures Process Reliability Index (PRI) and Percent Plan Complete (PPC), are all used in the framework. During the execution of this research, the measure 'planning reliability' is already implemented within BAM and successfully used in a BV tender plan. In addition, the consulted expert is pursuing to collect VPI using these measures on already completed projects, in order to fill the project database.

12.3.2 Stakeholder satisfaction

For this VPI theme a stakeholder management expert of BAM is consulted. Based on the presentation of the designed framework, additional insights are provided by the expert:

- In addition to periodic and final measurements, a baseline measurement step at the beginning of the roadmap is required. This enables the project team to always be able to compare their current performance on stakeholder satisfaction to the baseline situation. This insight is consistent with what is stated by Josephson and Lindström (2007) and discussed in Chapter 4: "the principle idea of performance measurement is to measure before a project begins, during the project, and after the project is finished".
- To conduct performance measurements right after impactful events in the project occur. This can be a variety of event. For instance: a meeting with stakeholder, providing of information, announcing certain decisions, causing various forms of nuisance, or after transitioning to the

next construction phase. Measuring right after these events provides the contractor with the most valuable information on its performance.

After these insights were incorporated in the performance measurement framework, the expert validated the roadmap and noted that the framework will be used as the basis of BAM's new stakeholder management strategy.

12.4 Solution implementation

This subchapter describes the fourth step in the regulative cycle (as presented in Chapter 11): the solution implementation. To limit the scope of this research, this chapter only defines where in the current business process of BAM the designed framework should be placed. In order to establish this, a collaboration with BAM's process control department is sought. The head of this department aided in finding the correct existing processes to which the performance measurement framework can be linked. The business process is shown in BAM's Project Management Information System (PMIS). Attachment 8 introduces the PMIS and shows the exact places where the designed performance measurement processes should be implemented.

By conducting this last step of the regulative cycle, one could expect it to be completed. However, as stated previously, the regulative cycle is an iterative process. So when the performance measurement framework has been implemented by BAM into their business process, the functionality of the designed framework and its implementation should be evaluated (see Figure 9). This leads to new possible problems and challenges that should be investigated, incorporated in the solution design, validated by experts, and implemented in the firm. By continuously conducting this process, the performance measurement framework keeps evolving and keeps matching with the wishes and demands of BAM.

12.5 Conclusion

This chapter describes the design, validation, and implementation of the performance measurement framework. It discusses the desired functionality and architecture of the framework. In addition, the validation of the framework is discussed for both VPI themes. This is conducted by using BAM's expert knowledge in the fields of stakeholder management and planning. The collaboration with these experts creates support for the designed framework and for the monitoring of performances in general within BAM. The comments and input provided by these experts allowed for the definitive performance measurement framework to be created, which is presented in the next chapter.

13 Definitive performance measurement framework

This chapter presents the validated and definitive performance measurement framework for the selected VPI themes planning and stakeholder satisfaction. The framework is designed in collaboration with BAM's experts in these specific fields. In addition, all insights obtained in Section II and Section III of this research are processed in the frameworks. First the performance measurement process for planning is presented. Thereafter, the process for stakeholder satisfaction is presented.

13.1 Planning

This subchapter presents the performance measurement process for the VPI theme planning. The process is shown in Figure 10. As presented in the figure, the process consists of three steps. In addition, the activities that should be conducted previously to applying the framework are presented as 'step 0'. For the VPI theme planning this comes down to determining the planning for the project, and specifically all individual activities, connections, and milestones. In step 1 all three performance measures, the lagging measure 'planning reliability' and the leading measures 'Process

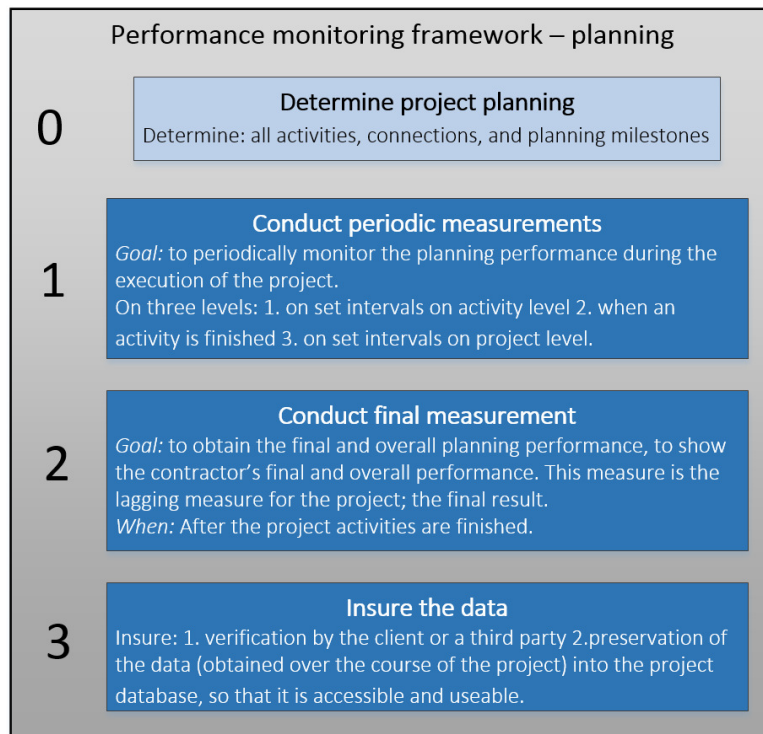


Figure 10: Performance measurement process for the VPI theme planning

Reliability Index' (PRI) and 'Percent Plan Complete' (PPC), are used to monitor planning performance during the execution of the project. In step 2, only the lagging measure 'planning reliability' is used to conduct a final performance measurement. This serves as the overall past performance of a particular construction project. Step 3 ensures that the data is being verified and preserved in the project database, which improve the usability and accessibility of the data.

13.2 Stakeholder satisfaction

This subchapter presents the performance measurement process for the VPI theme stakeholder satisfaction. It is shown in Figure 11. As presented in the figure, the process consists of five steps. In addition, the activities that should be conducted previously to applying the process are presented as 'step 0'. For the VPI theme stakeholder satisfaction this comes down to determining the stakeholder management strategy for the project, and specifically the stakeholder groups, modes of communications, contractual obligations, and the project environment. In step 1, performance measures have to be selected, adapted to the environment and contract of the project. At least two measures have to be selected from the longlist to be used in the stakeholder satisfaction survey: Number of complaints, Customer Satisfaction score (CSAT), Net Promoter Score (NPS), or Customer Effort Score (CES). In addition, a motivational follow-up question should always be used with every performance measure in the survey, as discussed in Chapter 5. In step 2, the baseline measurement is conducted. This allows for performances to be compared to the project's starting situation throughout the duration of the project. Step 3 is concerned with the periodical performance measurements. These should be conducted right after certain events, as previously described. These periodic measurements allow monitoring stakeholder satisfaction performance during the execution of the project. In step 4 the final satisfaction of the stakeholders is obtained. This serves as the overall past performance of a particular construction project. Step 5 ensures that the data is being verified and preserved in the project database, which improve the usability and accessibility of the data.

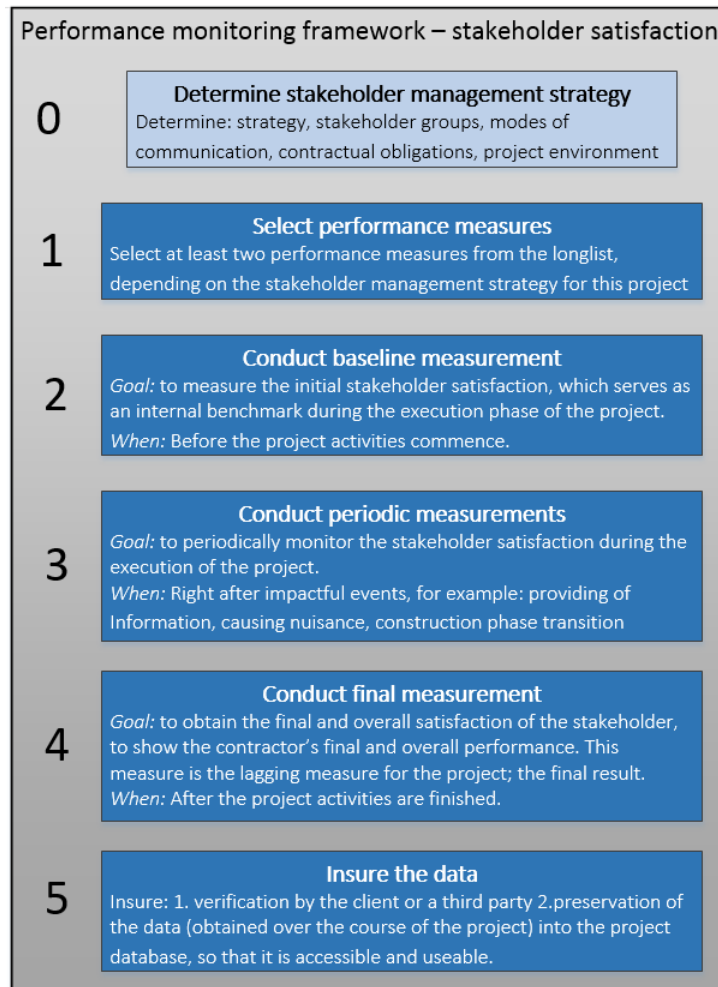


Figure 11: Performance measurement process for the VPI theme stakeholder satisfaction

13.3 Conclusion

This section developed and designed the performance measurement framework for the measurement and monitoring of planning and stakeholder satisfaction performances. By conducting these activities, an answer on sub research question five is provided:

5. 'What framework can be constructed regarding the process of measuring and monitoring the selected VPI themes in the execution phase of BAM's construction projects?'

This process in this section is guided by the steps of the regulative cycle: the problem investigation, the solution design, the design validation, and the solution implementation (Eshuis & Wieringa, 2002). This results in a performance measurement framework that is consistent with the theoretical and empirical perspectives of this research. In addition, expert knowledge is utilized to increase the usability of the framework for BAM. Also, by collaborating with experts the support for the designed framework is improved. Lastly, the implementation of the framework is facilitated, by assigning the framework's place in BAM's current business process.



Section V: Conclusion and recommendations

This concluding section of the research report provides the final conclusions and recommendations. First, the sub and main research questions are discussed and answered in Chapter 14. Thereafter, practical and research recommendations are provided in Chapter 15.

14 Conclusion

This chapter elaborates on the final conclusions of this research which are presented according to the structure of the report. First, the sub research questions are answered. Thereafter, the answer to the main research question is discussed.

14.1 Sub research questions

The sub research questions, as presented in Chapter 1, are answered below.

1. *‘What are the most frequently used project goals in Dutch Best Value tenders as defined by clients?’*

This sub research question aims to incorporate the client’s perspective into the research, by analyzing the project goals as defined by clients in their project documentation. For this analysis the project goals of 21 different construction projects are categorizing into verifiable performance information (VPI) themes. This categorization results in the adoption of the two most frequently occurring VPI themes: ‘stakeholder satisfaction’ and ‘planning’, as is discussed in Chapter 3.

2. *‘What is the theoretical perspective on performance measurement in the construction industry, and in particular the measurement and monitoring of the selected VPI themes?’*

This sub research question aims at developing the theoretical perspective to which the empirical part of this research can be reflected. For this purpose, literature concerning the measuring and monitoring of VPI in construction projects and firms is investigated. In addition, literature concerning the two selected VPI themes and the relationship between project goals and performance measures is investigated. This results in the theoretical framework, in which seven generic aspects of performance measures are presented. For instance, the framework concludes that quantitative VPI is preferable to qualitative VPI and that a mix of leading and lagging indicators should always be used when measuring performance. In addition, the measures for two selected VPI themes that are suggested by theory are presented. Lastly, the theoretical perspective on the relationship between project goals and performance measures is explained. See Chapter 0 for the theoretical framework.

3. *‘What VPI is used in Best Value tenders within BAM to give substance to the project goals and how is this information found and gathered during the tender?’*

This sub research question aims at discovering what VPI is used by BAM to support their performance claims in their BV tenders plans and how this information is found during a tender. The first part of this question is investigated using a project documentation study into the supporting documents that serve as evidence to the performance claims. The second part of the question is investigated by conducting interviews with tender strategists, in which they have to estimate their perceived maturity on the VPI. The results of the project documentation study clearly show what VPI is used in the selected BV tenders and how this relates to theoretical framework, from which the objective quality of the VPI is determined. For instance, the multiple case study shows that BAM uses three types of evidence: client satisfaction surveys, in-house research, and third party research. It is concluded that a mixture of at least two different types of evidence is preferable. In addition, the interviews provide insight into how the VPI is found during the tender and if the tender strategist’s perceived maturity on the VPI is consistent with the objective quality. From the interviews is concluded that the perceived maturity matches the objective quality in four out of five

cases. In the remaining case the tender strategist's perceived maturity is lower than the objective quality. This shows that the tender strategists underestimate their own performance and are eager to improve the quality of their plans. See Chapter 9 for the complete results of the multiple case study.

4. *'What are the differences and similarities between the theoretical perspective on VPI and VPI used in practice during Best Value tenders of BAM?'*

This sub research question aims at discovering the differences and similarities between the answers on sub research questions 2 and 3. These insights are obtained by comparing the empirical patterns as observed in the multiple case study to the theoretical framework. This results in an overview of the current state of BAM's practice in BV tenders. The overview shows two aspects on which BAM should improve: the use of a mix of generic and project specific VPI and a mix of leading and lagging measure performance. In addition, the overview shows which aspects should be uniformly apply and on which aspects the performance should be maintained. See Chapter 10 for the overview of the current state of BAM's practice in BV tenders.

5. *'What framework can be constructed regarding the process of measuring and monitoring the selected VPI themes in the execution phase of BAM's construction projects?'*

This sub research question aims at using the knowledge obtained during this research to design a framework for the measuring and monitoring of the most frequently occurring VPI themes in the execution phase of construction projects. The goal of this framework is directly linked to the research objective: to improve the effectiveness of the BV tender process of BAM. This is accomplished by ensuring that VPI that is useful in the tender phase of projects is being measured and monitored in the execution phase of projects. The framework design process is guided by the regulative cycle. This consists of an iterative design process of four steps: problem investigation, solution design, design validation, and solution implementation. This results in a performance measurement framework that is consistent with the theoretical and empirical perspectives of this research. The framework consists of two performance measurement processes, one for planning performance and one for stakeholder satisfaction performance. These processes consist of multiple fixed steps, which are flexible and adjustable on itself. For instance, both measurement processes contain a periodic and final measurement step. The implementation of the framework is facilitated, by assigning the framework's place in BAM's current business process. See Chapter 13 for the performance measurement processes.

14.2 Main research question

The answer to the main research question, as presented in Chapter 1, is discussed below.

'What non-financial verifiable performance information should be monitored, and how should this be conducted by BAM, in order to improve the effectiveness of the Best Value tender process?'

By answering all five sub research questions, the main research question can be answered. By first investigating the client's and theoretical perspective on what VPI should be measured and monitored and how this should be conducted, and thereafter comparing this to BAM's current practice, a tailor-made solution to BAM's performance measurement problem is developed. This solution is shaped in the form of a performance measurement framework. By implementing the framework in the current business processes of BAM, the firm's planning and stakeholder

satisfaction performance can be measured and monitored. This provides BAM with an enormous amount of VPI, which can be utilized to support performance claims in the selection phase of BV tenders. This improves the effectiveness of BAM's BV tender process.

15 Recommendations

This chapter describes the recommendations that are provided based upon this research. These recommendations are divided in practical and research recommendations.

15.1 Practical recommendations

This sub chapter describes the practical recommendations to BAM. When these recommendations are heeded, BAM can greatly improve its insight in non-financial performances and improve the effectiveness of its BV tender process.

- This research is based on the client's perspective on performance measurement, because of the urgent need for knowledge regarding this topic. However, to evolve into a data-driven company in which performance are quantitatively measured and monitored, a different approach is required. Ensure the development of an intrinsic motivation for performance measurement within BAM, instead of only being motivated because clients require contractors to measure performance.
- In addition to this intrinsic motivation to evolve into a data-driven company, BAM should not lose track of its client's perspective on performance measurement. This perspective should be periodically analyzed, so that BAM can focus on developing the performance areas that are of value to its clients.
- In the process of developing and applying performance measures, the following recommendations should be heeded: performance measures should provide quantitative data, are collected using a built-in collection process, are easy to understand, are periodically monitored, provide a mix of project specific and generic information, consist of leading and lagging measures, are benchmarked, are based on scientific research, and are verified by a client or third party.
- In the process of supporting performance claims in BV tenders, use multiple sources of evidence and supporting documents to support every single performance claim. In addition, ensure that all VPI is consistent with the recommendations concerning the application of performance measures.
- Implement the performance measurement framework as presented in this research. This ensures the measurement and monitoring of performance information for the VPI themes planning and stakeholder satisfaction. The framework should be implemented in all construction projects of BAM, not only in BV projects.
- Evaluate the implementation and effectiveness of the performance measurement framework and make adjustments to the framework based on the evaluation.
- Keep optimizing and adjusting the performance measurement framework to BAM's requirements, the client's perspective, and to changes in the construction industry. The performance measurement framework as presented in this research is not set in stone and should be updated and optimized in order to ensure its effectiveness throughout time.

15.2 Research recommendations

This sub chapter describes the scientific research recommendations.

- This research has solely been conducted for BAM and based on data provided by BAM. To improve the external validity of the results, this research should be replicated for other Dutch construction firms to see if similar results are obtained.

- To limit the scope of this research, two VPI themes are selected for further focus. However, the client's perspective analysis found 16 different VPI themes in the tender documents as defined by clients. For all these VPI themes, research should be conducted on how to effectively measure and monitor their performance.
- The relationship between project goals and performance measures in the light of the BV approach has not received any attention in scientific research. In order to better understand this relationship, further research should be conducted.
- Two of the observed empirical patterns in the multiple case study are not explainable using literature. Firstly, only project specific VPI is used in every case while the theoretical framework suggests to always combine generic company-wide VPI and project specific VPI. As an explanation for why this empirical pattern is different from the theory, one can say that due to BAM's large amount and variety of projects, it can be difficult to establish the collection of generic company-wide VPI. This factor requires further research in order to understand the difference between theory and practice.
Secondly, only lagging performance measures are used in every case, while the theoretical framework suggests to always combine leading and lagging measures. An explanation for the difference between this empirical pattern and theory, is that leading measures are much more difficult to develop and apply than lagging measures (Beatham *et al.*, 2004). This factor requires further research in order to understand the difference between theory and practice.

Appendices

A. Glossary

Best Value (BV) approach: A 'way of thinking' in which the division of roles between client and contractor revolve around the contractor's expertise and transparent performances. The client has to minimize its manage, direct, and control actions so that the contractor (expert) can be in the lead.

Best Value Procurement (BVP): The act of applying the Best Value approach in the procurement of works, services, or supplies (sometimes also referred to as Performance Information Procurement System, or PIPS).

Key Performance Indicator (KPI): A measurable value that demonstrates how effectively a company is achieving key business objectives.

Measuring performance information: The activity of collecting new performance information during the execution phase of construction projects, at a certain frequency and with a certain quality.

Monitoring performance information: The activity of keeping performance information up to date, concerning time, quality, comprehensibility, and usefulness.

Most Economically Advantageous Tender (MEAT): A collection of procurement strategies which allow the contracting party to value a tender on both financial and quality aspects, with the aim of awarding the contract to the contractor that offers the best quality for the lowest price.

Performance measure: A quantifiable parameter that produces performance information.

Performance measurement: The process of collecting performance information/

Performance management: The overarching process of collecting, monitoring, and acting on the VPI in order to improve performance.

Project goals: A set of highly valued objectives that is defined in the tender documentation by the contracting party, to which the contractors have to give substance in their tenders in order to be awarded the contract.

Tender: The activity or process for proposing an offer or a bid for a contract. It is conducted as a response to a request for work (project) that is put in the market, with the aim to create an official written offer that contains a cost and quality proposal to perform the works, services, or supplies required by the contracting party. This offer is usually submitted by a specified time and date.

Verifiable Performance Information (VPI): Measurable metric (numbers, percentages) facts provided or learned about the performance of a person, project team, department, or company which are tested and proven to be true.

VPI theme: A common subject that is determined by analyzing the differently formulated project goals as defined by clients. These themes serve as a guide throughout this research.

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Attachments

Confidential